

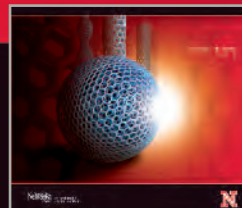
ANNUAL REPORT
2010-2011

Table of Contents

Collaborations, Partnerships Drive Innovation	1	Building Industry Connections	23
Discovery Could Spark Smaller, Faster Electronics	2	Virtual View to Safer Job Sites	24
MRSEC Fosters Collaboration	3	Teaming on Wheat Improvement	25
Harnessing Laser Power Creates Precise Nanostructures	5	UNL Technology Powers Solar Startup	25
Nanohybrids Promise 'Best of Both Worlds'	6	Zeroing in on Genes to Beat Rice Blast Fungus	26
Water for Food Institute Building Partnerships	8	Coalition Aims to Turn Algae into Biofuel	27
World Water Expert to Lead Institute	9	Partnership Expanding Brain Research	28
Understanding Aquifer Recharge	10	Targeting Metabolism to Combat Staph Infections	30
Targeted Research Investments Hedge Against Food Crisis	11	Probing Genes, Gut Microbes and Food Safety	31
Uncovering New Perspectives on Whitman	12	Breaking the Revictimization Cycle	32
Civil War Washington Going Digital	14	Rooting Out Health Disparities	33
Humanities Grants Support Language, Digital Initiatives	15	Student Ad Agency Sets Sail	34
Improving Children's Reading Comprehension	16	Hollywood Pros, Students Team Up for Film Series	35
Transforming Early Childhood Education	17	Prepping for Legal Reform	36
Bullying: Filling Gaps Between Research, Practice	18	Durham School Building on Strengths	37
Preparing Military Kids for Success in School	19	Research Highlights	38
Museum Celebrates 140 Years of Discovery	20	Financials	41
Development Revving Up at Nebraska Innovation Campus	22		

On the Web

Explore the UNL Research Annual Report website for more photos, links and videos related to the stories featured in this report: research.unl.edu/annualreport/2011



On the Cover

Nanotechnology promises to revolutionize industry, energy, medicine and science with products and technologies from everyday consumer goods to sophisticated electronics and biomaterials. Nanotechnology is among the University of Nebraska-Lincoln's research strengths. From nanomagnetism and spintronics to laser-assisted nanomaterials and nanohybrids, our faculty are turning nanotechnology's potential into reality. The cover features illustrations of a carbon nano-onion and carbon nanotubes. UNL electrical engineer Yongfeng Lu uses lasers to produce these and other precision nanostructures. Read more on pages 2-7.

Collaborations, Partnerships Drive Innovation

Creating a culture of collaboration has been central to UNL's research progress over the past decade. Expanding collaborations and partnerships is essential to our success as we build for the future.

The reason is simple: We achieve far more by working together – across disciplines, institutions and geographic boundaries – with both public and private sector partners. The complexities of 21st century challenges and opportunities demand this approach.

We've made significant progress. Our research in digital humanities, water for food and nanotechnology, as well as strides in economic development, are among the examples of UNL's collaborative spirit featured in this report.

Nebraska Athletics and the UNL Office of Research and Economic Development are partnering to create research space for a new interdisciplinary research initiative in the East Stadium addition to Memorial Stadium, home to Husker football. This initiative will bring together behavioral, biological,

social science, and health and performance researchers in the proposed Center for Brain, Biology and Behavior to tackle, among other topics, performance issues such as the effects of concussion on the brain (page 28).

Nebraska Innovation Campus, UNL's private-public research campus, illustrates the payoffs when the state, university and private sector work together. A \$25 million investment by Nebraska's Legislature and the governor has fueled \$80 million in private and public investments in the Phase I development (page 22).

UNL's entrance into the Big Ten Conference in 2011 launched a promising and exciting new era of collaboration for UNL research and academics as well as athletics. Big Ten members are among the nation's leading research universities, renowned for excellence in the classroom, lab and playing field. Collaboration is a rich Big Ten tradition, and the affiliated Committee on Institutional Cooperation offers the most sophisticated collaborative infrastructure in American higher education. It's a

great fit for UNL and we look forward to building productive partnerships across the conference.

From carbon nanostructures to aquifer recharge, from virtual 3-D construction sites to genetic control of gut microbes, and from a high-powered laser lab to world-class digital humanities research, UNL faculty are innovating for the future. This report highlights how our collaborative spirit fuels this innovation to benefit Nebraska, the nation and the world.

We are excited about our future and look forward to enhancing collaborations and developing key partnerships. We welcome your innovative ideas. If you would like to partner with us or know of potential collaborators, please let us know.

Prem S. Paul
Vice Chancellor for Research and Economic Development



Chancellor Harvey Perlman (left) and Vice Chancellor Prem S. Paul



Discovery Could Spark Smaller, Faster Electronics

Nanopods, cameras the size of credit cards, computers that run trillions of calculations per second. Can gadgets get any smaller or more powerful?

Yes, engineers say, but the limit is looming.

To help head off this predicted size barrier, a team at UNL's Materials Research Science and Engineering Center (MRSEC) has made an important breakthrough in spintronics, which exploits electron spin for use in advanced information technologies.

"In a nanometer, there are only so many atoms next to each other. After you reach that level, you can't make things smaller," said physicist Christian Binek, the project's lead investigator. "To move on from that point, we have to do something fundamentally new."

Today's electronics use an electric current to store and process information. But currents generate heat, limiting the number of transistors that can be packed onto a chip. Currents also use energy, reducing battery life. Based on their findings, the UNL researchers envision a conceptually new generation of ferromagnetic transistors overcoming these limitations.

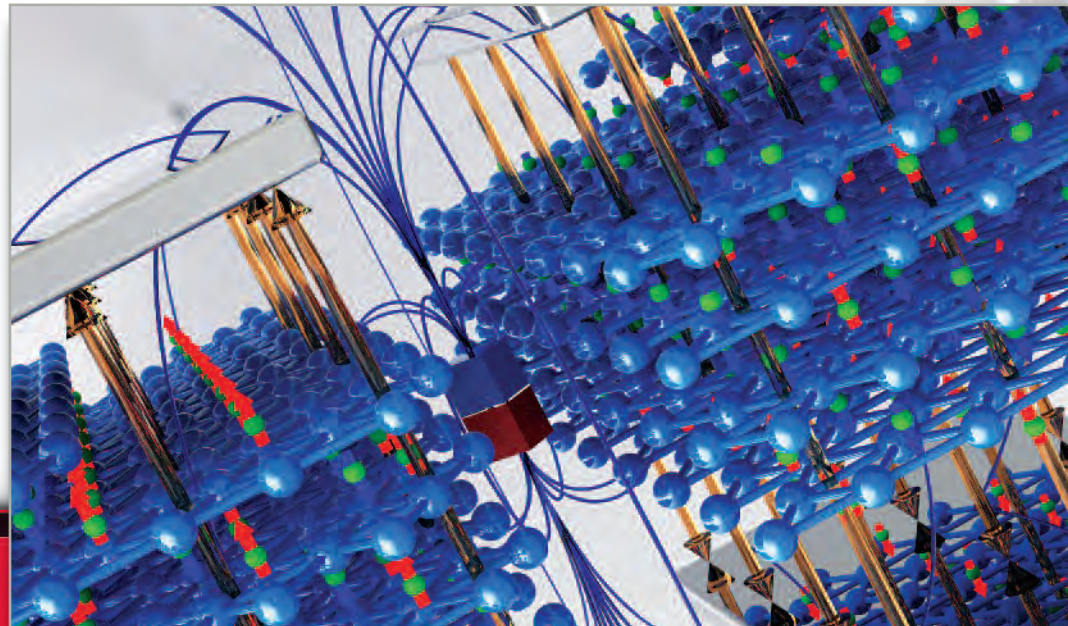
Binek's team discovered how to switch ferromagnets' magnetization using voltage, which doesn't generate heat. The magic ingredient is chromia, the oxide form of chromium, which can be magnetized with voltage. Making a precisely ordered thin film of chromia, bringing it into contact with a ferromagnet and applying voltage also switches the ferromagnet's magnetization.

Binek now is developing voltage-powered logical and memory devices, which could lead to less expensive, smaller and more powerful gadgets that use less energy. Consumers, for example, would be able to store more movies on longer-powered mobile devices. Researchers also may

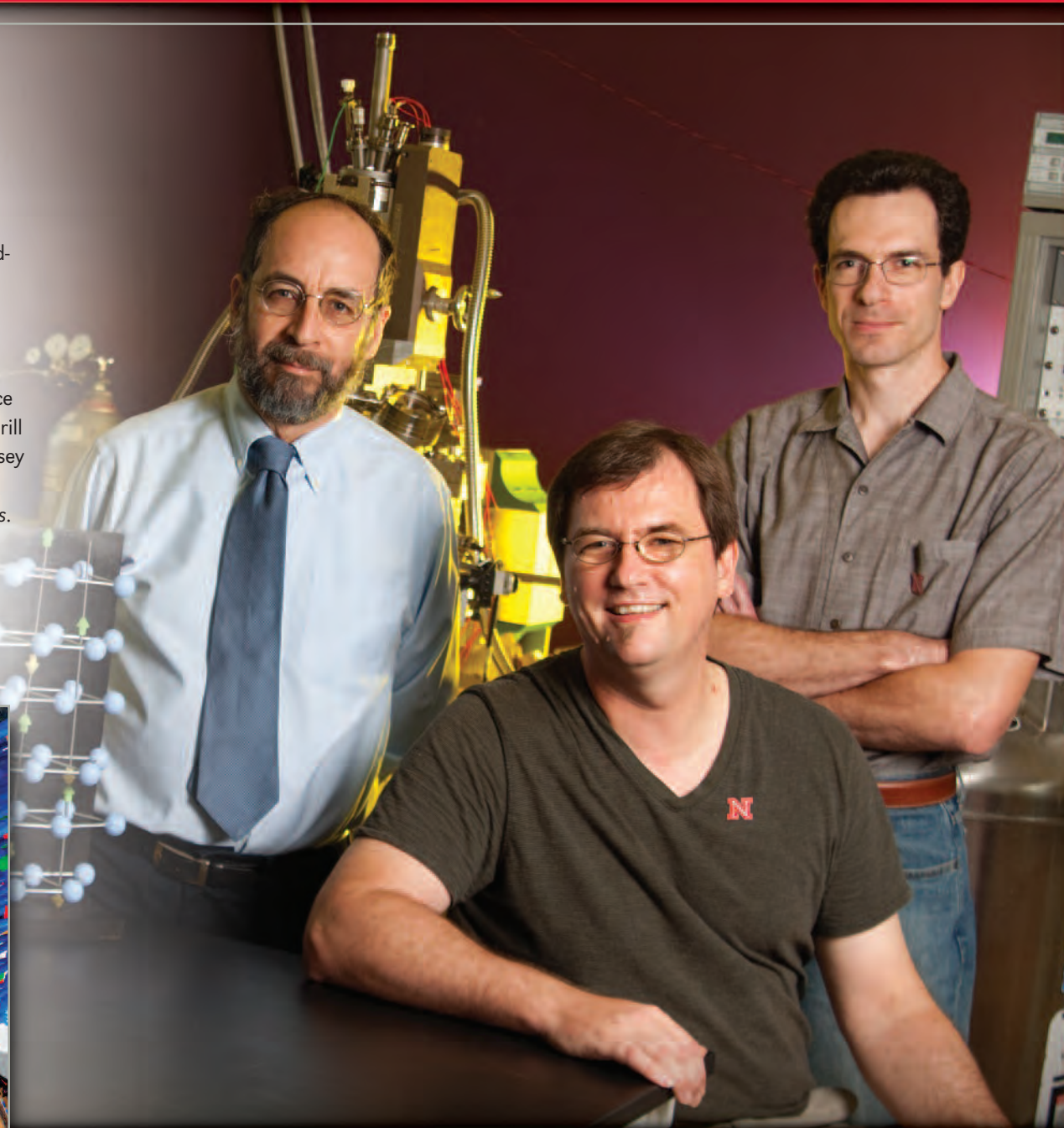
one day have the computing power to run mind-blowingly complex calculations, enabling new scientific discoveries.

Binek credits collaborations made possible by MRSEC, which is funded by the National Science Foundation. Co-investigators, UNL physicists Kirill Belashchenko and Peter Dowben, a Charles Bessey Professor, contributed invaluable expertise. The team reported its discovery in *Nature Materials*.

"I was forced to leave my comfort zone and look more broadly, with different methods and different ideas. Working together gave us this breakthrough," Binek said.



Spintronics illustration



From left: Peter Dowben, Christian Binek and Kirill Belashchenko

MRSEC Fosters Collaboration

UNL's Materials Research Science and Engineering Center provides valuable collaborative and financial opportunities for nanoscientists studying new magnetic structures and materials.

That's paying off, said physicist Evgeny Tsymbal, MRSEC's director, and a Charles Bessey Professor at UNL.

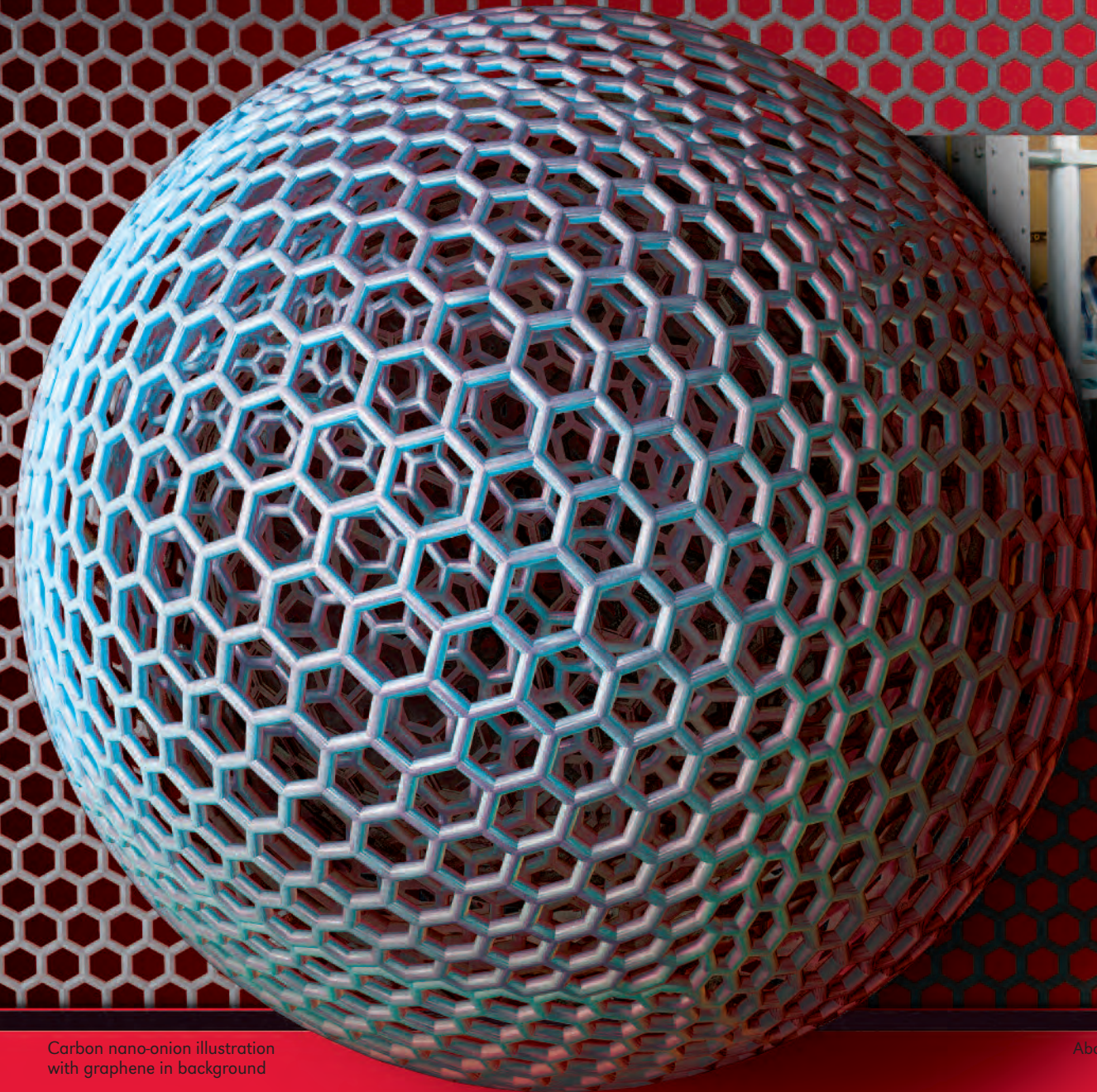
In addition to the Christian Binek team's breakthrough in spintronics, Tsymbal cites other MRSEC collaborations. Physicist Alexei Gruverman's group used advanced scanning probe techniques to improve ferroelectric tunnel junctions for use in nanoelectronic devices and data storage. Physicist Axel Enders is able to grow and characterize nanoscale films and new nanomaterials, which may lead to improved high-density magnetic recording.

Strong ties with industry ensure scientists concentrate on problems industries face and provide opportunities for industry-financed support. Several researchers have received MRSEC supplemental funds provided by an industry consortium.

Established in 2002 with a \$5.4 million National Science Foundation grant, MRSEC received an \$8.1 million, six-year renewal grant in 2008. Its research focuses on quantum and spin phenomena in nanomagnetic structures. This research has potential applications in advanced computing, data storage, energy production, handheld electronic devices, sensors and medical technologies.

"MRSEC plays a very significant role," said Tsymbal, "providing opportunities for collaborations, infrastructure, access to facilities and very important educational and outreach programs."





Carbon nano-onion illustration with graphene in background



Above, from left: graduate students Zhiqiang Xie and Lisha Fan and postdoc Prem Kumar

Harnessing Laser Power Creates Precise Nanostructures

Carbon, the ubiquitous element of life, has many special properties. Harnessing it at the atomic level to create nanostructures promises to transform many everyday products, from computer chips to sunglasses.

Discovering fast, cost-effective ways to mass produce these nanostructures is key to their practical use. It's Yongfeng Lu's specialty.

"Carbon nanostructures have very large potential in different applications," said Lu, Lott University Professor of Electrical Engineering.

His UNL team has developed several unique processes that use lasers to make precise carbon nanostructures. They are refining their techniques and exploring new applications for their nanostructures. Since 2003, they have earned more than \$14 million in research grants.

Their laser-based production techniques can precisely control the length, diameter and properties of carbon nanotubes. Using these highly electrically and thermally conductive nanotubes, Lu's team developed methods to improve transistors

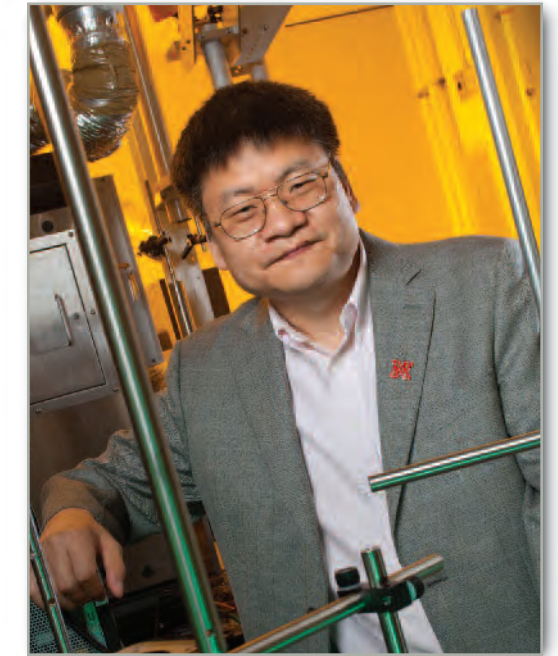
and sensors that may one day speed up computers and other electrical devices, while minimizing energy consumption and heat generation.

They also discovered how to control a carbon nanotube's diameter from one end to the other, which alters its characteristics. Lu envisions variable-diameter nanotubes customized for specific uses.

Now they're studying how to join carbon nanotubes to make smaller, lighter wires that carry large amounts of current for use in electric cars and other products.

Another breakthrough process creates carbon nano-onions, spherical nanostructures resembling onion layers that have unique electrical, optical and magnetic properties. Nano-onions can store large amounts of energy on their extensive surface area. Using nano-onions, Lu's team has developed supercapacitors for high-density energy storage.

Nano-onions also have optical limiting properties, absorbing light as it intensifies. Lu's research could lead to improved eye protection, optical sensors, satellites and other optical-dependent materials.



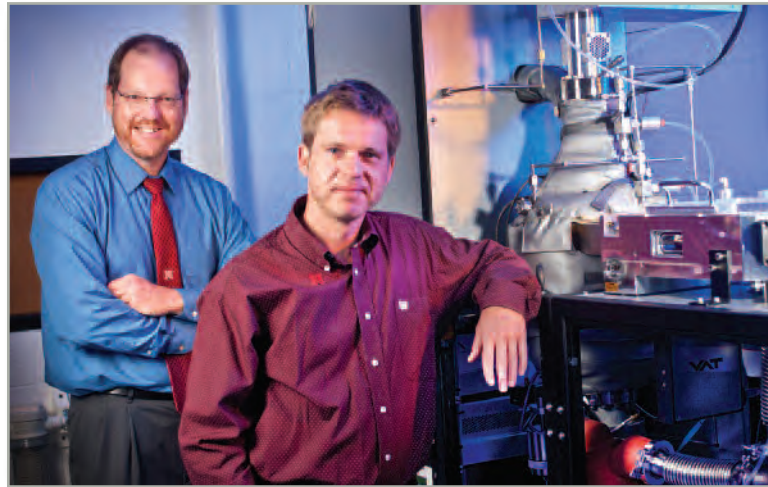
Yongfeng Lu

Lu's team also developed a fast, single-step process using lasers to write graphene patterns on surfaces. A basic building block for other nanostructures, graphene resembles nanoscale chicken wire. Its electrical conductivity and transparency could be used in products such as LCD televisions and solar panels.

"Carbon is everywhere, so the future of electronics, photonics and many high-tech industries will not be limited by supplies," Lu said.

Nanohybrids Promise ‘Best of Both Worlds’

Scientists are always seeking better ways to find and quantify minute things, such as toxins in the air or cancer particles in blood. UNL researchers lead a collaboration to create more powerful detection devices by combining manmade nanoparticles with nature’s inherent recognition capabilities.



Patrick Dussault (left) and Mathias Schubert

Creating these “nanohybrids” requires the diverse expertise of researchers in biology, chemistry and nanomaterials engineering. A Nebraska team recently launched the UNL-based Center for Nanohybrid Functional Materials, which brings

together 15 researchers from UNL, the University of Nebraska Medical Center, the University of Nebraska at Kearney, Creighton University and Doane College.

With nanohybrids, “you get the best of both worlds,” said UNL chemist Patrick Dussault, a Charles Bessey Professor, who co-leads the center with Mathias Schubert, associate professor of electrical engineering.

Nanohybrids combine nanostructures – which can be engineered to behave uniquely under certain conditions, such as when subjected to a beam of light or radio energy – with chemical or biochemical agents, such as RNA or antibodies that can bind a specific substance. This new nanomaterial can both find and reveal its target.

Materials often behave differently at nanoscales, Dussault said. Understanding the basic sensing

principles of nanohybrids is a major goal of the new group. With this knowledge, researchers hope to develop tools with enhanced detection capabilities.

Potential applications include devices that more selectively or sensitively diagnose diseases or find environmental contaminants. The ability to better detect toxins in air or water also could benefit national security.

The center builds on UNL’s strength in nanomaterials. With about \$7.5 million in funding from the National Science Foundation through Nebraska EPSCoR, the center is creating a new core facility and partnering with several departments to hire new faculty, enhancing UNL’s leadership in nanoscience.

The center also has begun developing partnerships with industries in Nebraska and beyond.

“I think potentially it can attract a lot of companies, big and small, to Nebraska,” said Fred Choobineh, Nebraska EPSCoR director. “It’s very creative and cutting-edge research.”

Disc used for atomic layer deposition, a thin film processing technique for creating complex nanostructures

Water for Food Institute Building Partnerships

The University of Nebraska's Robert B. Daugherty Water for Food Institute is expanding its reach with international partnerships.

An agreement between the Water for Food Institute and the UNESCO-IHE Institute for Water Education in Delft, the Netherlands, enables Nebraska students to study abroad and brings students from developing nations to Nebraska to study agriculture and water resources management. The partners also will develop joint Master of Science degree programs in

water for food, short courses and collaborative research projects on water for agriculture.

UNESCO-IHE is the world's largest international postgraduate water education institution. Nearly all its graduates are from developing countries and it operates under the United Nations Educational, Scientific and Cultural Organization. Its mission is to educate and train professionals and to build capacity in water-related fields in developing countries and countries in transition.

Other recent Water for Food Institute partnership activities include:

- Co-sponsoring a yield gap analysis workshop with China Agricultural University in Beijing in August. Experts from around the world presented research on how to close the yield gap – the difference between actual and potential crop yield.
- Holding the third annual global Water for Food Conference in May, hosted by the institute and the Bill & Melinda Gates Foundation. It featured more than 60 speakers and drew more than 450 participants from 24 nations. The 2012 conference will be June 24-27 in Lincoln, Neb.
- Collaborating with the M.S. Swaminathan Research Foundation to organize a workshop in Chennai, India, in March on the global challenge of sustainably producing enough food with limited water. The workshop was sponsored by the Indo-US Science & Technology Forum.



Kebede Ayele, International Development Enterprises, Ethiopia; Soumen Biswas, Professional Assistance for Development Action, India; and Jeff Raikes, Bill & Melinda Gates Foundation, at 2011 global Water for Food Conference keynote dialogue

The Robert B. Daugherty Water for Food Institute is a research, education and policy analysis institute committed to helping the world efficiently use its limited freshwater resources to ensure the food supply for current and future generations. It was founded in 2010 with a \$50 million gift from the Robert B. Daugherty Charitable Foundation.



NU President James B. Milliken (left) and András Szöllösi-Nagy, rector, UNESCO-IHE Institute for Water Education, sign partnership

World Water Expert to Lead Institute

Roberto Lenton, one of the world's foremost experts in water management and development, will lead the Robert B. Daugherty Water for Food Institute at the University of Nebraska.

Lenton's appointment begins in February 2012 after his responsibilities end as chair of the independent World Bank Inspection Panel. He will remain a panel member until August 2012.

"Roberto Lenton is the ideal person to lead the Daugherty Institute as its founding director," NU President James B. Milliken said. "His experience in water management, food security, sustainable agriculture and responsible use of resources is exceptional. As important, he shares our vision for the institute and its potential to have an impact on the world."

Lenton helped establish and then served as director general of the International Water Management Institute in Sri Lanka from 1987 to 1994. Under his leadership, IWMI grew from a small project-based organization to a major institute employing more than 300 people in 10 countries with an annual budget of over \$10 million.

A citizen of Argentina with degrees from the University of Buenos Aires and the Massachusetts Institute of Technology, Lenton also was director of the United



Roberto Lenton

Nations Development Programme's Sustainable Energy and Environment Division, program officer in the Rural Poverty and Resources program with the Ford Foundation, and an assistant professor at MIT. He also was senior adviser on water at Columbia University's Earth Institute.

Jeff Raikes, CEO of the Bill & Melinda Gates Foundation and a member of the Water for Food Institute board of directors, said, "Dr. Lenton is one of the most widely recognized leaders in the world in water circles. I don't believe we could have found a more qualified and respected founding director."

M.S. Swaminathan, known as the father of the Green Revolution in India, also praised Lenton's selection and said he is "undoubtedly one of the most eminent leaders in the area of water and food security."

Understanding Aquifer Recharge

In many areas worldwide, aquifer depletion is a critical challenge for agricultural production. Understanding how quickly aquifers are recharged is essential to assessing depletion risks, but it's one of the most difficult parts of the water cycle to measure.

UNL hydrogeologist John Gates studies the world's aquifers to understand groundwater recharge, whether he's investigating drainage below a single irrigated field or the health of an entire groundwater system.

"Aquifers that receive no recharge are nonrenewable resources, analogous to fossil fuels," Gates said. "By determining the rate of groundwater renewal, we are able to assess the long-term viability of irrigated agriculture."



Sediment samples from Nebraska's Sandhills

Gates primarily studies arid regions, where precipitation is relatively scarce. In these areas, periodic storms can recharge groundwater aquifers. Gates and UNL meteorologist Adam Houston are teaming to study how storms affect recharge.

"If we want to achieve predictive capability about recharge in arid areas, we have to get on top of this issue of episodic recharge," he said.

In northern China, Gates works with researchers to improve the efficiency of irrigation, which relies on groundwater. Decades of heavy irrigation and increasing urbanization have strained the region's aquifers, which recharge too slowly to sustain current use rates. Much of northern China's groundwater, he learned, is thousands of years old.

Determining groundwater age helps Gates understand recharge rates. Using techniques such as radiocarbon dating of water-soluble carbon picked up as water passes through the soil, he calculates the water's age based on changes in isotope compositions over time. "Isotopic tracers let us unravel how long groundwater has been in an aquifer."



John Gates

In contrast to aquifers in northern China, most of the High Plains Aquifer in Nebraska receives sufficient recharge for the time being, thanks largely to its sandy soil.

"We do have some hot spots of depletion around the state," Gates said. "But Nebraska is fortunate to have naturally high recharge rates."

Targeted Research Investments Best Hedge Against Food Crisis

Population growth, water shortages, rising food and energy prices, and climate change are fueling fears of a global food crisis by 2050.

UNL agronomist Ken Cassman thinks agricultural research is the world's best hedge against food shortages. But, to be effective, investments must target the most critical issues, especially in places with the greatest need for more food.

"We have a new set of challenges. Business as usual won't result in enough food supply to feed an incredibly dynamic world population," he said.

Cassman is seeking practical solutions to pressing food security issues. He is the first chair of the new Independent Science and Partnership Council, which advises the Consultative Group on International Agricultural Research (CGIAR) on the scientific merit and feasibility of global agricultural research projects. CGIAR is a network of 15 international research centers working to improve agricultural productivity, conserve natural resources and stimulate agricultural growth in developing nations. The seven-member council helps CGIAR funders identify agricultural development projects with the highest scientific quality and the greatest potential to increase farmers' incomes in poor, rural areas.

"To increase investment in agricultural research, we have to know our research priorities are correct and the science is being done well," said Cassman, who holds the university's inaugural Robert B. Daugherty Professorship.

During his three-year term, Cassman is helping CGIAR establish a portfolio of proven research projects that leverage various organizations' research specialties and form international partnerships. The goal is to ensure research and solutions reach areas with the greatest need, including Asia, Sub-Saharan Africa and South America.

The council also identifies emerging food security issues that need more research. Addressing these challenges drives Cassman's UNL research priorities and complements the work of the Robert B. Daugherty Water for Food Institute at the University of Nebraska.

"This is a huge opportunity for UNL to be at the forefront of emerging issues, and it could expand our opportunities for international partnerships," he said.



Ken Cassman

Uncovering New Perspectives on Whitman

After UNL's Kenneth Price announced his discovery of nearly 3,000 documents in Walt Whitman's handwriting, penned while a clerk in the U.S. attorney general's office after the Civil War, he was amazed at the media attention.



Kenneth Price

In spring 2011, people across the U.S. and from India to Azerbaijan read about how Price dug into the U.S. National Archives and unearthed a trove of information that sheds new light on the legendary writer's post-Civil War thinking.

"It's verification that Whitman is a world poet," said Price, Hillegass University Professor of 19th Century American Literature and co-director of the Walt Whitman Archive. "He's come to represent an extraordinary range of ideas to people in different cultural contexts," from democracy to Marxism and from spirituality to sexuality.

As a government scribe, Whitman hand-copied letters and papers authored by federal officials on issues ranging from Reconstruction to civil rights amendments and westward expansion. Though not officially authored by Whitman, these documents likely felt his influence, Price said. Likewise, the weighty national issues passing through his office and his desk almost certainly influenced Whitman.

The documents reveal insights about Whitman as a dedicated government worker and how his government job shaped "Democratic Vistas," a seminal 1871 analysis of American democracy, as well as his later poetry.

Nearly 2,000 of these documents have been published in the online Walt Whitman Archive, a long-term effort to study Whitman's work and make it available on the Web. Another 1,000 documents will soon follow.

The discovery underscores the significance of the Whitman Archive project, which provides scholars and the public access to valuable information that might otherwise never have emerged.

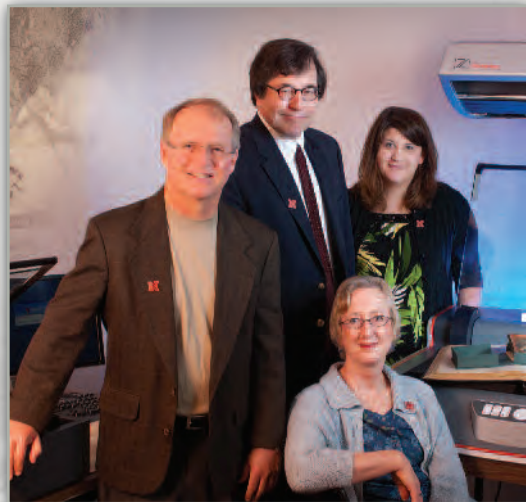
"I'm looking forward to seeing what scholars do with this material over the next couple of decades," Price said. "Anybody who's writing a biography or doing a significant critical study on this period is going to turn to this material."

A grant from the National Historical Publications and Records Commission supported this research.

Web: whitmanarchive.org

Civil War Washington Going Digital

Transformed during the Civil War by a flood of soldiers, slaves and abolitionists, Washington, D.C., played a pivotal role in the antislavery and civil rights movements.



From left: Kenneth Price, Kenneth Winkle, Susan Lawrence (seated) and Elizabeth Lorang

A UNL interdisciplinary digital research project, Civil War Washington, investigates this seminal period through the U.S. capital itself, a unique perspective that provides insights into the nation's evolution. With a three-year, \$220,000 "We the People" grant from the National Endowment for the Humanities, researchers are expanding

the project to study how race, slavery and emancipation affected the capital 150 years ago.

"That story is a critical piece of our nation's history and it has not been thoroughly studied," said Kenneth Winkle, Thomas C. Sorensen Professor of American History and project co-director.

Before the Emancipation Proclamation that freed all slaves, Congress emancipated slaves in Washington, D.C. Thousands of National Archive records documenting this initial emancipation are being digitized for the project, and searchable texts will be available on the Web.

"We're studying how and why this first emancipation took place and how it represented a model for the later emancipation," Winkle said.

The project also will provide a photographic album of the nation's capital during the Civil War by selecting, digitizing and commenting on photographs available primarily through the Library of Congress.

"We view the Civil War as a challenge to fundamental American values: equality, rule of law, the importance of nation," Winkle said.

Focusing on Washington allows researchers to explore how the Civil War and its resolution reaffirmed those values.

History and English faculty are teaming with digital scholarship experts in UNL's Center for Digital Research in the Humanities on this project, which began in 2007. Civil War Washington is an interactive online resource that integrates maps, data, government records, newspaper and narrative accounts, images, photos and other information from that period. The project's core is a map documenting the physical changes to the city.

The project serves as a resource for everyone from academics to Civil War buffs.

Web: civilwardc.org

Humanities Grants Support Language, Digital Initiatives

From endangered indigenous languages to railroad history and digital scholarship, recent grants from the Andrew W. Mellon Foundation and the National Endowment for the Humanities are supporting three UNL humanities initiatives.

The University of Nebraska Press is collaborating with the University of Oklahoma Press and the University of Texas Press on the Recovering Languages and Literacies in the Americas initiative with funding from a three-year, \$781,900 Mellon Foundation grant. The initiative will develop resources to help linguistic scholars publish indigenous language grammars and dictionaries, literacy studies, ethnographies and other linguistic monographs, which are cost-prohibitive to produce on lean budgets. Twenty-seven books will be published on the grammar and literacy of endangered languages. The initiative also aims to generate broader interest in linguistic monographs and to find more efficient, cost-effective ways to produce them.

The archival collections from four major railroads will be available on a single website through the UNL Libraries' Major Railroad Archival Collections project. A three-year, \$208,500 grant from the Mellon Foundation in cooperation with the Council on Library and Information Resources funds this partnership with the Nebraska State Historical Society to catalog the nearly 2 million artifacts from major collections. The website will make it easier for historians and railroad aficionados to link multiple railroad information sources.

With support from a four-year, \$500,000 NEH challenge grant, UNL is working to permanently endow its internationally recognized Center for Digital Research in the Humanities. NEH challenge grants require a 3-to-1 match. The University of Nebraska Foundation, UNL Libraries and the College of Arts and Sciences aim to raise \$1.5 million to receive the full \$500,000.



Top: Civil War-era hospital in Washington, D.C.
Above left: U.S. Capitol with unfinished dome

Improving Children's Reading Comprehension

Imagine reading a favorite childhood book. Remember the excitement of feeling connected to the story or a certain character?

Much educational research has focused on teaching young children to read. But comprehension – the ability to attach meaning to words – is equally important to reading competency. Students struggling with reading comprehension are less likely to read for enjoyment, to learn new ideas or to expand vocabulary, which affects later academic success.

In 2010, the U.S. Department of Education's Institute of Education Sciences launched a five-year, \$20 million initiative to address the problem. UNL education researchers are part of the multi-university early childhood research team studying how to improve reading comprehension for children in pre-kindergarten through third grade.

The UNL team identifies factors that affect children's ability to build reading comprehension skills, such as home literacy, language used at school and innate aptitude. Based on findings, researchers are developing classroom activities



Tiffany Hogan

to boost students' comprehension skills in the primary grades, when language skills are malleable and growing rapidly.

"Reading comprehension is cyclical," said Tiffany Hogan, UNL project leader and assistant professor

of special education and communication disorders. "If you improve children's reading skills early, they'll experience success and want to read more. If they read more, their comprehension and language skills continue to improve."

The Ohio State University leads the early childhood education team, which includes UNL, the University of Kansas, Arizona State University and Lancaster University, U.K. UNL's share of funding is nearly \$4.4 million.

UNL provides expertise in primary grades and rural education. Researchers are assessing 1,200 Nebraska students, including 100 English language learners, to understand how they learn basic and higher-order language skills. The goal is to identify how oral language skills affect reading skills.

This research could influence pre-K-12 educational policy, Hogan said. Findings will be distributed to other researchers, state education departments, schools and parents.

"It's exciting for Nebraska to contribute to nationwide understanding of reading comprehension."

Transforming Early Childhood Education

Ensuring young children get the educational and development opportunities essential to learning success is the vision for the University of Nebraska's new Buffett Early Childhood Institute.

The multidisciplinary research, education, outreach and policy center aims to transform early childhood education in Nebraska and nationwide. It will focus on children from birth to age 8, especially those most at risk. The goal is to narrow the achievement gap during children's prime time for learning and development.

Projects will involve NU's top educational researchers, early childhood experts, families

and community stakeholders. Researchers will collaborate to study the effectiveness of various educational approaches and programs.

Early childhood education is one of the university's priority research initiatives. The institute will capitalize on expertise and facilities including UNL's Nebraska Center for Research on Children, Youth, Families and Schools; the College of Education and Human Sciences; Ruth Staples Child Development Laboratory; Barkley Memorial Center; and the Center on Children, Families and the Law. UNL early childhood education experts Carolyn Pope Edwards and Helen Raikes, who both are Willa Cather Professors, serve on the institute's

advisory committee and are among researchers from four NU campuses who are contributing.

Edwards, who studies parental engagement during the preschool years, will offer expertise on ways parents can foster positive learning environments at home.

"The early childhood years are a time when families are particularly responsive. Parents are primed to recognize opportunities for their children and how to help them succeed," said Edwards, professor of psychology and child, youth and family studies.

Annual support provided by a founding gift from Omaha philanthropist Susie Buffett will be more than matched by university, private and federal sources to leverage an investment greater than a \$100 million endowment. It will enable the institute to hire an executive director, recruit and retain faculty, support research, provide scholarships for early childhood educators, develop curriculum, bolster policy and outreach efforts, and create a scholarly journal.

"Nebraska is taking a bold step in making a commitment to the early childhood years," said Raikes, professor of child, youth and family studies.



Helen Raikes (left) and Carolyn Pope Edwards

Bullying: Filling Gaps Between Research, Practice

When Susan Swearer first turned her research toward bullying, few people were discussing it. More than a decade later it's in the national spotlight.

The UNL educational psychology professor studies psychological risk factors and consequences of bullying, for perpetrators and victims. It's a mental health problem in which everyone involved can suffer depression and anxiety, she said.

A widely recognized expert, Swearer works extensively with schools nationwide to reduce bullying. She co-founded the Bullying Research Network, an online clearinghouse to support

research initiatives in effective prevention and interventions, and organized UNL's first bullying prevention and intervention conference in 2011.

In spring 2011 Swearer served on an expert panel at the White House Conference on Bullying Prevention. President and Michelle Obama participated along with high-ranking administration officials.

"The first step to changing any behavior is awareness, so this certainly propelled awareness onto the national stage and very emphatically said this is not an OK behavior," she said.

Many factors influence bullying, from individual psychological health to family and school dynamics to community and societal effects. Today's approaches focus too heavily on schools and not enough on individual interventions, she said. Research by Swearer and a University of Illinois at Urbana-Champaign colleague shows a multilevel approach is most effective.

"There's such a gap between research and practice," Swearer said. "We know what needs to happen to reduce bullying. Actually having that happen is a lot harder."

Budget constraints and the issue's complexity are partly to blame. So is apathy. Many people feel bullying isn't a problem, Swearer said, and society rewards certain types of bullying behavior in adults, such as aggressive leadership or company takeovers.

Consequences of bullying can be severe and long-term. Victims often suffer mental health problems. Suicides of bullying victims underscore the emotional damage. Some bullies grow up to be adult harassers, which complicates their work and relationships and may even lead to prison.



Susan Swearer

Preparing Military Kids for Success in School

Frequent moves and overseas deployments are among the unique pressures facing military families and can mean children enter school behind their peers academically and socially. For families living off base, these stressors are compounded by having less access to the child care, education and support services that bases offer.

UNL Extension leads a program to better prepare military families' children, from birth to age 12, for school success. The Child Care and Youth Training Technical Assistance project is providing tools to help 28,000 child and youth development professionals nationwide to improve the quality of educational services for military families living off base.

The project, a partnership between UNL and Penn State University, aims to strengthen the knowledge and skills of existing child care providers as well as increase the number of providers to expand access to services. Nearly 280,000 military children will benefit from the three-year initiative, funded by the U.S. Department of Agriculture in partnership with the U.S. Department of Defense.

Training is provided through workshops and online materials. The curriculum, which is based on the latest child and youth development research, covers topics such as healthy living, social and emotional well-being, learning, discipline, productive play and managing stress. Because healthy, secure children are better prepared to learn, providers' knowledge of these issues is critical, said Kathleen Lodl, assistant dean of UNL Extension.

With help from Extension educators nationwide, UNL and Penn State researchers are creating professional development tools customized to needs in the 13 participating states. Although Nebraska is not one of the states initially targeted in the project, training materials will be available to child care providers statewide.

"This is a genuine partnership among faculty and staff across the country," Lodl said. "This project exemplifies what Extension is all about – partnering with others to help people improve their lives."



©iStockphoto.com/Yvonne Chamberlain

Museum Celebrates 140 Years of Discovery



For generations, school children have gazed with astonishment at the towering mastodons and mammoths in world-famous Elephant Hall.

“Archie,” the world’s largest mounted mammoth, and other Nebraska elephants from the past 13 million years have been star attractions at the University of Nebraska State Museum’s Morrill Hall since it opened in 1927. Yet they represent but one facet of the museum’s broad mission and vast collections.

Throughout 2011, the museum has celebrated 140 years of discovery, research and education.

Established in 1871, it is one of the nation’s leading university research museums, with more than 14 million specimens and artifacts in internationally recognized collections in anthropology, botany, entomology, paleontology, parasitology and zoology. Museum scientists today go far beyond Nebraska to collect specimens, traveling to Central and South America and even to the wilds of Mongolia.

More than 100,000 people each year visit Morrill Hall, Mueller Planetarium, the research collections and branch locations at Ashfall Fossil Beds State Historical Park and the Trailside Museum of Natural History at Fort Robinson State Park.

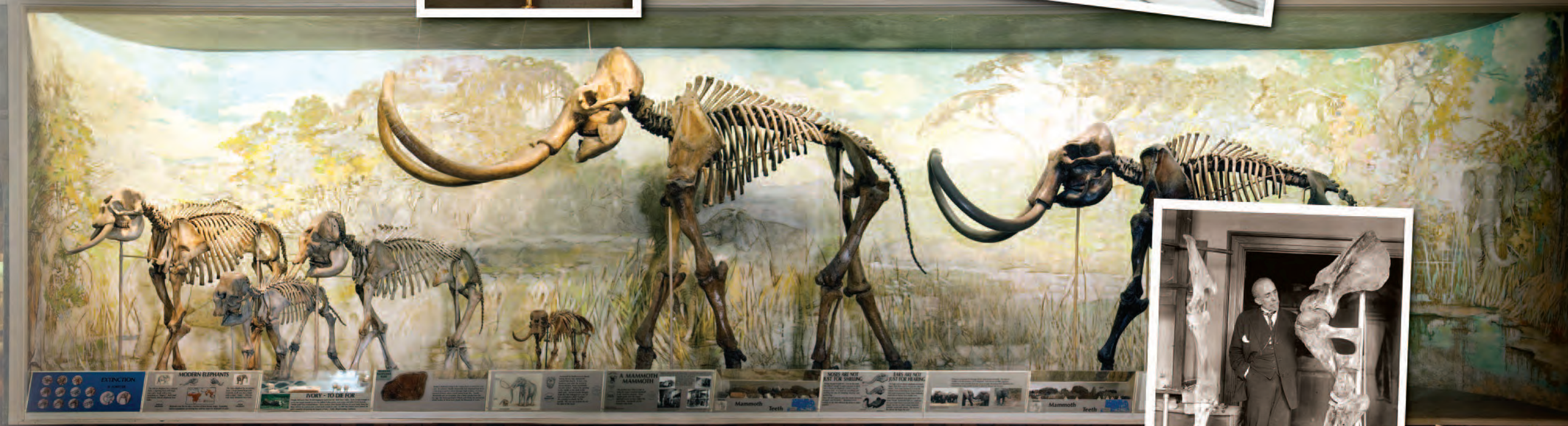
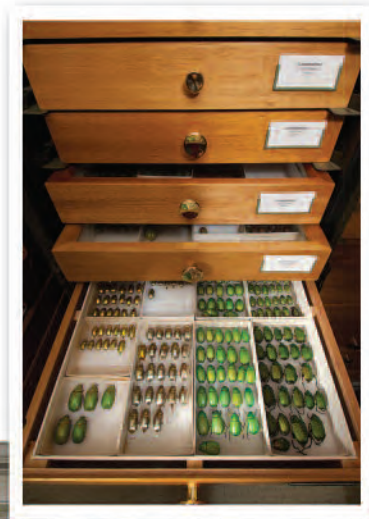
“Research and science education are the museum’s complementary missions,” Museum Director Priscilla Grew said.

Most museum visitors don’t realize that only a fraction of the collections are displayed, Grew said. “Behind the scenes, our scientists study the research collections to explain the past and to inform current issues, such as global climate change and threats to endangered species. This research provides the scientific framework for our popular exhibits.”

Early museum leaders in the 19th century laid the foundation for the museum’s renowned reputation and collections. Today’s researchers, staff and students continue to build and maintain collections that enhance Nebraska’s premier natural history museum. Increasingly, they are providing worldwide access via the Web to exhibits, artifacts, searchable databases and educational information.

“Our mission is not only to preserve our prehistoric past, but to introduce new generations to the power and richness of the natural world,” Grew said.

Web: museum.unl.edu



World-famous Elephant Hall display of “Archie” (middle) and friends

Top photos: Sampling of museum's extensive research collections and exhibits

Erwin H. Barbour, museum director 1891-1941



Development Revving Up at Nebraska Innovation Campus

Fueled by \$80 million in public and private investments, the first phase of development is progressing at Nebraska Innovation Campus (NIC), the private-public research community designed to strengthen Nebraska's economy and UNL's research.

A \$25 million investment by Nebraska's Legislature and Gov. Dave Heineman kick-started plans in spring 2011. NIC officials announced the \$25 million had been leveraged to generate about \$80 million in public and private investment for four new or renovated buildings. The Legislature included \$25 million for NIC in the state's two-year budget.



Illustrations of renovated 4-H Building and companion building

The 4-H Building will be renovated and expanded to create a nearly 170,000-square-foot central commons building. State funds of \$10 million will renovate the building's east half. Woodbury Corp., managing partner of investor Nebraska Nova Development LLC, will renovate the west half and build a connected companion building. Earlier in 2011, NIC officials signed with Nebraska Nova for Phase 1 development.

Slated for completion in 2013, these two buildings will anchor NIC, providing space for university research, incubator businesses or translational research, retail stores, tenant offices and labs.

The state provided \$15 million to be matched by private philanthropy for a food, fuel and water research facility. When that match is complete, the university will construct a building for \$30 million or more. Woodbury announced it would build an equal-sized life science building if the university raises at least the required \$15 million match.

"The result is four significant buildings that create the critical mass for the attraction of private-sector companies," UNL Chancellor Harvey Perlman

said. "We are off to a good start because the governor and the Legislature had confidence in this vision for Nebraska's future."

NIC will be a premier private-public sector sustainable research campus that capitalizes on UNL research growth and faculty expertise to

strengthen economic potential for Nebraska and the university. Located adjacent to UNL, it will be developed over the next 25 years.

"This is one of the most ambitious and most significant projects on the horizon for Nebraska," Heineman said. "Innovation Campus represents

an important opportunity for the University of Nebraska to leverage its research talent to fuel new economic growth."

Web: innovate.unl.edu

Building Industry Connections

Opportunities for industry collaborations are growing along with Nebraska Innovation Campus.

Fostering those relationships is a priority for UNL Industry Relations, which serves as UNL's "front door" for companies, entrepreneurs and economic development groups looking to work with the university. Industry Relations is building relationships with many Nebraska and national companies.

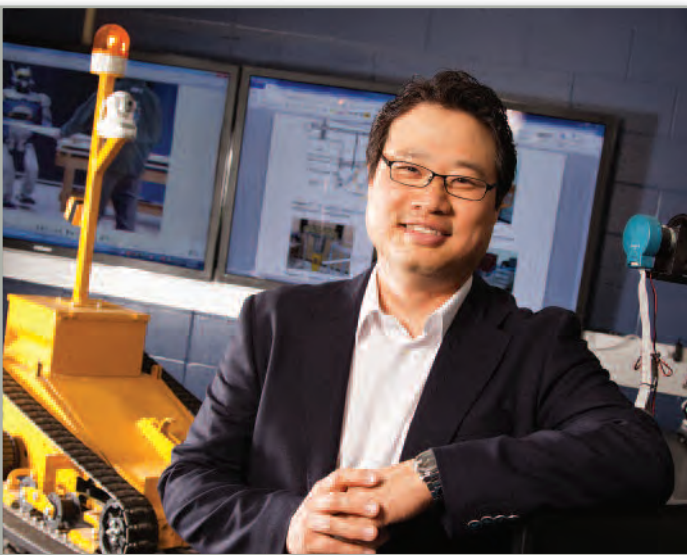
But the best is yet to come, said Industry Relations Director Ryan Anderson. Innovation Campus is creating a remarkable opportunity for UNL to work with industry to strengthen Nebraska's economy and create jobs.

Industry Relations is "connecting the dots, inside and out" to ensure collaborations are mutually beneficial.

"Partnerships provide lots of ancillary benefits in the long run for the university and industry," Anderson said. "Working together, we can accomplish more than either party could achieve alone."

Virtual View to Safer Job Sites

Robots soon may be a common feature at construction sites. But to work safely and efficiently, robots – and their operators – need exact, 3-D views of their surroundings.



Yong Cho

To help make construction robots safer and more practical, UNL construction engineer Yong Cho is developing technology that provides a precise 3-D, computer-generated virtual view of the work site in real time.

He received a \$400,000, five-year National Science Foundation CAREER Program award, which supports outstanding pre-tenure faculty.

Though not yet widely used in the U.S., robots are performing difficult construction jobs in Korea and Japan. Because construction sites change rapidly and robots are performing intricate tasks such as driving bolts into girders, they require continually updated and precise data about their surroundings.

The 3-D view is a bit like a simplified virtual reality game, Cho said, “but it can take hours, days and months to create those worlds. We don’t have that kind of time in construction, maybe a few minutes.”

Cho and his Charles W. Durham School of Architectural Engineering and Construction team’s system features a lightweight hybrid 3-D laser scanner, a laser rangefinder and other optical sensors that can be mounted on construction robots, cranes and other equipment.

“We’re creating virtual three-dimensional worlds for future construction sites, which will most likely



3-D virtual view of robotic workspace

be populated with a lot more machines,” he said. “The goal is not to replace people with construction robots. We want to provide precise, effective and safe ways to help humans perform jobs that can be very dangerous.”

A precision-based robotic system also will help reduce construction waste.

Cho is testing his technology on robotic systems in South Korea, in collaboration with university researchers there, and at large crane construction sites in the U.S. He’s also collaborating on construction automation curricula that can be used in college teaching programs worldwide.

Teaming on Wheat Improvement

UNL’s strength in wheat research and breeding is at the heart of a partnership between Bayer CropScience and the university that illustrates the economic potential of the university’s research.

NUtech Ventures and Bayer CropScience AG signed a nonexclusive licensing agreement in late 2010 focused on wheat improvement. It includes support for UNL research and education programs and an endowed professorship. Bayer also plans to establish its first North American wheat breeding station near Lincoln, Neb., and will work with Nebraska farmers in seed production. The agreement gives Bayer CropScience access to UNL wheat germplasm.

Under the agreement, Bayer CropScience is making available \$2 million to fund the university’s first presidential chair named for the Nebraska Wheat Growers. UNL wheat breeder P. Stephen Baenziger is the first to hold the Nebraska Wheat Growers Presidential Chair.



Sally Clayshulte, Bayer CropScience, and P. Stephen Baenziger

“While this partnership does not directly involve Nebraska Innovation Campus, it confirms that there are opportunities for us to leverage our research in order to create economic growth for Nebraska,” UNL Chancellor Harvey Perlman said.

UNL’s wheat breeding program has long provided farmers with improved wheat varieties to enhance their competitiveness, said Prem S. Paul, vice chancellor for research and economic development. “This new partnership broadens the economic benefits of our research.”

“We fully expect that the novelty of this public-private partnership will attract future investments and relationships with our programmatic strengths in agriculture and the life sciences,” said Ronnie Green, Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources.

The agreement is mutually beneficial, said David Conrad, executive director of NUtech Ventures, the nonprofit corporation responsible for commercializing UNL research. “It allows both Bayer CropScience and UNL to improve their respective wheat breeding programs, while preserving both parties’ ability to collaborate with other companies and universities.”

UNL Technology Powers Solar Startup

UNL-developed technology is expected to spur development of new solar panel technology. Rare Earth Solar, a Nebraska startup company, licensed the technology from NUtech Ventures and plans to be the state’s first solar panel manufacturer.

UNL chemist Chin Li “Barry” Cheung and his then-doctoral student Joseph Brewer developed the patent-pending technology, which replaces typical semiconductor materials used in solar cell manufacture with rare earth elements. Brewer co-founded Rare Earth Solar and is its chief technology officer.

Allen Kruse, Rare Earth Solar’s other co-founder and CEO, said the company’s unique process using rare earth elements is inexpensive and will produce panels that are more durable and cost effective than the majority of thin film panels now available.

“Matching entrepreneurs with innovative technologies developed by university researchers is key to producing companies that can create high-wage jobs and grow Nebraska’s economy,” said David Conrad, executive director of NUtech Ventures. “It’s a model we hope we can replicate by developing long-term relationships with the business and investor communities.”

Rare Earth Solar is securing a manufacturing site in Beatrice, Neb., and plans to begin operation in the near future.



Zeroing in on Genes to Beat Rice Blast Fungus

Rice, the primary food staple for more than half the world's population, is plagued by rice blast, a fungal disease that annually destroys 10 to 30 percent of the world's rice crop, enough to feed 60 million people.

Defeating the fungus is a top priority. But no sooner do scientists develop a new fungicide or resistant rice variety, than a mutated *Magnaporthe oryzae* emerges.

UNL plant pathologist Richard Wilson seeks the ultimate victory: identifying the genes underlying the disease to allow the plants' own defenses to defeat the fungus.

"There have not been any effective global defense strategies, either through traditional breeding or pesticides," Wilson said. "But if there's a gene-for-gene interaction with the plant, it would be hard for the fungus to evolve away because the plant would be in step with it."

Magnaporthe turns deadly upon entering the plant's nutrient-rich interior. Wilson and colleagues discovered the genes that control a genetic switch that enables the fungus to recognize the plant's

sugars and trigger disease. This research appeared in the *Proceedings of the National Academy of Sciences* in late 2010.

Next, they will identify growth genes controlled by this genetic switch mechanism. With this information, Wilson hopes to one day give rice the ability to recognize the fungus and trigger its defenses.

Wilson's team already uncovered one of these genes. Inactivating it with a fungicide could prevent disease. "But our feeling in the community is that fungicidal targets would just be short-term solutions and eventually the fungus would mutate," Wilson said.

Although Asia takes the brunt of rice blast disease, the problem is global. The U.S. is the world's third largest rice exporter, and Arkansas is dealing with a rice blast outbreak.

A bigger U.S. concern is wheat blast, caused by a related fungus that's expected to arrive in North America someday. Rice blast research should help against wheat blast, Wilson said. "We think there will be fundamental processes that can be used in both rice and wheat to help fight this problem."



Richard Wilson



Rice blast fungus in petri dish

Coalition Aims to Turn Algae into Biofuel

Algae, those slimy, primordial throwbacks generally considered a nuisance, may help power the future.

But before algae can be harvested as a renewable biofuel, we need to know much more about them, said biochemist Donald Weeks, Maxcy Professor of Agriculture and Natural Resources.

Weeks heads UNL's Nebraska Coalition for Algal Biology and Biotechnology, or NCABB, a collaboration of 15 biologists, biochemists, plant pathologists and geneticists committed to first understanding algal biology, then harvesting algal oils for energy.

"No one has tried to improve algae genetically for biofuel production," said Weeks. "That work is just now getting under way."

Algae's impressive growing ability, which makes them the scourge of ponds and lakes, also makes them an appealing energy source. Algae produce 10 times more biomass per acre than corn, sugarcane and other land plants used to produce ethanol. They also don't compete with food crops, can grow on wastewater and require fewer nutrients and less attention than other biofuel crops.

Unlike fossil fuels, which contribute to greenhouse gases, algae absorb CO₂ during photosynthesis, dramatically limiting their carbon footprint.

NCABB's co-leader, biochemist Edgar Cahoon, who heads UNL's Center for Plant Science Innovation, brings expertise in lipid metabolism and expansion of algal research through the center. "I'm hopeful that what we're doing will contribute to finding solutions to this really important problem."

UNL leads this effort in collaboration with faculty at the University of Nebraska at Kearney, Doane College and Creighton University.

In 2010, NCABB received more than \$6 million as part of a five-year National Science Foundation grant to the Nebraska EPSCoR program to hire new faculty and create algal research facilities.

"It's fundamental work that's very important to our nation and Nebraska," said Nebraska EPSCoR Director Fred Choobineh. "We have expertise unique in the nation."

It's not just about research, he added. The coalition is reaching out to industries in Nebraska and elsewhere to establish partnerships that could boost Nebraska's economy.



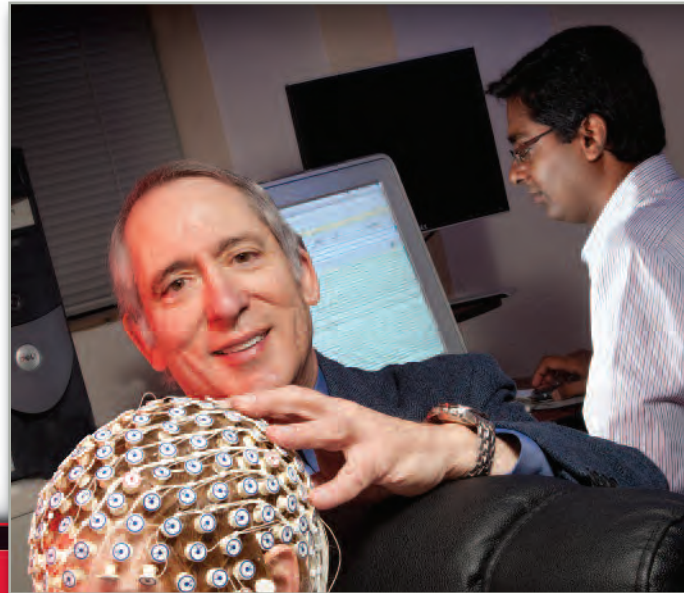
Edgar Cahoon (left) and Donald Weeks

Partnership Expanding Brain Research

Concussions are common contact sports injuries with potentially long-lasting consequences. Although initial symptoms usually disappear within a week, players may suffer cognitive effects for years, especially with severe or repeated concussions.

A partnership between UNL researchers and Nebraska Athletics will help expand scientists' understanding of concussions.

Using a functional magnetic resonance imaging machine (fMRI), UNL psychologist Dennis Molfese records fine images of the brain to identify areas active during certain activities.



Dennis Molfese (left) and postdoc Srinivas Kota

The goal is to learn which brain areas behave differently after a concussion.

"By doing neuropsychological tests, we can help players understand what skills have been affected and what they're capable of doing," said Molfese, Mildred Francis Thompson Professor and an international expert on brain recording techniques.

A net of electrodes records real-time images of the brain's electrical activity and eye movements.

These images provide clues about how a concussion has affected an individual, such as short-term memory loss; decreased attention, memory span and ability to multitask; difficulty processing language or numbers; and less impulse control.

This research could lead to better methods of reducing concussion risk and identifying when an athlete can safely return to the field.

Nebraska Athletics and the UNL Office of Research and Economic Development have partnered to



Rendering of East Stadium addition

integrate research space into the East Stadium addition to Memorial Stadium, slated for completion in 2013. The research space will provide headquarters for a proposed new multidisciplinary research center focused on brain, biology and behavior that would integrate biological scientists, social scientists and researchers interested in health and performance.

UNL's entry into the Big Ten Conference provides additional opportunities. Molfese leads a Big Ten/Committee on Institutional Cooperation traumatic brain injury research collaboration. It includes creating a shared database on concussion research conducted by members and their athletic departments.

"Science and research at Nebraska could inform athletics around the world," Molfese said.

Postdoctoral fellow Srinivas Kota inside photogrammetry system that creates a 3-D representation of brain electrode positions

Targeting Metabolism to Combat Staph Infections

Combating staphylococci, or staph, the leading cause of hospital-acquired infections, traditionally means targeting the bacteria with antibiotics. But *S. aureus* and *S. epidermidis*, the two biggest perpetrators, are increasingly dodging those bullets.

Staph infections strike nearly 400,000 people a year in the U.S., increasing medical costs by more than \$14 billion, and drug-resistant strains can be deadly.

Instead of trying to kill it with drugs, UNL microbiologist Greg Somerville and chemist Robert Powers want to turn staph's own metabolism

against itself. They are investigating the metabolic pathways that produce the toxic virulence factors that harm infected people.

"Metabolism is the genesis of everything," Somerville said. "If we can understand how the bacteria sense their metabolic status, then we can manipulate that to trick the bacteria into doing things we want."

For example, a vaccine that forces staph to make its presence known could alert the body's immune system to clear the infection before it takes hold.

A major culprit in staph virulence is a sugar polymer that accumulates on the bacterial surface, which helps to form a biofilm. These biofilm infections are particularly problematic for heart patients when they form on implanted medical devices. Vaccination before surgery could help boost immunity.

In an important step toward a vaccine, Somerville and colleagues were able to hinder the uptake of a specific amino acid, which decreased the sugar's production, slowed biofilm formation and reduced staph's virulence.

This research also has implications for the dairy industry. Staph is the leading cause of bovine mastitis, which costs the dairy industry about \$2 billion a year.

Somerville is a faculty member in the School of Veterinary and Biomedical Sciences. He and Powers are members of UNL's Redox Biology Center. A \$1.4 million grant from the National Institutes of Health's National Institute of Allergy and Infectious Diseases funds this research.



Greg Somerville

Probing Genes, Gut Microbes and Food Safety

While many cattle can carry microbes that may cause foodborne illness, some are chock-full of pathogens. Researchers have been asking why for decades. To improve food safety they've looked at environmental factors with little success.

UNL microbiologist Andrew Benson, W.W. Marshall Family University Professor of Biotechnology, thinks one of the answers may be genetic. His new research extends his team's discovery that genes help control the types of microorganisms living in the mouse gut, which they reported in the *Proceedings of the National Academy of Sciences*.

"It's not a significant leap to think the same thing could be going on in cattle," Benson said. "If you could identify which genes are associated with carrying high numbers of these organisms, you could potentially reduce those particular variants in the population. That would have a huge impact on food safety."

With a five-year, \$2.35 million U.S. Department of Agriculture grant, Benson is examining how genetic differences among cattle affect gut microbial composition to identify genes associated with high pathogen numbers. This is a potentially



Andrew Benson

game-changing approach that has not been explored previously. If successful, it could be integrated into breeding programs to reduce the number of cattle that shed high levels of *E. coli* O157:H7 or other pathogens.

Benson continues using mice as a model to explore how certain genes cause shifts in the ratios of gut microorganisms. Some of the shifts are associated with human conditions, such as Crohn's disease, inflammatory bowel disease and obesity. He's looking for overlap between genes that control microorganisms and genes associated with disease.

Because individual species of gut microorganisms appear to colonize together as unique groups, Benson is investigating which groups cause disease so he can then identify key members.

"If you wipe out the right species, then the ecosystem may reconfigure itself and change dramatically," Benson said, potentially ameliorating disease.

This work is part of UNL's Gut Function Initiative, which Benson co-leads. A nearly \$1 million grant from the National Institutes of Health's National Institute of Diabetes and Digestive and Kidney Diseases, funded by the American Recovery and Reinvestment Act of 2009, also supports this research.

Breaking the Revictimization Cycle

Child and adolescent survivors of sexual assault are anywhere from two to 11 times more likely to be sexually victimized again as adults.

UNL psychologist David DiLillo wants to end the vicious cycle of the phenomenon known as revictimization. His research aims to find the common denominator that makes young victims vulnerable.

Identifying a common, underlying risk factor holds the clues to treating the effects of the initial victimization. It also could lead to strategies to protect victims in the long run.

Previous studies found that young sexual assault victims have a higher risk of experiencing post-traumatic stress disorder or engaging in substance abuse and risky sexual behavior.

The effects of revictimization are even more detrimental. Revictimization is associated with impaired mental health functioning. Victims also struggle to establish intimate relationships that are long-lasting and fulfilling.

“It’s bad enough that someone endures the experience multiple times, but when that happens,

the associated problems are compounded,” DiLillo said. “That’s one of the reasons that this is such a significant problem.”

Although the study looks at risk factors that might increase vulnerability for victims, it in no way implies that victims are responsible for their victimization. DiLillo emphasizes that responsibility always lies with the perpetrators.

The five-year, multi-site study is funded by a \$3.1 million grant from the National Institute of Child Health and Human Development at the National Institutes of Health.

DiLillo directs UNL’s Clinical Psychology Training Program and the Family Violence and Injury Lab. He has extensively studied childhood sexual assault and its long-term impacts. Collaborators on this project are UNL quantitative psychologist Lesa Hoffman; Kim Gratz, a nationally recognized expert in emotional dysregulation based at the University of Mississippi Medical Center; and Terri Messman-Moore, who has conducted seminal research on revictimization at Miami University in Oxford, Ohio.



David DiLillo

Rooting Out Health Disparities

Diet, exercise and lifestyle choices have long been the tools Americans use to take charge of their health. But for vulnerable populations, they might not be enough.

UNL sociologist Bridget Goosby is studying how social inequalities like racial discrimination affect human biology and contribute to health disparities. Her research examines whether the stress from such experiences can make someone susceptible to disease that’s then passed down through generations.

Sociologists know descriptively that social experiences affect health, but know far less about how it happens biologically.

Goosby’s findings could change the way Americans think about health and put renewed focus on helping vulnerable populations. Ultimately, she hopes they could lead to the elimination of health disparities.

“This goes down to the cellular level and it goes across generations,” she said. “If you don’t help this mother to be healthy, then you’ve got a long-term problem with the health of the children.”

A five-year, \$562,000 Mentored Research Scientist Development Award, known as a K01 award, from the National Institute of Child Health and Human Development at the National Institutes of Health supports this research. These awards help exceptional faculty develop as outstanding teacher-scholars and researchers.

For Goosby, that means an opportunity to receive specialized training in biodemography and guidance in her research from some of the nation’s top scholars in that field. Biodemography examines from a biological perspective how social experiences affect people and influence health differences across populations.

Goosby previously studied the mental health of poor populations, and how low birth weight affects high school academic performance and test scores. She was influenced to focus her research on health disparities after noticing the prevalence of health issues in her own family.



Bridget Goosby

Student Ad Agency Sets Sail

Presenting a business plan to a dean and potential investors isn't a typical classroom experience, admits Anna Loach, a recent UNL graduate.

Then again, most college students aren't seeking permission to launch a small business within their program. In fall 2010, a class of 14 students led by Amy Struthers, associate professor of advertising and public relations, developed a concept for Jacht Club, a student advertising agency. The idea was to give students more opportunities to gain real-world experience and meet a growing need for advertising campaigns produced quickly and economically. Flexibility is critical in today's fast-paced media environment, Struthers said.

"We wanted to create a business that is nimble and understands consumers without getting bogged down in an 18-month campaign development cycle," she said.

Gary Kebbel, dean of UNL's College of Journalism and Mass Communications, was sold on the idea. Named for a small, fast Dutch sailing vessel, the agency has found its niche with clients willing to experiment with digital platforms and seeking a youthful perspective. Its growing clientele list includes the Nebraska



Amy Struthers (standing center) with Jacht Club students

Dairy Association, M&M Cupcake and the Nebraska Department of Environmental Quality's Wellhead Protection Program.

As one of the agency's account executives, Loach said she quickly learned that understanding business is as important as being creative. Nebraska Global, which supports startup software companies, offered invaluable advice about entrepreneurship and teamwork, and provided workspace, furniture, computers and software in Lincoln's Haymarket district.

Jacht Club also found mentors in alumni, local advertising professionals and UNL's Jeffrey S. Raikes

School of Computer Science and Management. The agency and the Raikes School are considering future partnerships.

The agency aims to be self-sustaining in five years. Struthers said success will come from close interactions between students and clients to develop, test and perfect ideas. The traditional agency model isn't as conducive to such give and take, she said.

"The advertising agency could – and should be able to – look to academia for better ways to adjust to the changing media landscape," she said.

Hollywood Pros, Students Team Up for Film Series

If theater students can experience a full, professional-style production, then why not film students? That's what professors in UNL's Johnny Carson School of Theatre and Film asked themselves.

No school had tried to mount a film project on the scale that Paul Steger, the school's director, proposed several years ago, with industry professionals working as mentors alongside students.

The result is "Vipers in the Grass," a 22-minute police story set in Nebraska and written by Hollywood screenwriter Jorge Zamacona. It's the first in the Carson School Film Series. It involved about 180 students and 30 faculty from throughout the Hixson-Lied College of Fine and Performing Arts and the College of Journalism and Mass Communications.



Producer/screenwriter Jorge Zamacona (center) instructing cast, crew

Students worked on all aspects, from location scouting to filming, music scoring and post-production marketing.

"It's literally two years of industry experience, working professionally on one project," Steger said. "It's exactly what you have to do when you're working in the industry."

Professionals, who received no compensation beyond expenses, included Hollywood director Alex Zakrzewski, editor Mike Hill and actress Harley Jane Kozak, among others.

"More of them than you would imagine are interested in giving back to young professionals," Steger said. "They never had an opportunity like what we're providing."

The contacts and experiences are helping students land jobs in the notoriously difficult entertainment field. About 95 percent of recent UNL film graduates found relevant jobs immediately. Student film quality also is improving, with more acceptances into film festivals.



Students Aaron Nix (left) and Amanda Levy prep camera

"Vipers in the Grass," funded by the Johnny Carson Theatre and Film Endowment and a Program Enhancement Fund grant through the Hixson-Lied College, has been submitted to film festivals.

The next film project, a romantic comedy, began pre-production this fall. Scripts were solicited from throughout the University of Nebraska system; three finalists worked with professional writers in summer 2011.

"We think we have a really good thing going on," Steger said. "This is a way for us to address what we think are important concerns for both the industry and the education environment."

Prepping for Legal Reform

When Mexico in 2008 decided to reform its judicial system to include U.S.-style oral advocacy, the nation's lawyers needed to be trained in the art of oral arguments and cross-examination.

UNL law professors Kevin Ruser and Steven Schmidt answered the call.

They and their colleagues are helping law faculty at the Universidad Nacional Autónoma de México (UNAM) transition to teaching an oral advocacy legal system to law students and practicing lawyers and judges. Mexico's legal reform must be completed by 2016.

Since 2010, a UNL team has traveled to Mexico City to teach workshops. They also hosted several UNAM faculty members in Nebraska for clinics and courtroom tours. Others are attending UNL law classes. The team also will help establish a trial clinic-style curriculum similar to what's used in U.S. law schools.

"Their instincts are spot on because they are practicing lawyers," Ruser said. "They've made these arguments in writing so now they just have to do it orally."

While oral arguments are central to the U.S. legal system, in Mexico, a judge traditionally ruled after reading written evidence without the benefit of validating evidence or witnesses through live testimony.

"The best thing about (oral advocacy) is that it lends a lot of transparency," Ruser said. "Before, nobody really knew what happened or how decisions got made. Now everything is going to happen in open court."

Initially, the team faced skepticism that judicial change was necessary. The team now receives an enthusiastic reception. Newly trained lawyers recognize they are an important resource for their nation's transitioning legal system.

Ruser said he's learned much from his Mexican counterparts and hopes the collaboration leads to permanent faculty and student exchange programs.

The work is part of a three-year, \$450,000 grant from the U.S. Agency for International Development through the American Council on Education-Higher Education for Development Program.

Durham School Building on Strengths

Innovative initiatives at UNL's Charles W. Durham School of Architectural Engineering and Construction are building on its unique strengths as the nation's only program that integrates architectural and construction engineering with construction management.

The goal is to be the school of choice for top engineering students and faculty. Part of the College of Engineering, the Durham School is based at Omaha's Peter Kiewit Institute with comprehensive teaching and research programs at PKI and UNL.

"Our mission," said director Eddy Rojas, who arrived in 2010, "is to educate the engineer and constructor of the future, a professional who is not only technically competent, but who also focuses on innovation, possesses an entrepreneurial spirit, enjoys social and global awareness and is a leader in the community."

Among initiatives launched in fall 2011 are a student-run company that designs, builds and markets educational games to K-12 schools and a project to finance, design and build an elementary school in Haiti. Both provide students with broad real-world experience.

Faculty also benefit from such initiatives, including opportunities to receive a share of research and travel stipends awarded annually. An in-house multimedia specialist helps faculty prepare simulations, educational games and other media tools for research or teaching.

In spring 2011, the school launched the Durham National Ph.D. Symposium, designed to entice top candidates to apply for faculty positions. Each year, 10 to 12 doctoral students are invited to give presentations and tour the school. It's an opportunity to showcase the school's programs and meet young talent.

Even if they don't join the school, "we have a group of students who go back to their institutions and spread the word about what wonderful things we are doing here in terms of research and teaching," Rojas said.

The Durham Endowment Fund supports these and other initiatives.



Eddy Rojas

Credits

The 2010-2011 Annual Report is published by the University of Nebraska-Lincoln Office of Research and Economic Development. More information is available at <http://research.unl.edu> or contact:

Prem S. Paul

Vice Chancellor for Research and Economic Development
301 Canfield Administration Building
University of Nebraska-Lincoln
Lincoln, Nebraska 68588-0433
(402) 472-3123 • ppaul2@unl.edu

Writers/Editors:

Vicki Miller, Monica Norby, Ashley Washburn, Elizabeth Banset, Office of Research and Economic Development

Contributing Writers:

Gillian Klucas, Jean Jones, Dana Ludvik
Some articles are based on stories from University Communications and IANR News Service.

Art/Illustrations/Photography:

Joel Brehm, Alan Jackson/Jackson Studios, Craig Chandler, Brett Hampton, Kathe Andersen, Xi He, Will Echtenkamp, Jill Thayer, Nebraska State Museum, UNL Libraries Archives and Special Collections, U.S. National Archives

Print Design: Sym Labs

Web Design: Joel Brehm

(research.unl.edu/annualreport/2011)

Connect with us on Twitter @UNLresearch and on Facebook at facebook.com/UNLresearch.

The University of Nebraska-Lincoln does not discriminate based on gender, age, disability, race, color, religion, marital status, veteran's status, national or ethnic origin, or sexual orientation.

Research Highlights



Laser Expansion

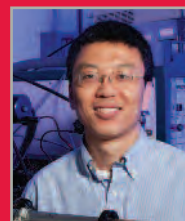
Renovations are under way to create a state-of-the-art, high-power laser collaborative laboratory that will expand UNL's research capabilities. A \$1.8 million National Science Foundation grant through the American Recovery and

Reinvestment Act of 2009 funds this project to create shared core research facilities in Behlen Laboratory. The expansion is adjacent to the Extreme Light Laboratory, where UNL physicist Donald Umstadter, the Leland J. and Dorothy H. Olson Chair in Atomic, Molecular and Optical Physics, and his team operate the Diocles Laser, one of the world's most powerful lasers. The expansion includes five laboratories, collaborative research space for laser scientists and a chamber for a second high-power laser. The facility will place UNL among the top international leaders in laser science. Construction is scheduled to be completed in late 2012.

Red Spouse/Blue Spouse

A national study shows political attitudes are among the strongest traits shared by U.S. married couples –

even stronger than qualities such as personality or looks. The study suggests that people instinctively choose a spouse with similar social and political views. Researchers found little support for the notion that partners adapt to each other's political beliefs over time. The implication is that marriage may reinforce polarization in American politics because parents with ardent political leanings pass those values to their children, who are likely to choose mates with similar beliefs. John Hibbing, UNL Foundation Regents University Professor of Political Science, collaborated with colleagues at Rice University, Virginia Commonwealth University and two Australian institutions on the research, published in *The Journal of Politics*.



Measuring Extreme Noise

Accurately assessing noise exposure is key to developing better tools that protect against hearing loss, but current microphones can't measure extreme levels. Ming Han, assistant

professor of electrical engineering, is developing a fiber-optic microphone that could help reduce noise-induced hearing loss in military personnel. A top 10 winner of the U.S. Department of the Navy's national Chief of Naval Research Challenge,

Han earned \$100,000 for his research. His tiny microphone, about the thickness of a human hair, can accurately measure noise levels in challenging environments, especially those with limited space or high temperatures.

PBS Features ANDRILL

Viewers nationwide learned more about ANDRILL's research when "Secrets Beneath the Ice" premiered on the PBS series NOVA in late 2010. Produced by NET Television, the documentary features researchers working with ANDRILL, the Antarctic geological drilling program that is revealing clues to past and



future climate change in the rock and sediment beneath Antarctica. UNL is home to the U.S. scientific management office for the project, which is funded by the National Science Foundation. ANDRILL involves more than 200 scientists, students and educators from Germany, Italy, New Zealand, the United Kingdom and the U.S. An NET Television crew made several trips to Antarctica to create the documentary, which was part of a broader NSF-funded informal science education project called Antarctica's Climate Secrets, designed to increase understanding of Antarctica and the importance of ANDRILL's discoveries.



Curto Wins Sloan Fellowship

Carina Curto, assistant professor of mathematics, won a two-year, \$50,000 research fellowship from the Alfred P. Sloan

Foundation to support her research in the field of mathematical neuroscience. Curto uses mathematics to improve understanding of how the brain works, especially at the level of information processing in neural circuits. Many neurological disorders such as autism, Parkinson's disease and schizophrenia are believed to arise from malfunctions in neural circuitry.



Jon Pedersen (left) and Jim Lewis

Noyce Grants

UNL faculty are leading efforts to increase the number of highly qualified mathematics and science teachers in Nebraska schools. Jim Lewis, Aaron Douglas Professor of mathematics, received a six-year, \$3 million grant from the National Science Foundation's Robert Noyce Teacher Scholarship program to cover tuition, fees and a stipend for students to earn master's degrees and certification to teach math in grades 7-12. In May 2011, 22 Nebraska mathematics teachers were awarded master teaching fellowships through this program. This builds on previous efforts to enhance mathematics education, including the NSF-funded Math in Middle Institute and NebraskaMATH. The grant also funds an effort to keep master's degree-holding K-12 teachers in high-need schools. Jon Pedersen, professor of

teaching, learning and teacher education, won a five-year, \$1.2 million Noyce grant to cover tuition and fees for more than 50 people who earned bachelor's degrees in science disciplines to complete a master's degree and certification program to teach physics, chemistry and earth sciences.

Junk Food Bans Pay Off

Schools that eliminate junk food and sugary drinks from their lunch menus have healthier, lighter-weight students, a UNL study found. Researchers estimated the relationship between schools' food policies and students' weight by comparing those policies with survey information from students in grades 7-12, parents and administrators. Findings from this USDA-funded study suggest that one major policy change – banning junk food from a la carte lunch lines – would reduce the number of overweight or obese students by 18 percent. The team, which included marketing expert Patricia Kennedy and economist Mary McGarvey of UNL and economist Bree Dority of University of Nebraska at Kearney, recommended expanding the USDA's current ban on selling foods of limited nutritional value to include items such as candy bars, soda, chips, cookies and high-fat snacks.



Ancient Climate Change Discovery

Research by a UNL scientist and colleagues may change how scientists think about global warming. Researchers found that a major pulse of ancient global warming – a period called the Paleocene-

Eocene thermal maximum – may have been more complex than previously believed. Analyzing oxygen isotopes in fossil mammal teeth from Wyoming's Bighorn Basin, scientists found the first continental evidence that this well-studied pulse of warming may have been preceded or even caused by earlier warming. Their findings suggesting there were two sources of warming instead of one have implications for climate change prediction models. Ross Secord, assistant professor of earth and atmospheric sciences and curator of vertebrate paleontology at the University of Nebraska State Museum, and colleagues at the University of Michigan and University of Missouri reported their findings in the journal *Nature*.

Fellows Tackle Food Security

Two UNL faculty members are providing expertise on food security issues to policymakers through

fellowships at the U.S. Department of State during 2011-2012. Curtis Weller, professor of food and bioprocess engineering, is one of 13 Jefferson Science Fellows. He is advising policymakers on a variety of topics related to global food systems, food processing, and sanitation for food and drinking water. Alan Tomkins, professor of psychology and law and director of the university's Public Policy Center, is a Franklin Fellow. He works on the Secretary of State's Global Hunger and Food Security Initiative as primary adviser on the diplomatic side of the Feed the Future Initiative, which is led by the U.S. Agency for International Development.

Rapid Changes in Greenland's Climate

Abrupt average temperature changes over a few decades may have profoundly affected human civilization in western Greenland over the past 5,000 years. Using a new technique that measures qualities of salt-loving microscopic plants called haptophytes, scientists studied carbon-dated sediment cores from



the beds of two saline lakes in West Greenland. This technique allowed them for the first time to fine-tune their knowledge of climate change in that area. They found some dramatic changes. The fossil organisms revealed a succession of temperature shifts, sometimes rapid and large, that roughly coincide with changes in human occupation of the area. The scientific team, including Sherilyn Fritz, George Holmes University Professor of earth and atmospheric sciences, reported its findings in the *Proceedings of the National Academy of Sciences*. Lead author, William J. D'Andrea, a postdoctoral fellow at the University of Massachusetts, began this research as his master's thesis project with Fritz at UNL.

GAANN Fellowships Growing

A growing number of UNL doctoral students are receiving support through the Graduate Assistance in Areas of National Need (GAANN) program. Enhancing the nation's research and teaching capacity in areas of critical need is the goal of this U.S. Department of Education program. In 2011, UNL had eight active GAANN grants totaling \$3.9 million to fund doctoral fellowships over the life of the grants for programs in chemistry, educational psychology, mathematics, physics and astronomy, statistics and engineering. To qualify, students must show both ability and financial need.



Marjorie Langell (center) with students Anita Zaitouna and Brad Worley

Marjorie Langell, a Charles Bessey Professor who leads the chemistry department's GAANN program, said it is making a difference in her students' lives. One of her students, a single mother of two, might not have committed to a doctoral program without GAANN's additional financial support and guidance, Langell said.

Lewis Named Professor of Year

Jim Lewis, Aaron Douglas Professor of mathematics, was selected as the 2010 Carnegie Foundation for the Advancement of Teaching Nebraska Professor of the Year. The award is part of the U.S. Professors of the Year awards program, which recognizes dedicated educators who have had a profound impact on the lives of students and contributed significantly to undergraduate education.

New Engineering Dean

Timothy Wei is the new dean of the College of Engineering. He came to UNL in April from Rensselaer Polytechnic Institute where he was professor and head of the Department of Mechanical, Aerospace and Nuclear Engineering, and interim dean from June 2008 to August 2009. Earlier, he was a professor of mechanical and aerospace engineering at Rutgers University, where he formed several multidisciplinary research teams. His research interests are in coupling fundamental fluid dynamics experiments with technologies of socio-technological importance. Wei earned a doctorate in aerospace engineering from the University of Michigan and master's and bachelor's degrees in mechanical engineering from Lehigh University and Cornell University.



Extension Addressing Climate Change

The unpredictable impacts of climate change, such as extreme weather conditions and new policies that address greenhouse gas emissions, will necessitate new animal production practices. UNL Extension is partnering with five other land-grant universities to inform livestock and poultry producers how to move animal production toward practices that are

environmentally sound, climatically compatible and economically viable. Informing consumers about climate change and animal agriculture also is a goal. A five-year, \$4.1 million USDA grant will help researchers and extension personnel develop educational programs and Web resources for producers, stakeholders and the public, and coordinate resources nationally. Other collaborators are Washington State University, Texas A&M University, University of Georgia, Cornell University and University of Minnesota.

Vanishing Arctic Tundra

Imagine vast Alaskan and Canadian tundra giving way to trees, shrubs and plants typical of more southerly climates. UNL and South Korean climatologists predict these and other Arctic changes are likely by the end of this century. The team analyzed 16 global climate models from 1950 to 2099 and combined this information with more than 100 years of observational data to evaluate what climate change might mean to the Arctic's sensitive ecosystems by the dawn of the 22nd century. UNL climatologist Song Feng and colleagues reported their findings in *Climate Dynamics*. By 2099, a quarter to nearly half of the Arctic areas dominated by polar and sub-polar climate types will decline and be replaced by more temperate climates.



Nebraska Lectures

An educational psychologist and a history professor shared their research during the 2010-2011 Nebraska Lectures: The Chancellor's Distinguished Lecture Series. In her fall lecture, Susan Sheridan,

George Holmes University Professor of educational psychology, discussed how to narrow the learning gap between disadvantaged children and their peers in "Ready for School, Ready for Life: Creating a Future for All Children."



In her spring lecture, Margaret D. Jacobs, history professor and director of UNL's women's and gender studies program, presented "A Battle for the Children: Indigenous Child Removal in the United States and Australia from 1880-1940."

She outlined the lasting consequences of U.S. and Australian governments sending Indian and Aboriginal children to boarding schools to assimilate them into the dominant culture. Jacobs won the 2010 Bancroft Prize for her book on the subject. The Office of the Chancellor, the Research Council and the Office of Research and Economic Development co-sponsor these lectures featuring prominent faculty.

UNL Research Fair

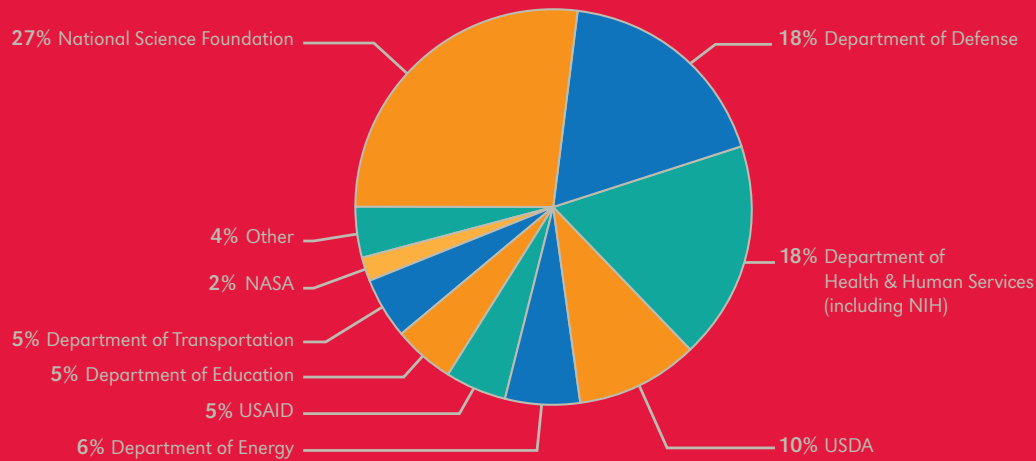
Symposiums focused on two UNL research priorities highlighted UNL's 2011 Spring Research Fair. The Nebraska Supercomputing Symposium, co-sponsored by the Holland Computing Center and the Department of Computer Science and Engineering, featured a universitywide discussion on high-performance computing topics. The Food, Water and Energy Resources Policy Symposium, co-sponsored by the Office of the Chancellor, Office of Research and Economic Development, Institute of Agriculture and Natural Resources and Office of Academic Affairs, was part of an ongoing discussion to plan a major interdisciplinary research initiative on these topics. The Research Fair included faculty recognition events, student poster sessions and a session on preparing for graduate school. Featured speakers were Caspar Ammann, National Center for Atmospheric Research; William G. (Gerry) McCartney, Purdue University; Victoria White, Fermilab; Shenggen Fan, International Food Policy Research Institute; Kathie L. Olsen, ScienceWorks LLC; and Stan Johnson, National Center for Food and Agricultural Policy.



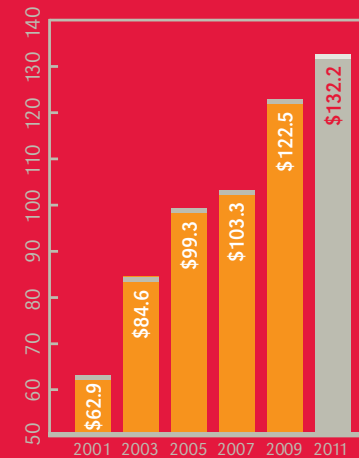
Research Fair activities: student poster session (top); symposium discussion (middle); and recognition breakfast (bottom)

Financials

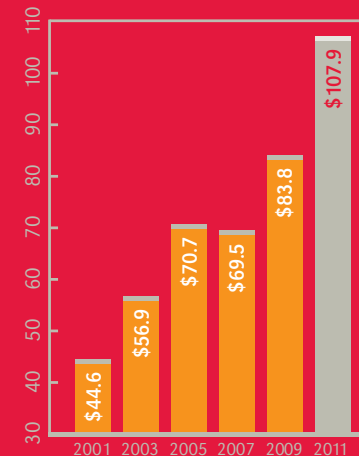
FY 2011 Research Funding by Federal Agency



Total Research Funding (in millions)



Total Federal Research Funding (in millions)



Research Funding

UNL faculty earned \$132.2 million in research funding during the fiscal year that ended June 30, 2011. UNL’s research funding trends over the past decade are positive, increasing 110 percent from \$62.9 million in 2001. Research funding from federal sources grew 142 percent – from \$44.6 million in 2001 to \$107.9 million last year. In fiscal 2011, UNL achieved an institutional goal of exceeding \$100 million in federal research awards. The chart above details federal agency funding. The other charts illustrate UNL’s total and federal research funding trends.

