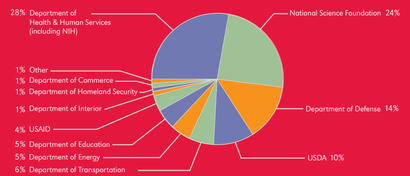
Financials

FY 2008 Research Funding by Federal Agency



Five-Year Total Research Funding

(in millions)

Five-Year Total Sponsored Programs Funding

(in millions)

Record Research Funding

UNL faculty earned a record $105.7 million in external awards for research during the fiscal year ending June 30, 2008. Funding increased 3.2 percent from $102.4 million a year earlier. Of the FY 2008 total research funding, $72 million came from federal sources as the chart above shows. Total external funding for sponsored programs, which includes research and other activities, also set a record of $174.2 million, up from $171.8 million in the previous fiscal year.

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Cover Art:
Climate change is a global concern with the potential to alter the life and landscape of Nebraska and the High Plains. On the cover, a thunderstorm moves toward the Upstream Ranch along the Calamus River in Nebraska's Sandhills, one of the fragile ecosystems that could see significant impacts of climate change. Diverse research by UNL scientists is expanding our understanding of climate change and providing tools to help preserve the region's long-term sustainability. UNL is partnering with the U.S. Geological Survey to explore developing a regional climate change research framework.

A Time to Think Boldly

The research enterprise at the University of Nebraska–Lincoln has achieved great success in the past 10 years. Our faculty are addressing important challenges for Nebraska, our nation and the world. From climate change and renewable energy to childhood literacy and transportation safety, their research and scholarship is being published in high impact journals, and they are being recognized for their contributions with prestigious awards and honors. UNL research funding reflects these achievements, growing 115 percent since 2000. We applaud the efforts of our faculty and highlight some of their successes in this report.

As an institution, it is now our time to think boldly. The challenges facing the world today are complex, and the solutions will require great resources of talent, expertise and infrastructure as well as collaborations that engage diverse disciplines. At UNL we are reaching beyond our institutional, state and national borders to find new partners who share our bold vision. Whether partnering with the U.S. Geological Survey to explore development of a regional climate change research framework or developing collaborative research programs with the national laboratories, new partnerships are among UNL's highest priorities.

Our most exciting partnership is Nebraska Innovation Campus, a 249-acre private-public research and technology center adjacent to our campus. Innovation Campus is being developed with the support of 2015 Vision, a group of Lincoln, Neb., business leaders dedicated to strengthening research, education and economic development through entrepreneurship and investment. Innovation Campus will leverage UNL's research capacity by attracting private sector companies to locate near the university where they can work closely with university researchers, generating jobs and economic activity. We believe that our breadth of expertise in agricultural biotechnology, biosciences, software engineering, laser sciences, transportation safety, food processing and safety, and renewable energy research will provide partnership opportunities attractive to private enterprise.

I invite you to read this report and consider the possibilities before us – to envision new ways to meet the serious challenges we face and to join in partnerships that focus our diverse knowledge and talents on solutions yet to be imagined.

Chancellor Harvey Perlman and
Vice Chancellor Prem Paul

Prem S. Paul
Vice Chancellor for Research
and Economic Development

Lake Mud Holds Climate Secrets

Sheri Fritz studies mud. It may not sound glamorous, but mud can tell the UNL geoscientist what the climate was like in the past and point to clues about the future.

Surprisingly, lakes record history's droughts. As the weather warms, water evaporates and leaves behind more salt in lake water and on lake bottoms. Over time, mud layers provide a record of drought events that Fritz and colleagues analyze in core samples pulled from lake bottoms.

Also telling are the diatoms she finds. The microscopic plants' cell walls are made of silica and preserved in the mud. Different species of diatoms, each with a unique shape, thrive under different salinity and weather conditions. By studying diatom shapes within mud layers, Fritz can determine climate conditions back through time.

A cross-section of a core sample pulled from a lake bottom provides clues to long-term environmental change.

Much of her work has been in the Great Plains. Fritz has learned that mega-droughts, the centuries-long droughts like the one that hit the western United States during medieval times, were rare during the last 2,000 years. Less extreme droughts, such as the 1930s Dust Bowl drought, occur frequently.

"These multi-year droughts happen every few decades, and they're part of natural climate variability," she said. "We shouldn't view droughts as extreme events, but consider them routine and be better prepared to deal with them."

Fritz also studies northern Rocky Mountain lakes. By comparing the timing of droughts in both areas, she can establish whether they were localized or more extensive, which provides insights about historic ocean conditions and weather patterns that cause widespread droughts. Grants from the National Science Foundation support Fritz's research.

Understanding historic climate conditions also provides a template for understanding other biological and social patterns. To analyze the role of drought in the evolution of biodiversity and culture in the tropics, Fritz also studies lakes in the South American Andes and Amazon Basin.

This research "doesn't allow us to predict the future. But it allows us to evaluate if what's happening now is different than what happened before," she said. "It gives us tools so that we understand how the environment responds to conditions that are warmer than they are today."

Sheri Fritz

Of Grass and Sand – Lessons In Resilience

Nebraska's Sandhills – the largest sand dune formation in the Western Hemisphere – can withstand drought surprisingly well. Grass is key to this resilience.

More than 50 geologists, hydrologists and ecologists joined forces on UNL's Sandhills Biocomplexity Project, funded by a $1.8 million National Science Foundation grant, to study how this unique complex of dunes, grasslands, wetlands and lakes responded to climate change over several thousand years and how it functions today.

"The challenge is to take what we're doing and combine it with climate change prediction models to try to say what will happen in the future," said ecologist David Wedin, who heads the project.

Though a mega-drought about a thousand years ago caused the dunes to blow, grass has kept them relatively stable through less severe but frequent droughts. To measure the Sandhills' resiliency, Wedin and colleagues killed the grasses in 3-acre experimental plots. They expected the sands would begin to blow. To their surprise, the sands haven't moved much after four years.

The underground system of roots and microbes buffers the dunes against climate variability, Wedin said.

"We're fortunate to have healthy native grasslands because they provide stability in those soils. I'm more concerned about center pivots, encroaching red cedar trees and mismanagement that imperils the grasslands than climate change."

Today cattle graze the grasslands of this diverse ecosystem in the heart of Nebraska's ranch country. More than 35 percent of the groundwater in the High Plains Aquifer lies beneath the Sandhills, which plays a major role in recharging the underground water supply in an eight-state area. This makes the region's ongoing health vital.

The project also included studies of the area's hydrology and the interaction between the dunes and the atmosphere. Scientists are applying what they learned about the Sandhills' past to improve climate models that predict the future and laying groundwork for future climate-related research.

Dave Wedin checks equipment at a plot where grass was removed to study how the Nebraska Sandhills responds to climate change. Right: A blanket of grass keeps the Sandhills relatively stable.

Web Tools Aid Drought Decisions

UNL computer scientist Steve Goddard can't eliminate the guesswork from farming, but his computer tools help farmers make important decisions to cope with drought. In the process, he's helping researchers document climate change.

Steve Goddard

Goddard is developing Web-based tools that give farmers information such as soil moisture levels on their farms and the best times to plant or irrigate. They even let farmers know how competitors in other states might be faring, providing clues to future crop prices. These Web tools (http://greenleaf.unl.edu) are designed to help farmers make more informed decisions to maximize profits when water supplies are short.

By integrating daily climatology data with spatial and relational databases, such as soil type and historic precipitation records, the tools create localized, up-to-date and user-friendly information. Goddard likens his programs to Google maps.

"People like (Google) because it's very easy to use spatial data. That's what we're trying to do with climate data."

Goddard partners with UNL's National Drought Mitigation Center and High Plains Regional Climate Center and USDA's Risk Management Agency, which funds this project. He is integrating his programs so they feed information to each other. "By relating the data between tools and having a spatial and temporal look at the data, you get new information and a better picture of what's going on."

These climate pictures also benefit climate change researchers. For example, Goddard's self-calibrating version of the Palmer Drought Severity Index (PDSI) quantifies climate extremes across time and space, allowing scientists to document changes at different locations and to compare the actual climate to model predictions.

"You can say that it will be 10 percent dryer and 5 percent warmer, but what does that mean to you? Our tools give you a reference," Goddard said. The updated PDSI lets farmers and researchers know how those conditions compare, say, to the last drought.

"People can relate to that because they can relate to their own experience very concretely."

Partnering on Climate Research

Climate change will alter life and landscape on the High Plains, perhaps profoundly.

How much, when, where and what can be done are among myriad questions that must be answered to preserve the region's long-term sustainability. Many scientists expect changes eventually could endanger some ecosystems, threatening the people and creatures that rely on them.

Providing answers about impacts and solutions to protect the region's resources in a changing climate requires highly integrated and collaborative research. UNL and the U.S. Geological Survey are partnering to explore development of an integrated research framework for the Platte River Basin and the High Plains.

"Climate change is real. The question is what are we going to do to mitigate and adapt to it?" said Tom Armstrong, USGS senior adviser for global change programs.

UNL and USGS hosted a conference in May 2008 that explored issues and perspectives on the potential regional impacts of climate change. About 150 UNL and USGS researchers, representatives from state and regional organizations, farmers, ranchers, resource managers and policymakers discussed the challenges stakeholders in the region may face in a changing climate. Earlier, UNL and USGS researchers toured Nebraska's Platte River and Sandhills to learn firsthand about each other's research.

The conference wrapped up with teams of researchers identifying research questions and monitoring needs. A conference report and research recommendations are being shared with decision-makers and federal agencies.

These activities are helping shape the innovative research partnership involving USGS, UNL and regional stakeholders. Creating an integrated, real-time knowledge base and climate response system is the long-term goal. This system will help policymakers, resource managers, communities and producers manage limited water resources and fragile ecosystems, and provide a model for managing other ecoregions.

"By working together, we can develop solutions for Nebraska, the nation and the world," said Prem Paul, UNL vice chancellor for research and economic development.

Above: UNL and USGS scientists learned about each other's work during a tour of climate-related research sites in Nebraska's Platte River Basin and Sandhills.

New Home Furthers Virology Collaboration

Researchers in the Nebraska Center for Virology – one of the university's signature programs – are collaborating more than ever, thanks to their new home in the Ken Morrison Life Sciences Research Center.

The $21 million, 74,000-square-foot research facility is designed to foster interactions and collaborations among researchers, students and staff. UNL researchers associated with the center, who previously worked at several locations across campus, moved into the building in early 2008.

It provides space to expand research on many of the leading viral threats to people, animals and plants. The building features full labs for 12 scientists with separate areas for virus and cell culture, cold and dark rooms, shared instrumentation facilities, a Biological Safety Level 3 laboratory suite, offices, meeting rooms and video conferencing capabilities.

"We need a state-of-the-art facility for what we're doing and this building provides that," said Charles Wood, the UNL molecular virologist who leads the Nebraska Center for Virology. "It also enables people to collaborate, interact, share ideas and do better work, all under one roof."

The center's scientists study the molecular mechanisms viruses use to cause disease. Their discoveries could lead to new tools to prevent or treat diseases caused by HIV, human papilloma virus, herpes and other major viruses.

The Nebraska Center for Virology links virologists at UNL, University of Nebraska Medical Center and Creighton University. It was established in 2000 as a Center for Biomedical Research Excellence with a five-year, $10.7 million NIH/National Center for Research Resources grant and earned a five-year, $10.6 million renewal in 2005. It's among the university's most productive research programs.

The building is named for Morrison, a Hastings, Neb., businessman and longtime UNL supporter who provided the lead private gift for construction.

Charles Wood in his laboratory at the Ken Morrison Life Sciences Research Center.
Insets: The building's exterior and a new lab.

Innovation Campus in the Works

Innovation, collaboration and economic development are linchpins in an ambitious vision for the Nebraska Innovation Campus, a private-public research partnership at UNL.

This long-term project is in the initial planning stages. It will build UNL's research capabilities, strengthen private-public collaborations, attract businesses that create jobs and expand Nebraska's economy.

The Nebraska Innovation Campus is planned for about 250 acres adjacent to UNL and near downtown Lincoln on land that now houses the Nebraska State Fair. Support for the project has grown since UNL officials unveiled the concept in late 2007. The Nebraska Legislature approved plans to move the state fair to Grand Island, Neb., freeing up most of the land by 2010 for research campus development.

"The modern economy is based on innovation. Many private-sector companies prefer to locate adjacent to or on a university campus where they can collaborate with university scientists and engage university students," UNL Chancellor Harvey Perlman said.

"We have a unique opportunity to create such an environment that will allow Nebraskans to benefit from the economic development value of our research."

Officials envision a research campus with public and private research and technology space where entrepreneurs and private companies work closely with UNL researchers and students. The campus concept proposes up to 1.6 million gross square feet of mixed-use space that private companies and UNL will develop as demand increases and private and public funds become available.

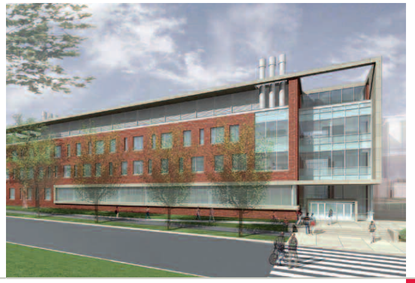
"Innovation Campus will facilitate converting research inventions into products for the marketplace that enhance Nebraska's economy," said Prem Paul, vice chancellor for research and economic development.

Above: A conceptual drawing of the Nebraska Innovation Campus.

Projects Aim to Ease Research Space Shortage

Demand for research space is growing along with UNL's research enterprise. Several current or planned projects will begin to address this critical space shortage, providing state-of-the-art facilities and improving infrastructure. Here's a rundown:

Physical Sciences Building: In early 2010, physics and astronomy faculty will move from cramped labs and offices in three older buildings to the new $37 million Physical Sciences Building. Construction is under way on the four-story, 121,000-square-foot building to house laboratories and offices for physics and astronomy faculty along with teaching labs, lecture halls and classrooms.



Physical Sciences Building

NanoScience Facility: Construction of the adjacent NanoScience Facility will begin when the Physical Sciences Building is complete. The $13.5 million facility will provide 32,500 square feet of laboratory, core facilities and administrative space for College of Engineering and College of Arts and Sciences researchers who collaborate through UNL's Nebraska Center for Materials and Nanoscience.

Schorr Center: The Paul and June Schorr III Center for Computer Science and Engineering opened in early 2008 in redesigned space in South Stadium. The 18,400-square-foot center houses UNL's Research Computing Facility and its supercomputers, which support research campuswide. A major gift in their parents' honor from the children of Paul and June Schorr III of Lincoln, Neb., helped fund the center.

Whittier Renovation: A $23.6 million phased renovation is transforming the historic Whittier Building into space for two major research centers – the Nebraska Transportation Center and the Nebraska Center for Energy Sciences Research. The first phase, slated for completion in late 2009, will provide about 26,000 square feet of laboratory, office and meeting space for faculty, staff and students affiliated with these two new centers.

Whittier Building

Animal Research Facility: UNL is renovating its 31-year-old Animal Research Facility to better accommodate researchers' changing needs for laboratory animals. Upgrades will increase space for housing rodents and other animals and modernize operating systems. The first phase of renovations will be completed in 2009.

Quilt Center Expanding Its Reach in New Building

UNL's International Quilt Study Center and Museum is literally opening new doors to research and attracting scientists, scholars, students and quilt aficionados worldwide.

The center is a leader in the growing field of quilt studies and is renowned as home to the world's largest public collection of antique and contemporary quilts.

Patricia Crews

In spring 2008, the center moved into a new 37,000-square-foot building, expanding its ability to research, preserve and display quilts. Previously, a space shortage relegated much of the center's more than 2,300-piece collection to storage, which limited opportunities to study the collection. The $12 million glass and brick building provides ample room for exhibitions as well as research.

Space is essential for studying quilts, said center director Patricia Crews, a textile scientist and historian. Researchers need room to meticulously examine patterns, fabric, colors and threads to obtain important clues about a quilt's historic and cultural significance.

"Our unique interdisciplinary program encourages important quilt scholarship and appreciation of quilts both as aesthetic objects and as cultural artifacts, celebrating their beauty and importance to social and economic history," Crews said.

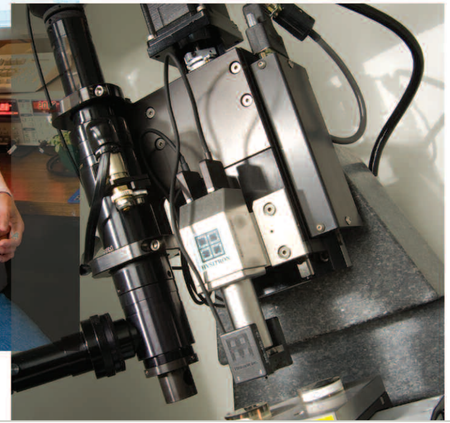
The new space will allow the center to expand its collection, which already includes quilts from more than 25 countries. Research areas, a photography studio, classrooms, climate-controlled storage rooms, public galleries and meeting space also make it easier to host visiting scholars, offer internships and hold public exhibitions.

The building, designed by the internationally known Robert A.M. Stern Architects of New York, was constructed as UNL's first certified "green" building. It was funded through private donations, including a major gift from the Ardis and Robert James Foundation. The center was founded in 1997 when the Jameses, both Nebraska natives, donated their 950 quilts to UNL along with a generous endowment.

The center's collection helped launch a one-of-a-kind graduate program in textile history with a quilt studies emphasis.

Right: Quilt research requires close examination.
Inset: International Quilt Study Center and Museum at night.

Genetics Project Melds Biology, Nanotechnology



Above: Joseph Turner and Sally Mackenzie
Right: A nanoindenter measures material properties at nanoscale depth.

At first glance inside Joseph Turner's laboratory, you'll spot students diligently examining plants and may think this is a biologist's domain. But the UNL engineering mechanics professor is part of a unique multidisciplinary project bringing together engineers, biologists and computer scientists to study how genes function and to develop a new generation of nanotechnology tools to help them.

Through the Nano-enhanced Epigenetics Research project "we're trying to understand what makes a gene respond the way it does so that we might be able to someday duplicate or manipulate it," said plant scientist Sally Mackenzie, who heads UNL's Center for Plant Science Innovation.

Turner and Mackenzie are coordinating the project involving UNL, University of Nebraska Medical Center and Creighton University researchers. It's funded with a three-year, $9 million grant from the National Science Foundation to Nebraska's Experimental Program to Stimulate Competitive Research (EPSCoR).

The biology team is exploring how plant genes react to stresses, such as drought, which may one day help plant scientists make agricultural plants more heat, cold or drought resistant. Other teams are examining how human genes respond to oxidative damage and comparing plant and animal cell responses to different environmental conditions.

Turner hopes his work applying engineering concepts to plant cell walls leads to nano-tools that can introduce encoding material, such as RNA, into a specific gene or cell of a living organism, a more targeted approach than is currently available.

"We needed to start a dialogue between biologists and engineers" to achieve these goals, he said. "Until engineers understand the problems and needs of biologists, we won't know exactly which problems we need to address."

Researchers hope their unique partnership leads to a multidisciplinary center and further collaborations.

Fred Choobineh, director of Nebraska EPSCoR, said this cutting-edge project builds on Nebraska's research strengths.

Students also will benefit, Mackenzie said. "They don't know what kinds of barriers have existed in past years between biology and engineering. They're more open to doing things in new ways. We're creating a new generation of scientist."

Strengthening Plant Science Research

Taking plant science research discoveries from the lab to the field is the overarching aim for scientists in UNL's new Center for Plant Science Innovation.

The new center, created in early 2008, is part of UNL's efforts to strengthen and integrate its plant science research. The center evolved from the Plant Science Initiative, a program established in 1999 that rapidly expanded interdisciplinary plant science research, increased research funding and produced a plant science major and curriculum.

The center builds on this momentum, with a goal of becoming nationally recognized for excellence in agricultural biotechnology research. The center's 14 scientists from several departments integrate fundamental, cutting-edge plant biology research with biotechnology to develop agricultural innovations and put them to work.

This ambitious goal is central to the center's mission of harnessing plant science research to improve Nebraska agriculture.

"We want to be especially relevant to Nebraska agriculture and (provide) the opportunity for our own growers to capture the value of what we do," said Sally Mackenzie, professor of agronomy and horticulture, who led the initiative and directs the center.

Tiny Tools, Big Potential

UNL chemist David Hage is creating tools so small he needs a microscope to see them, but they promise to help scientists make big advances in fields as diverse as medicine and the environment.

Hage uses high-performance affinity chromatography to rapidly separate and measure specific compounds in complex fluids. For example, he might be looking for a drug in a drop of blood, a pesticide in water or an explosive dissolved in liquid.

To find his target substance, Hage packs columns often smaller than a millimeter with a biological compound known to bind to the target, such as an antibody. He passes the fluid through this column under specific conditions. Seconds later, the target – now attached to the antibody – can be extracted and measured, even in miniscule amounts.

"There are an enormous number of molecules even in a small blood sample," he said, "but antibodies give us the ability to fish out or target a particular compound."

Developed with funding from the National Institutes of Health, the U.S. Environmental Protection Agency and the U.S. Geological Survey, Hage's tools, several of which are patented, have many applications. These include finding and measuring contaminants in water, helping forensic scientists detect explosives in liquids, and determining amounts of a drug or hormone in blood for improved diagnosis and treatment.

Hage's techniques also can help drug companies study how new drugs will behave in humans by testing how a drug binds to proteins and other compounds. Such information can help determine dosage levels.

"We're developing new tools where we can get away from the human and animal studies for a lot of this work," he said. "It has the potential to really speed up the development process for new drugs and to reduce costs."

Now he's working toward personalizing health care. People's reactions to drugs vary. By testing an individual patient's blood to see how it responds to a drug, doctors may be able to determine the best dosage for that patient. People with diabetes, depression and heart disorders are among those who would benefit from this individualized approach.

David Hage developed tools to rapidly extract and measure specific compounds in complex fluids.

Omaha and Ponca Dictionary Going Digital

A UNL anthropologist is documenting the Omaha and Ponca language and making this information accessible worldwide.

Mark Awakuni-Swetland and colleagues are creating a comprehensive Omaha and Ponca digital dictionary that will be available online for native communities, students, researchers and the public.

A $348,800 National Endowment for the Humanities grant funds this work through a joint NEH-National Science Foundation-Smithsonian Institution "Documenting Endangered Languages" initiative. It's also a "We the People" project, a special NEH recognition for model projects advancing the study, teaching and understanding of American history and culture.

Awakuni-Swetland hopes this project makes it easier to teach, preserve and revive the language. Originally a united group, the Omaha and Ponca became two distinct political and historic entities long ago. Today, only a few dozen elders in Nebraska and Oklahoma speak Omaha and Ponca as their first language.

This project will provide extensive information on the language and will be far more robust and usable than existing resources.

"We're going to dust off a historically and linguistically important collection of Omaha and Ponca language," Awakuni-Swetland said.

Mark Awakuni-Swetland

Twenty years ago at the Smithsonian's National Anthropological Archives, Awakuni-Swetland microfilmed the field notes and unpublished lexicon of James Owen Dorsey, a 19th century ethnographer and linguist. The dictionary will include Dorsey's 20,000 handwritten slips – each containing an Omaha word, most with an English translation. Words will be transcribed into modern spelling systems. Linguists and native speakers will add grammatical information and cultural notes.

"Many of Dorsey's slips include sample sentences in Omaha that describe how the Omaha were living in the 1870s-90s. It's a treasure of both language and Omaha history," he said.

Awakuni-Swetland, an adopted member of an Omaha tribe family, developed an Omaha language program at UNL. He's collaborating with UNL's Center for Digital Research in the Humanities and Catherine Rudin, linguistics professor at Wayne State College.

Historian Influencing Digital Research

William Thomas studies American history, but his pioneering work is influencing digital humanities research internationally and garnering awards on both sides of the Atlantic.

Historian Thomas, who holds UNL's John and Catherine Angle Chair in the Humanities, studies how railroads transformed American society in the 19th century. Although his research focuses on railroads' effect on slavery, free labor in the North and the Civil War, the digital tools he is creating to understand such a vast network are benefiting researchers worldwide.

In recognition of his work, the American Council of Learned Societies awarded Thomas a prestigious Digital Innovation Fellowship, which includes a $25,000 grant and a year's paid research leave. He's using the award to expand his digital atlas – "Railroads and the Making of Modern America" – that tracks the growth of railroad networks across space and time and links to relevant documents (http://segonku.unl.edu/railroads).

Users can analyze social, economic, immigration, cultural, agricultural, geographic and other data to explore the social consequences of railroad development.

Besides enhancing his own research, Thomas said, "the idea of this digital work is to enable many different kinds of scholarly activity to go on." He sees it firsthand with his graduate students, three of whom received recognition of their own at national conferences.

William Thomas

Thomas' expertise reaches beyond the United States. The British Association for American Studies awarded Thomas an Eccles Fellowship, which goes to one North American scholar annually. He will spend 12 weeks at the Eccles Center for American Studies at the British Library and will visit the digital humanities center at King's College, a world leader in this field.

Thomas said he looks forward to learning from the center's prominent digital scholars and researching the library's extensive map and record collections. In the 1850s, the British became some of the biggest investors in American railroads.

"This is one of the earliest experiences in American history of foreign capital ownership of American assets," Thomas said. "It's not a global economy like it is today, but it's the beginning."

Building Longer-Lasting Bridges

Aging bridges are causing public safety and financial worries nationwide.

UNL bridge engineers are working to ease these concerns by developing better ways to renovate existing bridges and to build new ones that last a century or longer. A $2 million grant from the National Academy of Sciences' Transportation Research Board is funding this four-year project that could change bridge design coast to coast.

Atorod Azizinamini

One goal is to extend the typical lifespan of highway bridges from 75 years to 100 years or more, said UNL civil engineer Atorod Azizinamini. Increasing service life could significantly reduce costs.

Roughly 30 percent of the nation's bridges are structurally or functionally deficient. While replacing them would be ideal, that is far too costly for cash-strapped governments.

"Finding ways to extend the useful life of bridges using modern materials and construction techniques and technologies is more practical," said Azizinamini, who heads UNL's National Bridge Research Organization.

Azizinamini and UNL civil engineers Maher Tadros and Andrzej Nowak, also leading bridge experts, are collaborating with international bridge designers to study whether high-performance steel and concrete materials can be used for individual bridge components. These new-generation materials, some of which were developed at UNL, are more resistant to corrosion. Researchers also will identify new construction strategies to renovate bridges without causing major traffic disruptions and examine new methods for predicting a bridge's lifespan so governments can better plan for maintenance needs.

This research has the potential to set new standards for renovating and designing bridges with spans of 300 feet or less, the size of 95 percent of the nation's bridges. The team's findings will be included in construction guidebooks published by the American Association of State Highway and Transportation Officials.

"We are providing the design profession with the knowledge to do a better job in the future so bridges last longer and can be fixed with minimal cost," Azizinamini said.

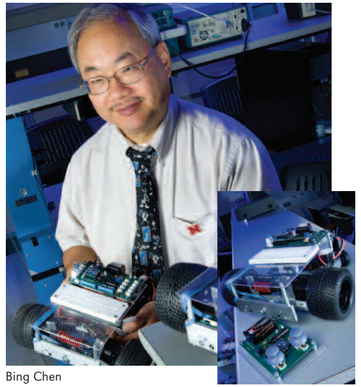
Robotics-Based Curriculum Goes Nationwide

It's hard to keep kids interested in science and math if they don't see how those skills apply in the real world. That disconnect prevents some capable students from pursuing careers in engineering, math, science and technology.

An innovative robotics curriculum developed by UNL engineers in collaboration with University of Nebraska at Omaha educators aims to make that connection for students nationwide. UNL's Silicon Prairie Initiative on Robotics in Information Technology Phase 2, or SPIRIT 2.0, provides flexible, interactive lessons and technical materials via the Internet for K-12 math and science teachers nationwide.

Lessons guide students through building a CEENBoT, a rugged, customizable robot made of circuitry and wire on wheels. The UNL-developed robots are named for the Computer and Electronics Engineering Department.

Students must apply concepts such as algebraic equations, friction, wireless and computer processing, and electronics to build a CEENBoT.



Bing Chen

They explore math and science topics as they experiment with moving the robot.

"The dream is to eventually have at least one CEENBoT being actively used in every K-12 science and math classroom in the United States," said Bing Chen, project leader and chair of UNL's Computer and Electronics Engineering Department at the Peter Kiewit Institute in Omaha.

SPIRIT 2.0 is a five-year, $3 million project funded by the National Science Foundation. It continues the original NSF-funded SPIRIT program that Chen launched in 2006. In the first phase, UNL engineers partnered with UNO and Omaha Public Schools to train 100 middle school math and science teachers to build and use the robots. In turn, participants helped design lesson plans. In this phase, engineers have teamed with educators at UNL, UNO and Iowa State University on curriculum development and evaluation.

Teachers attend a national CEENBoT training session, then share ideas online, download information and get technical and teaching advice from UNL and UNO faculty.

"We don't have restrictions on the creativity of the students or the teachers," Chen said. "I expect that in five years we will be truly surprised by the direction some of these teachers go with their students."

Exploring the Mysteries of the Universe

When UNL physicist Greg Snow and 370 colleagues from 17 countries first descended on western Argentina to observe cosmic rays, it may have seemed like science fiction to local residents. But today this international collaboration is finding answers to one of the universe's long-standing mysteries.

Greg Snow

Very high-energy cosmic rays, actually single energetic particles from outer space, are so rare they hit Earth only once per square kilometer per century. In order to study the rays, a worldwide collaboration of researchers built the Pierre Auger Observatory – an array of 1,600 particle detectors spread over 1,200 square miles – and is analyzing the results.

"This is not a project that can be done by 20 people," Snow said. "You need several hundred people to cover all the bases." Snow's piece of the puzzle is to measure the atmosphere's clarity using a network of lasers, mirrors and light detectors, a task requiring several international teams.

The effort already is paying off. In late 2007, researchers reported in *Science* their discovery that high-energy cosmic rays originate from active galactic nuclei, rare structures found in galaxies beyond our own Milky Way. Scientists also now understand the distribution pattern between high-energy particles and more common low-energy particles. A more challenging goal is to discover what these particles are; theories range from protons to iron nuclei.

Research continues in Argentina to answer those questions, and a Northern Hemisphere observatory proposed for southeastern Colorado would give the Pierre Auger collaboration a view of the entire universe.

As much as Snow relishes being part of the prestigious scientific effort, he also enjoys leading outreach activities in Argentina.

"We wanted to have a positive impact on the town and the province where we have our detectors spread," said Snow, who oversees a popular visitor's center, school visits, lectures and an extensive Web site (www.auger.org). "We feel it is our responsibility to share the excitement of the science we're doing with a broader audience."

Harnessing Bioinformatics to Find Proteins

Etsuko Moriyama mines for treasure without a hardhat. The UNL biologist uses a computer to dig out proteins from the vast hereditary information of an organism's genome.

Recent sequencing of many organisms' genomes, including humans, offers crucial and nearly unlimited genetic data. The problem is "the sheer volume of information," Moriyama said. Proteins are created from small fragments of DNA sequences. Finding the sequences that create specific proteins is an often difficult next step in solving biological questions.

Moriyama, associate professor in the Center for Plant Science Innovation and School of Biological Sciences, studies how G protein-coupled receptors – proteins involved in the senses such as sight and smell – function and malfunction in diseases. "But before we can understand how they function, we have to find them," she said.

With a $591,000 grant from the National Institutes of Health National Library of Medicine, Moriyama

Etsuko Moriyama with graduate students Seong-il Eyun (left) and Cory Strope.

is developing valuable bioinformatics tools to mine DNA sequences for proteins. Researchers often look for proteins by comparing known protein sequences of one species with sequences from the species of interest. But this "alignment" technique often fails.

For example, when Moriyama looked for proteins that insects use for smell, she discovered their olfactory receptors are too different from mammalian receptors and often too different from each other to help find the proteins.

Moriyama began developing new, more sensitive techniques researchers can use to quickly and accurately narrow the field of possible sequences.

Collaborating with laboratory scientists in UNL's Center for Plant Science Innovation is vital to Moriyama's bioinformatics research, which uses computers to analyze biological data.

"I can provide them with predictions and procedures, and they give me feedback so that I can refine and improve the techniques," she said. "Being a part of the center has helped me to establish these strong connections."

These collaborations have broader potential. "If we can succeed with this insect olfactory receptor mining, we can use a similar strategy for many different organisms and many different protein families," Moriyama said. For researchers worldwide, that could speed discoveries of new therapies and treatments for diseases.

Etsuko Moriyama

Examining Risky Behaviors to Help Homeless Youth

Kimberly Tyler

To cope with their traumatic pasts – or simply to survive on the streets – homeless young people and runaways may engage in activities that put them at risk for contracting HIV. Yet some at-risk young people make healthy decisions despite their circumstances.

UNL sociologist Kimberly Tyler wants to know why.

With a grant from the National Institutes of Health, Tyler is researching whether supportive social networks can buffer homeless youth from risky behaviors such as unprotected sex and drug use. Social networks are defined as the people with whom youth regularly interact.

During the two-year project, Tyler is studying the risk behaviors of 300 homeless young people and runaways aged 14 to 21. She will follow up with in-depth interviews with 40 participants to determine how they met the people in their social networks and the dynamics of those relationships. That may provide clues to whether peers influence their behavior positively or negatively.

"We don't know whether friends get them involved in risky behaviors or whether they gravitate toward certain behaviors in order to fit in with their peers," Tyler said.

Peer pressure is common in most teenage friendships, but particularly among homeless and runaway teens. Because many have experienced physical or sexual abuse at home, they tend to mistrust authority figures and turn to small groups of peers for guidance. By studying examples of positive peer pressure, researchers may uncover better ways of educating at-risk youth about HIV prevention.

While research on homeless young people is growing, Tyler is one of a few sociologists who focus on this issue in the Midwest. Participants in this project are from Lincoln and Omaha, Neb., and Des Moines, Iowa.

"There seems to be a perception that you have to go to the coasts to study homelessness, but that isn't true," Tyler said. "Virtually all homeless teens, wherever you go, face similar risks."

Demystifying the World of Viruses

Libraries are integral to making the latest science-based information accessible to their communities.

That's why UNL researchers are collaborating with public libraries and radio stations nationwide on an integrated educational media initiative to teach the public about cutting-edge virology research. The project features radio programs and sophisticated outreach materials, including Web-accessible activities, podcasts and graphic files for 10 virology-related topics. Funded by a five-year, $1.3 million grant from the National Institutes of Health, "World of Viruses" is one of the largest informal public education projects of its kind. It will help teens and adults better understand the biology of viruses, provide reliable sources of scientific information and encourage teens to consider careers in virology and other areas of biomedical research.

Judy Diamond

"Many people feel that infectious disease and virology are too complicated to understand, and we want to make information that's accessible but also understandable," said Judy Diamond, project leader and University of Nebraska State Museum professor and curator of informal science education.

Topics include viruses as bioweapons, emerging viral diseases, global infections such as HIV/AIDS and human papilloma virus, vaccine development and viruses in agriculture and the environment.

The first radio programs will be available in 2009. Libraries will be able to download complementary exhibit materials to use when local stations broadcast the programs. The project will have resources for educators and students in grades 6-12.

"Increasingly in this information age, libraries have become places where people from the community can come and interact with electronic media," Diamond said.

Experts from the State Museum, UNL's Nebraska Center for Virology, Soundprint Media Center Inc. and renowned science writer Carl Zimmer are producing the outreach materials.

"This project is exciting because it will bring recent discoveries and insights about viruses to the public, and especially to young people," said Peter Angeletti, a UNL virologist and a project collaborator. "We really need to educate the public and open a conversation about what viruses mean to their lives."

Revealing Bioenergy Potential of Switchgrass

Thick stands of lush native switchgrass waving in a summer's breeze represent the raw materials for the next generation of biofuels.

Commercial production of cellulosic ethanol from switchgrass or other biomass sources remains a few years off. But Nebraska researchers are making sure farmers have high-yielding strains and management information to efficiently grow switchgrass for biofuel.

Ken Vogel, a USDA-ARS plant geneticist at UNL, leads joint USDA-UNL research on switchgrass. He has developed high-yielding switchgrass varieties specifically for biofuel production and has studied their potential since the early 1990s. He and colleagues also have identified management practices for maximizing production and have evaluated yields, economics and energy output.

The team sparked international excitement in early 2008 with results of the largest study of its kind that showed switchgrass grown for biofuel produces 5.4 times more energy than needed to grow, harvest and process it into cellulosic ethanol. Findings, reported in the *Proceedings of the National Academy of Sciences,* were from a five-year study involving 10 farms in three states that examined net energy output, greenhouse gas emissions, biomass yields, agricultural inputs and estimated cellulosic ethanol production from switchgrass grown for biofuel.

"This clearly demonstrates that switchgrass is not only energy efficient, but can be used in a renewable biofuel economy to reduce reliance on fossil fuels, reduce greenhouse gas emissions and enhance rural economies," Vogel said.

Researchers also found greenhouse gas emissions from switchgrass-based ethanol production were 94 percent lower than emissions from gasoline production.

UNL agricultural economist Richard Perrin found the on-farm cost of producing switchgrass for biofuel averages about $60 per ton. Perrin's findings were published in *BioEnergy Research.*

Ken Vogel (left) and Richard Perrin

Switchgrass has long been used for conservation plantings and cattle grazing. Vogel said he's excited about growing switchgrass for biofuel production because it's a perennial that doesn't need annual planting, grows well on marginal land ill-suited to crops, and harvesting doesn't diminish its soil-protecting powers.

Capitalizing on Ethanol Byproducts

Biofuel plants are expanding nationwide, but Nebraska's unique mix of corn, cattle and ethanol production affords a competitive edge.

"A lot of states have ethanol and grain production and some others have cattle, but Nebraska is the only state that has all three. Our goal is to figure out ways to capitalize on that advantage," said UNL animal scientist Galen Erickson.

UNL animal scientists are leaders in researching how best to use byproducts from ethanol production for cattle feed. Their pioneering studies in the 1990s proved the benefits of feeding wet byproducts to cattle instead of drying the material. Eliminating drying reduces ethanol production costs about 5 percent and provides an economical, high-performance feed. This work transformed wet byproducts into a feedlot staple and aided development of Nebraska's ethanol industry.

With a grant from UNL's Nebraska Center for Energy Sciences Research, Erickson and colleagues are researching ways to use more of the rapidly increasing supply of wet byproducts and evaluating the economics for cattle producers.

For example, Erickson, colleague Terry Klopfenstein, agricultural economist Darrell Mark and graduate students developed an online computer program that feedlot operators can use to predict cattle performance and economic returns from feeding byproducts, based on individualized information such as grain, byproduct and transportation costs.

"Feeding byproducts is complex and cattle feeders need to know the bottom line. This gives it to them," Erickson said.

Feeding more byproducts is essential for both cattle and ethanol producers to continue making the most of the boom. Historically, wet byproducts have comprised 15-20 percent of feedlot rations. Researchers hope to boost that to as much as 50 percent.

Galen Erickson. Inset: Ethanol byproducts.

"There are limitations but we're looking at ways to overcome these," Erickson said.

Ongoing byproduct feeds research also is exploring everything from optimal feeding rates and new uses to waste management and meat characteristics.

Enhancing Diversity Through ADVANCE

UNL is launching a campuswide effort to recruit and support more women faculty in the science, technology, engineering and mathematics disciplines.

With a $3.8 million grant from the National Science Foundation's ADVANCE program, UNL is establishing a program to organize professional development opportunities for all faculty, disseminate information about existing family-friendly policies, facilitate dual-career hires and help departments broaden their searches for candidates.

At UNL, women comprise less than 20 percent of the faculty in the science, technology, engineering and mathematics disciplines, which is below the national average. The goal for ADVANCE-Nebraska is to ensure that the pools of applicants for jobs in departments in those fields match or exceed the percentage of women who receive doctoral degrees.

"We want the best faculty we can get, and the way we're doing business now is not attracting the widest applicant pool," said Mary Anne Holmes, associate professor of practice in geosciences and ADVANCE-Nebraska program director.

Barbara Couture, senior vice chancellor for academic affairs, will oversee the program. Encouraging a more diverse faculty will benefit students and enhance UNL's academic reputation, she said.

Throughout the five-year grant, UNL sociologists will study whether ADVANCE programs affect the UNL faculty's professional and social networks and enhance participating departments' academic success.

Cultivating a world-class and broadly inclusive science and engineering workforce for the nation is one of NSF's goals. The agency established the ADVANCE program in 2001 to increase participation and advancement of women in academic careers in these disciplines. ADVANCE programs have been successful at 30 other major universities.

"This is one way we can do our part to help develop a more diverse workforce in the science and engineering fields and attract the best, most talented people to UNL," said Prem Paul, vice chancellor for research and economic development.

ADVANCE grant planning team representatives (from left) Stephanie Adams, Mary Anne Holmes and Barbara Couture.

Improving Literacy for Low-Income Preschoolers

Children who don't develop strong literacy and language skills by third grade are likely to fall behind and have difficulty catching up, studies show.

UNL's new Rural Language and Literacy Connections program aims to give low-income 3- to 5-year-olds a foundation for reading and academic success by the time they reach kindergarten and first grade. A three-year, $2.74 million grant from the U.S. Department of Education funds this effort.

UNL is partnering with educators at Head Start Child and Family Development Inc., Grand Island Public Schools and local child care centers to develop an intensive, literacy-based early learning program for about 200 preschool children and their families in the Grand Island area.

"Reading skills generate confidence, positive social skills and problem-solving abilities that can have substantial influence on later success in school," said Lisa Knoche, project co-director and research assistant professor in UNL's Nebraska Center for Research on Children, Youth, Families and Schools.

The program takes a strong holistic approach, encouraging educators, parents and child care providers to work as partners in teaching literacy skills. It provides resources such as dual-language children's books, biweekly "literacy nights" for families and training programs for teachers and child care providers. Families also receive ongoing support through monthly home visits.

"Continuity in each setting of a child's life is very important for maximizing language and literacy skills," Knoche said.

UNL researchers will assess children through preschool and track them into elementary school to evaluate progress. They will use that information to develop recommendations for best teaching practices, said Helen Raikes, project co-leader and professor in UNL's Department of Child, Youth and Family Studies.

"UNL's access to data collection, evaluation and the support of our early childhood group is invaluable. It's the reason we got this grant and the reason why it will be a wonderful success," said Deb Ross, executive director of Head Start Child and Family Development Inc.

Lisa Knoche and children participating in UNL's Rural Language and Literacy Connections program in Grand Island, Neb.

Predicting Beef Tenderness

Jeyamkondan Subbiah scans a steak.

Think "perfect steak" and tenderness comes to mind. Yet there's no accurate, nondestructive way to predict meat tenderness before the consumer takes that first bite.

UNL food engineer Jeyamkondan Subbiah is developing a technology to change that. He has developed a hyperspectral imaging system for scanning steaks that combines image analysis and spectroscopy. The system captures multiple images of the muscle structure and measures biochemical properties, the two key qualities that affect beef tenderness.

Research so far is promising. Using a three-tiered ranking system, Subbiah's technology predicts tender, intermediate or tough beef with 77 percent accuracy. Using a two-way ranking – acceptable and tough – accuracy is 94 percent.

"Beef is expensive. Consumers expect it to be tender. One bad experience can make them not buy beef for a while," Subbiah said.

Tenderness is the primary factor in consumer satisfaction, but current USDA grading standards do not assess it. Technology that predicts tenderness would allow retailers to charge a premium for a "guaranteed tender" label. If consumers are willing to pay more, producers will have greater financial incentive to supply tender beef.

Hyperspectral imaging has been used to detect nutrient deficiencies in plants and contamination on fruit and chicken, but Subbiah is the first to adapt the technology to beef. His next goal is to rapidly scan entire carcasses, a key capability in making the technology commercially feasible.

The Nebraska Beef Council and National Cattlemen's Beef Association help fund this research. UNL is patenting the technology and hopes to identify a business interested in partnering on commercialization.

Heated Concrete Keeps Ice at Bay

Ice and snow quickly turn highways – especially bridges and overpasses – dangerously slick. UNL civil engineer Christopher Tuan has developed a technology to keep ice and snow off roadways and other concrete surfaces without using salt or other corrosive materials.

In his lab at the Peter Kiewit Institute in Omaha, Tuan developed conductive concrete, composed of regular concrete, carbon powder and steel fibers.

The mix is poured into a slab embedded with electrodes, turning a roadway or a sidewalk into a heated pad. When the temperature drops below 35 degrees Fahrenheit, the concrete is powered to start generating heat, preventing ice from forming on the surface.

The UNL-patented technology has been used for a bridge deck near Roca, Neb. Although conductive concrete is more expensive than traditional concrete, it is twice as strong and requires little maintenance once poured.

Tuan envisions conductive concrete also being used for walls and floors, giving homeowners a new, more energy-efficient option for basement heating.

The technology is licensed by E-Tech International, and UNL's Office of Technology Development is seeking additional partners to commercialize it.

Heated concrete bridge in action.

Conrad Leads Tech Development

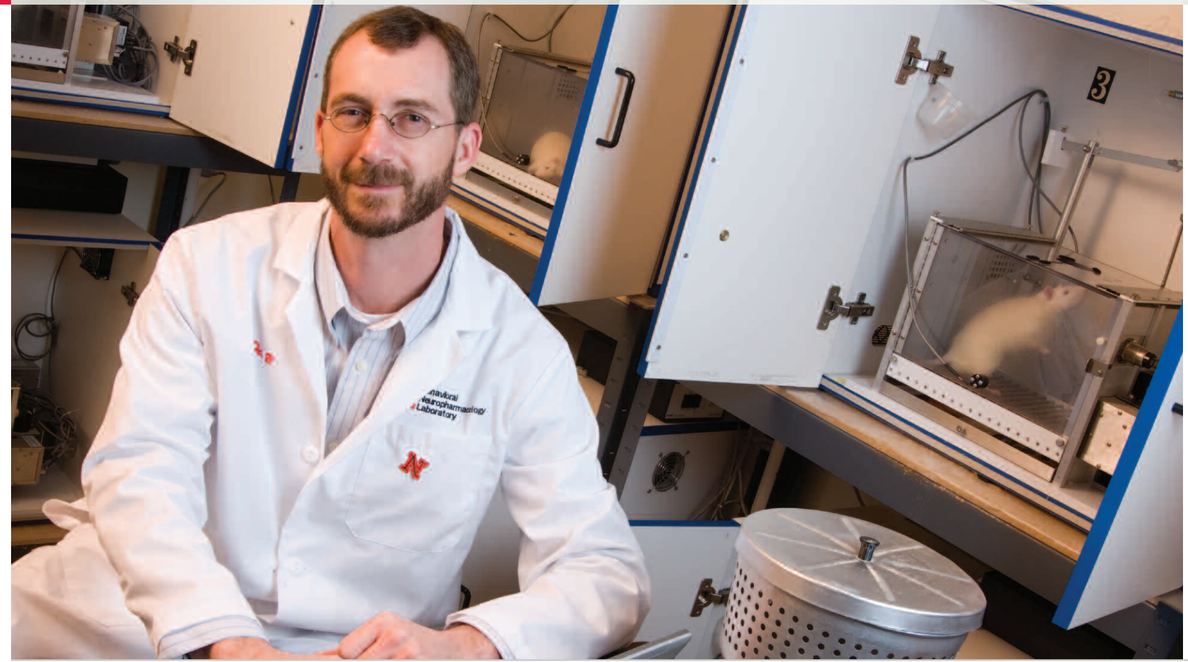
David Conrad

UNL is ratcheting up efforts to move research discoveries and inventions from the lab to the marketplace.

"This is an exciting time for technology development at UNL," said David Conrad, who became associate vice chancellor for technology development in July 2008. He heads the Office of Technology Development, which works to turn university research into tangible products and services that return income to inventors and the university.

Conrad earned a master's in business administration from Duke University, a Ph.D. in chemistry from the University of Illinois and a bachelor's degree in chemistry from the University of North Carolina. He previously was licensing manager at UNL. Earlier, he was a licensing associate for Iowa State University's Research Foundation and a technology consultant for Research Triangle Institute International in North Carolina. He has entrepreneurial experience as co-founder, president and CEO of a startup company.

Unraveling Secrets of Nicotine Addiction



If you seem to have a harder time giving up cigarettes than your friends do, it may be at least partly due to your first smoking experiences.

With a grant from the National Institutes of Health, UNL psychologist Rick Bevins is studying how the learning process affects a drug's addictive quality. Do a person's feelings about nicotine and smoking change the biological effect on the nervous system?

Bevins is using rats to find out. By giving them occasional sugar water when they experience nicotine, Bevins creates a positive learned association. Then he compares the differences in addictive behavior between these rats and those with neutral associations with nicotine.

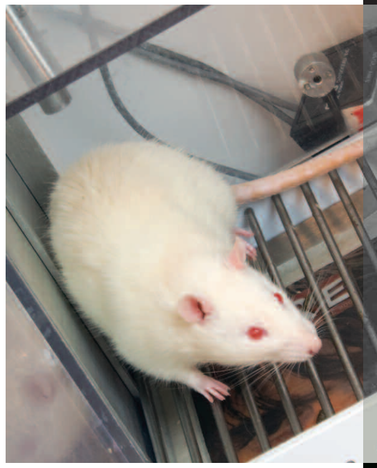
"We hypothesize that if you have a positive learning history, that drug is going to be more addictive," Bevins said. "The nicotine itself has literally changed its impact on the body and will have a more tenacious effect on the nervous system." That means nicotine may be more addictive for people who first associate smoking with rewarding experiences, such as acceptance by friends, improved self-image, relaxation or stress reduction than for those with neutral or negative experiences.

Understanding how addiction works will lead to better treatment and prevention strategies. "This research tells us that you need to pay very close attention to people's learning histories with nicotine and design therapies on a more individual basis," Bevins said.

In the United States, 23 percent of adults smoke. "If you can move the adult smokers from 23 percent to even 22 percent, then that's a huge portion of the population."

Bevins' work extends to other addictive drugs. Through collaborations with University of Nebraska Medical Center researchers, Bevins uses rats to evaluate treatment methods to decrease relapses in methamphetamine addicts and to find vaccines against methamphetamine and nicotine.

Rick Bevins



The vaccine induces the immune system to generate antibodies that prevent nicotine from entering the nervous system, leading to less addictive behavior in vaccinated rats.

Renowned Quartet at Home in Nebraska

It's a testament to a musical ensemble's reputation when half of a town's residents show up for the performance.

True, that town might have a population of only 600. But it's a sign that Nebraskans appreciatively embrace the Chiara String Quartet, a world-class contemporary chamber music ensemble.

Violinists Rebecca Fischer and Julie Yoon, violist Jonah Sirota and cellist Gregory Beaver have been artists-in-residence at UNL since 2005. The quartet has performed in towns large and small across the state and gotten hundreds of college musicians from across the nation interested in chamber ensembles, in addition to keeping its regular performance schedule.

"The fact that people of this stature have chosen to make Lincoln their home and take on the responsibility of providing this kind of exposure to Nebraskans is a statement in itself about how important music is and how sophisticated our audience is," said Ann Chang-Barnes, a pianist in UNL's School of Music and interim director of the Lied Center for Performing Arts, who has performed with the ensemble. Barnes hired the up-and-coming quartet to perform at Lincoln's Meadowlark Music Festival in 2004. School of Music director John Richmond was in the audience and loved what he'd heard. The rest, as they say, is history.

Chiara's presence has elevated UNL's visibility in the worlds of chamber music, string performance and orchestral music, Richmond said. Collegiate musicians nationwide clamor for fellowships in UNL's Chamber Music Institute, an intensive summer program that brings the best students to campus to work with the quartet and UNL music faculty. Growing interest in this area also prompted curriculum changes, such as requiring performance majors to get chamber group experience.

Faculty members who perform with Chiara expand their repertoires, too. In 2009, Barnes and Beaver will perform Beethoven's complete works for piano and cello.

"You don't get a chance to play with musicians of their caliber all the time," Barnes said.

Center photo: Chiara String Quartet members (from left) Rebecca Fischer, Julie Yoon, Gregory Beaver and Jonah Sirota in concert.
Inset photos (clockwise from top): Fischer, Sirota, Yoon and Beaver coach students at UNL's Chamber Music Institute.

Credits

The 2007-2008 Annual Report is published by the University of Nebraska–Lincoln Office of Research. More information is available at **http://research.unl.edu** or contact:

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Special thanks to Brent and Robin Meeks, owners of the Upstream Ranch, Taylor, Neb., for allowing the cover photo to be shot at their ranch.

More Research Highlights

Physicist Named Cottrell Scholar

Kirill Belashchenko sees more to magnets and spin than just MP3s and iPods. His work on a new theory may lead to spin-based devices that will read and analyze data faster than ever. The UNL assistant professor of physics was named a 2008 Cottrell Scholar by the Research Corporation. His $100,000 award will support his research on magnetic materials. Belashchenko focuses on applying the theory to computers that use spintronics, a technology based on quantum spin of electrons rather than charge. He is developing a technique for studying magnetic materials at finite temperatures.

Ethanol's Impact on Food Prices

Food prices have risen dramatically worldwide. A preliminary study by UNL agricultural economist Richard Perrin indicates that increasing demand for corn for ethanol production is responsible for about 1.2 percent of the increase in U.S. food prices during the past two years, but could account for as much as a 15 percent increase in poorer countries.

Two Earn CAREER Awards

Physicist Axel Enders and computer scientist Myra Cohen are the latest UNL faculty to earn NSF CAREER Awards, which help outstanding pre-tenure faculty develop as teacher-scholars and researchers. Enders studies advanced magnetic nanostructures, which could be used in computer hard drives and other high-density storage devices. Better understanding the functional properties of magnetic elements could greatly expand the data capacity of these devices. Cohen is developing algorithms to better test highly configurable software systems, such as Web browsers and databases. This research will enable software companies to better test how millions of combinations of optional features interact.

Jefferson's Vision of the West

Ever wonder how Thomas Jefferson, who never traveled west of Virginia, became so closely associated with the American West? UNL historian Doug Seefeldt's interactive digital history project offers some insights. "Envisaging the West: Thomas Jefferson and the Roots of Lewis and Clark" explores the third U.S. president's relationship with his country's expanding borders. The site includes interactive GIS-based maps that integrate information from diverse sources. It's one of more than 40 research projects by faculty working with UNL's Center for Digital Research in the Humanities.

Selenium Supplements

Selenium's potential health benefits have grabbed attention in recent years, and many multivitamin and mineral supplements contain this trace element. While it's an essential micronutrient, research by UNL biochemists in cooperation with an NIH scientist raises questions about whether healthy people need supplemental selenium. UNL biochemist Vadim Gladyshev, an expert in studying selenium and selenoproteins, and his colleagues reported their findings in *Genome Biology*.

Documenting Big Beetles

Scientists studying beetle biodiversity in Mexico, Guatemala and Belize are racing against habitat loss and climate change to document the insects before some disappear. Brett Ratcliffe, curator of insects at the University of Nebraska State Museum, heads this research, funded by a $481,000 NSF grant. Researchers are studying dynastine scarab beetles, or rhinoceros beetles, which are some of the world's largest insects. Researchers will produce a book documenting the dynastine scarab beetles in the three countries. NSF also funded research for the earlier volumes.

Quality of Life a Big Draw

Quality of life is a major selling point for attracting new residents to the Nebraska Panhandle. That's among the findings of a study that offers development strategies for rural communities. Findings by UNL researchers from the Panhandle Research and Extension Center, Nebraska Rural Initiative and Center for Applied Rural Innovation suggest jobs are important but are not the No. 1 draw. Top reasons for moving to the Panhandle were to adopt a simpler pace of life, to find a less congested place to live or to be closer to relatives. A USDA-CSREES National Research Initiative grant funded this study.

New Sheldon Director

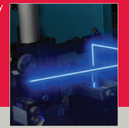
Jorge Daniel Veneciano, the new director of UNL's Sheldon Museum of Art, brings experience in arts administration and in developing community arts programs to the job. Veneciano joined UNL in July 2008 to lead Sheldon's artistic and strategic programs, engaging both the university and Nebraska arts communities. The museum houses a collection of more than 12,000 American artworks.

Accreditation Milestone

UNL's human subjects research protection program earned full accreditation from the Association for the Accreditation of Human Research Protection Programs Inc. in 2008. The rigorous voluntary accreditation process ensures that institutions adhere to the highest standards to protect human participants in research.

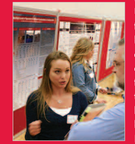
Workshop Showcases Laser Research

Federal agency and industry representatives learned about UNL's expertise and capabilities during the Frontiers in Laser Research Workshop in October 2007. The workshop, hosted by the Office of Research, featured tours of UNL laser research facilities and meetings with program officers from several funding agencies. UNL faculty presented their research, and agency and industry representatives outlined funding opportunities and new research initiatives. Participants discussed potential partnerships involving UNL, the Department of Defense and the Department of Homeland Security. Several faculty are pursuing research collaborations as a result of the workshop.



Protecting Fossils

A new building to be completed in late 2008 at the Ashfall Fossil Beds State Historical Park will protect more of the many fossils at the site, enable expanded scientific excavation and enhance visitors' experiences. UNL scientists have worked at the site near Royal, Neb., since its discovery in 1971. They've uncovered more than 200 skeletons of extinct rhinos, camels and horses lying in the volcanic ash that killed them 12 million years ago. Construction of the Hubbard Rhino Barn was made possible by a $1.2 million gift from the Theodore F. and Claire M. Hubbard Family Foundation of Omaha to the University of Nebraska Foundation.



Research Fair

UNL celebrated faculty and student accomplishments in research, scholarship and creative activities during the 2008 Research Fair. A springtime tradition at UNL, the fair features opportunities for faculty to meet with and hear presentations by funding agency representatives; graduate and undergraduate poster sessions and conferences; educational sessions; and faculty recognition events. UNL research took the spotlight during an on-campus luncheon for Nebraska lawmakers and business leaders. Speakers included Henry Blount, Parag Chitnis and Frank Scioli, all NSF; Joan Ferrini-Mundy, NIH; Brett Bobley, NEH; Gale Buchanan, USDA; Don Dillman, Washington State University; and Dan Collins, Arizona State University.

Nebraska Lectures Feature Prominent Faculty

A geoscientist and a textiles scientist outlined their work during the 2007-08 Nebraska Lectures: Chancellor's Distinguished Lecture Series. In her fall lecture, Sheri Fritz, Willa Cather professor in geosciences and the School of Biological Sciences, described how she studies lake mud to reconstruct the history of climate change in "Through Layers of Mud and Time: A Long-term Perspective on Environmental Change." In the spring, Patricia Crews, Willa Cather professor of textiles, clothing and design and director of UNL's International Quilt Studies Center and Museum, discussed how quilts reflect American culture and the lives of quilt makers in "Quilts: Reflections of Trade, Technology and Tradition." The Office of the Chancellor, the Research Council and the Office of Research co-sponsor these public lectures featuring prominent faculty.