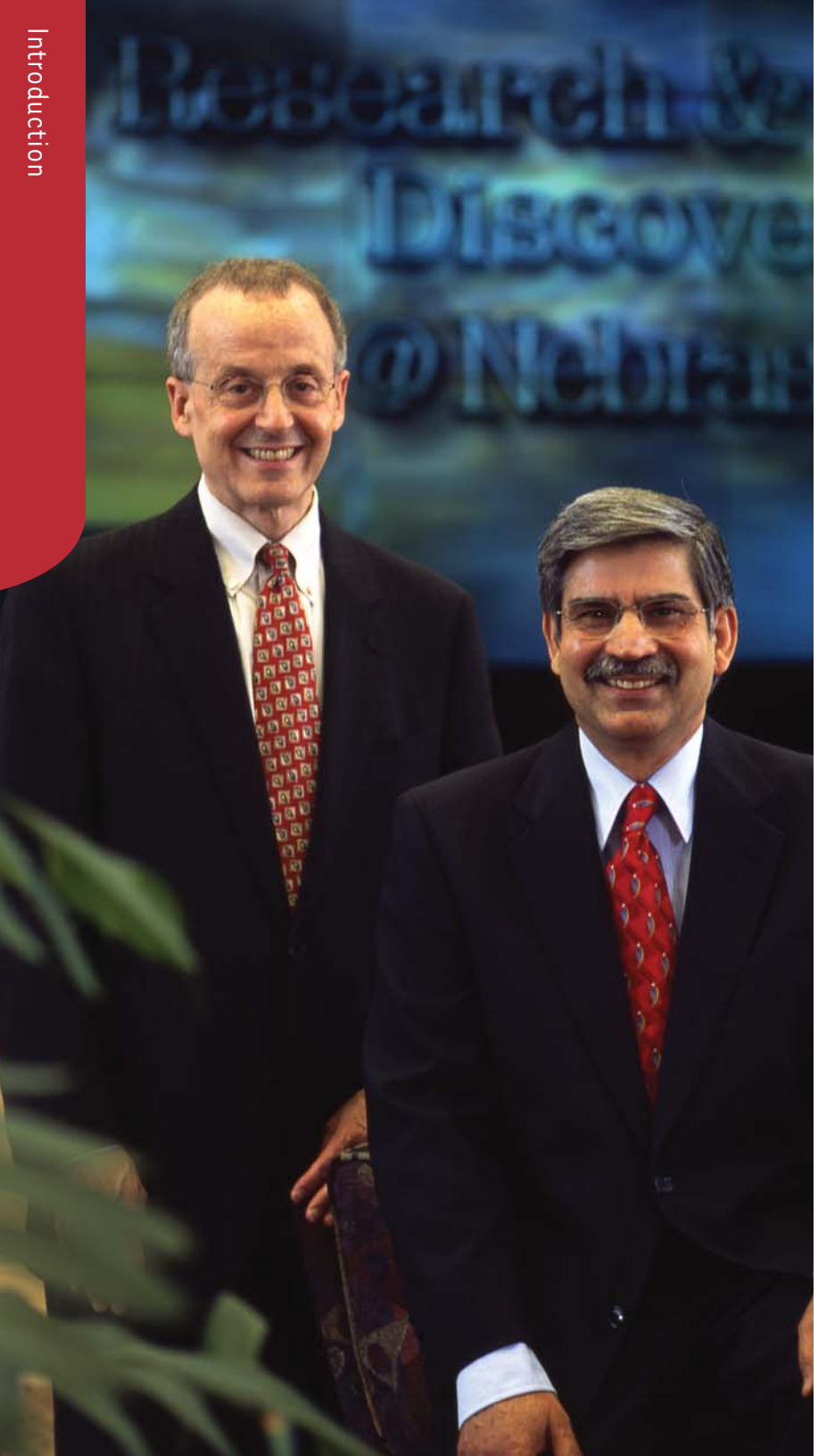
University of Nebraska Lincoln

Office of Research & Graduate Studies

ANNUAL REPORT 2002/2003



Welcome to Research and Graduate Studies at Nebraska

Great things are happening in research and graduate studies at the University of Nebraska-Lincoln. In the year ending in June 2003, we celebrated record levels of achievement in external funding and new partnerships and directions for our research enterprise.

New collaborations and partnerships between disciplines and institutions have yielded success. UNL is the lead institution in a six-university consortium comprising the Nebraska Plant Genome Center. Collaboration between UNL and University of Nebraska Medical Center scientists created an innovative center for the study of redox biology. And geoscientists and ecologists have teamed to model the relationship of land, grass and water in the Nebraska Sand Hills and its implications for other complex environmental systems.

The university is forging new relationships with state and federal partners, studying the research and policy issues surrounding water and the ways to further community- and faith-based mental and behavioral health and digitizing valuable texts to make them accessible electronically.

Strengthened ties with philanthropic and educational foundations have led to new relationships with, among others, the W.M. Keck Foundation and the Carnegie Foundation for the Advancement of Teaching.

The vigorous growth in the University of Nebraska-Lincoln's research activities stems from a close integration of our research strengths and priorities with UNL's identified Programs of Excellence and the overarching agenda laid out in *A 2020 Vision: The Future of Research and Graduate Education at UNL.*

We are helping faculty reach this vision with new competitive grants programs that invest strategic funds. Nebraska Tobacco Settlement Funds support key faculty hires and enhance biomedical research programs, and other strategic funds support scholarly and creative activity in the arts and humanities and development of research clusters.

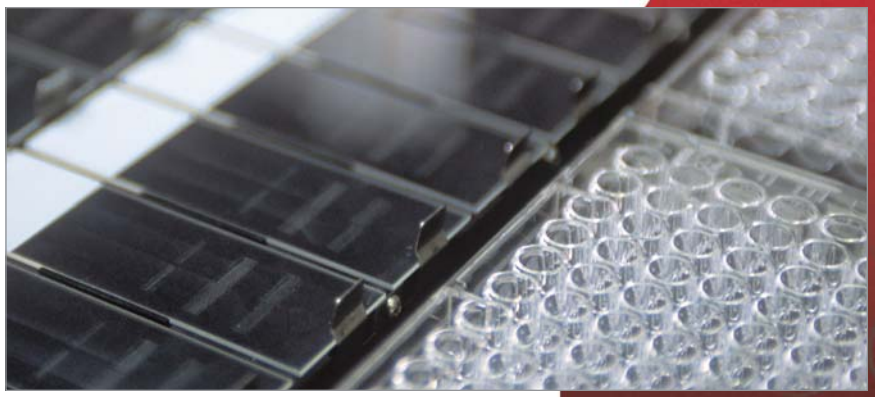
While we are improving the climate for research at Nebraska, we are also strengthening our commitment to technology development and to economic development for the State of Nebraska as we develop products and processes for commercialization.

Harvey Perlman, Chancellor, & Prem Paul, Vice Chancellor

This annual report tells only a few of the success stories realized by our scientists and scholars during the past year. We invite you to visit our web site, www.unl.edu/research, for more information.

Great things are happening at UNL. We are confident that by continuing our focus on success and emphasizing quality, we will fulfill our goal of inspiring excellence in research and graduate studies at the University of Nebraska-Lincoln.

Prem S. Paul
Vice Chancellor for Research &
Dean of Graduate Studies



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Quantum and Spin Phenomena in Nanomagnetic Structures

UNL nanomaterials scientists have built a unique and powerful research group recognized for its work in nanomagnetism, spin-polarized systems and nanostructure synthesis. In 2002 the National Science Foundation acknowledged their work with a $5.4 million grant to establish a Materials Research Science and Engineering Center in Quantum and Spin Phenomena in Nanomagnetic Structures, one of 27 such elite centers in the nation.

The MRSEC, led by David Sellmyer, UNL George Holmes Distinguished Professor of Physics and Astronomy, involves an interdisciplinary group of scientists from the departments of Physics and Astronomy, Chemistry, Mechanical Engineering and the School of Biological Sciences whose research focuses on nanomagnetic structures. Their work in magnetic materials at the nanoscale – as small as one-billionth of a meter – has applications in advanced computing and data storage systems, handheld electronic devices, advanced sensors and possible future medical technologies.

"Nanoscience and nanotechnology are amazingly creative new subfields of materials science, and the center's researchers will be developing precise fabrication techniques as well as doing the theoretical and characterization portions of the science," Sellmyer said.

UNL nanomagnetics researchers are nationally recognized for their theoretical and experimental work and fabrication of new materials. In just the last two years, their research has included the synthesis of the first magnetic polymer or "plastic magnet" and has generated six patents granted or filed on devices for data storage, portable electronics and optical sensors.

Two Interdisciplinary Research Groups make up the research thrust of the MRSEC. The first, "Nanomagnetism: Fundamental Interactions and Applications," focuses on synthesizing and studying novel patterned structures, studies of cluster-assembled structures and theoretical studies of electron-transport properties of nanocontacts. The second, "Spin Polarization and Transmission

David Sellmyer

at Nanocontacts and Interfaces," aims to synthesize novel magnetic contacts and understand the resulting transport properties, and will investigate novel ferromagnetic/organic ferroelectric heterostructures.

The grant funds more than research projects, Sellmyer said. Training of graduate and undergraduate students and programs for educational outreach and technology transfer to business and industry are included in the center. The center's research and its collaborations with industry partners such as IBM, Seagate and Hewlett-Packard hold high potential for inventions and discoveries that can be patented and commercialized. A recent example is a small, powerful neutron detector developed at UNL that could be used to detect hidden nuclear devices.

UNL's MRSEC grant was one of only three new awards made by the NSF program this year.

Mesospin Research Center Established with Keck Grant

The W.M. Keck Center for Mesospin and Quantum Information Systems and the W.M. Keck Fast Dynamics Laboratory were established at UNL in 2003 with a $750,000 grant from the W.M. Keck Foundation.

David Sellmyer, UNL George Holmes Distinguished Professor of Physics and Astronomy and director of the Center for Materials Research and Analysis, will direct the center, which will involve physics and chemistry faculty conducting frontier research on mesospin structures. Faculty involved in the center are: Peter Dowben, Sy-Hwang Liou, Bernard Doudin, Evgeny Tsymbal, Andrzej Rajca, Ralph Skomski, Anthony Starace and Roger Kirby.

The proposed research is basic, new and high risk. Mesospin research occurs at the intersection of condensed matter physics, chemistry and materials science, and deals with topics not even perceived until recently. Mesospin structures are extremely small, ranging in size from single atomic spins to high-spin molecules to nanoscale magnetic dots and clusters. These structures have great potential for future technological applications in information processing and storage.

A crucial aspect of the study of mesospin structures is developing extremely precise fabrication techniques that allow scientists to create such small structures. The UNL group will be developing both fabrication techniques and the theoretical science underlying mesospin structures.

The Keck funding will support research programs and laboratory facilities.

Unraveling Fundamental Problems in Redox Biology

At center stage in life science research is redox biology, the study of the reduction-oxidation reactions that are necessary for normal growth and development of organisms. In September, 2002, UNL became a major focal point for this essential research with a $10 million award from the National Institutes of Health to establish a Center of Biomedical Research Excellence in Redox Biology.

The Nebraska Redox Biology Center, believed to be the first center in the nation dedicated to redox research, links researchers at UNL and the University of Nebraska Medical Center. Ruma Banerjee, Willa Cather Professor and Professor of Biochemistry at UNL, is lead investigator on the grant and is the center director. Other center researchers include Han Asard, Joe Barycki, Don Becker, Vadim Gladyshev, Jaekwon Lee, Marjorie Lou, Stephen Ragsdale, Gautam Sarath and Steve Scott from UNL, and Dhruba Chakravarti from UNMC.

The center's scientific focus is on unraveling fundamental problems in redox biology in systems ranging from microbes to mammals.

Redox reactions are the means cells use to harvest energy and are essential to life, but can produce by-products that damage the cell. Research links a number of diseases to errors in redox reactions and failure of the cell's protective systems to guard against damage.

The Redox Biology Center's scientists will look at how cells maintain a reduction-oxidation balance, a process called redox homeostasis, and study the link between redox homeostasis and complex diseases such as cancer, cardiovascular disease, Alzheimer's disease and cataracts. The studies also will advance understanding of redox regulation, which is important in cellular aging and controlled cell death. Each of the center's researchers is studying some aspect of the reduction-oxidation process, from the role of enzymes to how cataracts develop, Banerjee said.

Banerjee's work focuses on homocysteine, an amino acid linked to heart disease when present in higher-than-normal levels and involved in a key cell protection mechanism. "Our studies could lead to insights that would be targets for intervention and treatment of heart disease," she said.

Stephen Ragsdale

The center supports the work of the participating scientists, eight postdoctoral associates, four graduate students and three technicians, and contributes to support of key core facilities. A major portion of the grant involves the mentoring of junior faculty by four senior faculty to help them become independently funded scientists.

The four senior faculty of the Redox Biology Center and their areas of research are:

Ruma Banerjee: Homocysteine-linked redox homeostasis

Stephen Ragsdale: Metalloenzymology and environmental biochemistry

Marjorie Lou: Redox enzymology of cataractogenesis

Vadim Gladyshev: Selenoprotein-mediated redox responses

Identifying Human Selenoproteins

Vadim Gladyshev

Using powerful computer programs they developed for searching genetic databases, UNL researchers have identified what they believe is the complete set of human selenoproteins, previously implicated in cancer prevention, male reproduction, aging and immune system function.

"Our programs enabled us to analyze human, mouse and rat genomes and we were able to confirm that 25 selenoproteins exist in the human genome," said UNL biochemist Vadim Gladyshev, whose laboratory led the research effort in collaboration with scientists in Spain. The work, which included the identification of seven new selenoproteins, was published in the May 30, 2003, edition of *Science*.

Selenoproteins contain the micronutrient selenium, a dietary essential shown to have beneficial health effects. Men with high selenium levels are three times less likely to develop prostate cancer and selenium is necessary for a healthy immune system.

"Now that we likely have the full set of selenoproteins, we can begin to study what they do," Gladyshev said. "We will try to link various selenoproteins to the roles of dietary selenium in cancer prevention and delaying the aging process."

Using a prototype software, Gladyshev and colleague Gregory Kryukov identified three new selenoproteins in the fruit fly genome. But the complexity of the human and mouse genomes overwhelmed the computer program. New programs developed by Kryukov, SECISearch 2.0 and SECISblastn, provided a 1,000-fold increase in power that made analysis of the human, mouse and rat genomes possible.

These powerful computational tools are an example of the emerging science of bioinformatics, which applies advanced computing techniques to analyze biological systems.

This research was funded by grants from the National Institutes of Health.

Leading the Fight Against AIDS and Cancer in Africa

The southern African nation of Zambia is at the epicenter of the AIDS pandemic. More than 21 percent of Zambian adults are HIV positive. One in every three mothers is HIV positive and one in every 10 Zambian babies is born infected. Zambians can now expect to live, on average, only into their late 30s. And HIV is just part of the problem, said Charles Wood, UNL molecular virologist and director of the Nebraska Center for Virology.

"The viruses and cancers associated with HIV are a serious problem," Wood said. "Kaposi's sarcoma, the cancer most associated with AIDS, is linked to human herpesvirus 8, and more than 40 percent of the Zambian population is infected with that virus."

Wood's extensive research program, funded by the National Institutes for Health, focuses on the transmission of HIV and the different viruses associated with AIDS, particularly human herpesvirus 8 (HHV-8), in Zambia. He is attacking the problem on many fronts, from the molecular level where genes regulate viral infection, to genetic studies of differing HIV strains and a large-scale clinical study on viral transmission. Five years ago Wood began a project with the Teaching Hospital of Zambia to study how HIV and HHV-8 are transmitted from mothers to their newborn infants. Of the initial 3,000 mother-infant pairs in the study, Wood is still tracking 700.

"We lost many, many mothers to HIV and we lose others because they are very poor and it is a mobile population," Wood said.

But following the mother-infant pairs has yielded significant information about how HIV and HHV-8 are transmitted. In tracking babies born to HHV8-infected mothers, Wood found that by the time the babies are 12 months old, about 20 percent are infected with HHV8. By the time they are four years old, 40 percent are infected. "It is unlikely that this infection is through sexual transmission, so what is happening?" Wood asked.

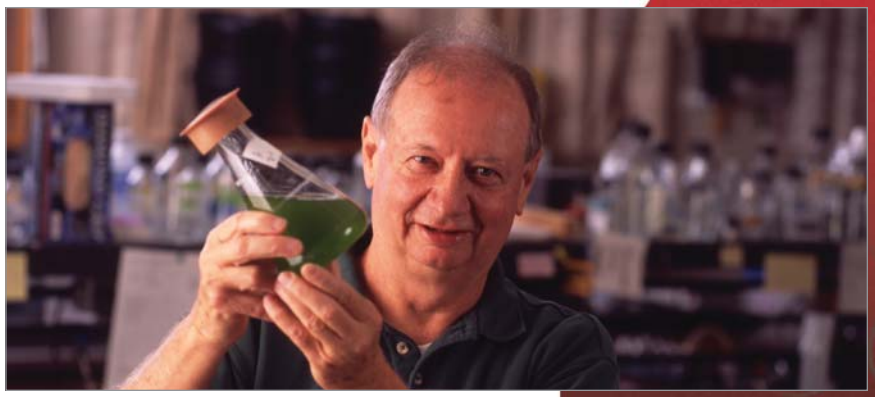
There are three routes of viral transmission from mother to infant: while in the uterus, through breast milk, and through saliva. Using a combination of blood tests to determine infection and genetic studies to

Charles Wood

track the source of the viruses, Wood found that HHV-8 is not transmitted in breast milk, as HIV is – a major finding. But unlike HIV, HHV-8 is transmitted in saliva – though not necessarily the mother's saliva – and this is likely the major source of transmission. This means HHV-8 is being transmitted to children by fathers and siblings as well as the mothers, through shared food and utensils.

"Knowing this, we can try to discourage people from sharing food and utensils and hopefully reduce the rate of infection and of cancers," Wood said. "Kaposi's sarcoma is now the second most common childhood malignancy in Zambia."

National Academy Member Passionate about Research



Jim Van Etten

"Science is its own reward."

That is a message UNL Plant Pathologist Jim Van Etten tries to instill in anyone interested in research. There is plenty of repetition to verify results, he said, "but occasionally, you'll find something new that no one else in the world knows. To me that's the ultimate high."

Van Etten's passion for discovery and his scientific accomplishments were recognized in 2003 with his election to the National Academy of Sciences, one of the highest honors for an American scientist.

Van Etten took a scientific gamble in the early 1980s, when he dropped two successful research programs to investigate a family of algal viruses he and colleague Russ Meints discovered.

Phycodnaviridae infect green algae and are among the most genetically complex viruses ever found. They have about 375 genes, compared with about 12 in HIV.

"We couldn't in our fondest dreams have anticipated all the things we've found since and there is so much more to learn about these viruses," Van Etten said.

Only about 60 known virus families exist, so simply finding a new one was significant. But the algal virus's complex genetic structure and unique characteristics make it particularly intriguing and promising for research. The initial discovery has led to several patents and many more discoveries, including information that may be significant to human, animal and plant health.

Van Etten's work has led to collaborative research with about 20 labs worldwide, including work by scientists examining potential health- and drug-related aspects of these viruses.

Developing a Vaccine Against Botulinum Neurotoxin

Botulinum neurotoxin is the most deadly toxin known and has been converted for use as a weapon of bioterrorism, making a vaccine against the neurotoxin one of the highest biomedical priorities for homeland security. UNL is a major partner in a project to fast-track development of a botulinum vaccine, funded by a recent $12 million grant from the National Institutes of Health/National Institute of Allergy and Infectious Diseases.

The vaccine project builds on the work of UNL chemical engineer Michael Meagher, director of UNL's Biological Process Development Facility (BPDF), in botulinum vaccine development over the past nine years.

Meagher and his colleagues in the BPDF are part of a research team led by DynPort Vaccine Co. that also includes the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and HTD Biosystems, Inc. UNL will receive $7.45 million of the grant for the BPDF's work in developing fermentation and purification processes and analytical methods for the botulinum vaccines.

"Developing a botulinum vaccine has been difficult and complicated because botulinum exists as seven different serotypes – A, B, C, D, E, F, and G – and each requires a separate vaccine," Meagher said. The NIH-funded project will fast-track development of a vaccine in one to two years that will provide protection against serotypes A, B, C, E and F, and within five years will produce a vaccine that will provide protection against all seven serotypes – a heptavalent vaccine. The heptavalent vaccine is expected to all but eliminate botulinum neurotoxin as a weapon of mass destruction, he said.

UNL's Biological Process Development Facility is one of the few university facilities in the United States that can take vaccines and therapeutics from the recombinant gene stage to production of a product suitable for human clinical trials.

"Bringing a candidate vaccine to Phase I clinical trials requires the ability to do process scale-up and cGMP manufacturing that meets FDA requirements. Very few universities have that ability; UNL does," Meagher said.

Michael Meagher

The BPDF has worked for nine years developing the technology and manufacturing processes for botulinum vaccines based on recombinant genes for neurotoxin serotypes A, B, C, E and F. Vaccines for serotypes A and B are already in advanced development and DynPort Vaccine Co. is producing cGMP pilot lots of the A and B vaccine candidates for Phase 1 human clinical trials. This collaboration was the basis for the NIH-funded project. HTD Biosystems provides expertise in formulation and stability of commercial vaccines.

The grant is made through a new program of the National Institute of Allergy and Infectious Diseases (NIAID) that emphasizes partnerships between universities, government and the private sector to speed development of vaccines, therapeutics, diagnostics and other products needed for biodefense.

Team Studying Tularemia Bacteria

Jeff Cirillo

In June, 2003, three Lincoln, Neb., men contracted inhaled tularemia after two of them mowed over a dead rabbit, and the third cleaned the mower with an air sprayer. All survived, but their unusual experience caught the attention of the Centers for Disease Control.

It also interested Jeff Cirillo, one of several UNL scientists collaborating on a $100,000 pilot study to conduct basic research on *Francisella tularensis* – the bacteria that causes tularemia, a potentially fatal disease.

The project is supported by the University of Nebraska and the Nebraska Tobacco Settlement Biomedical Research Development Fund and involves researchers from UNL and the University of Nebraska Medical Center.

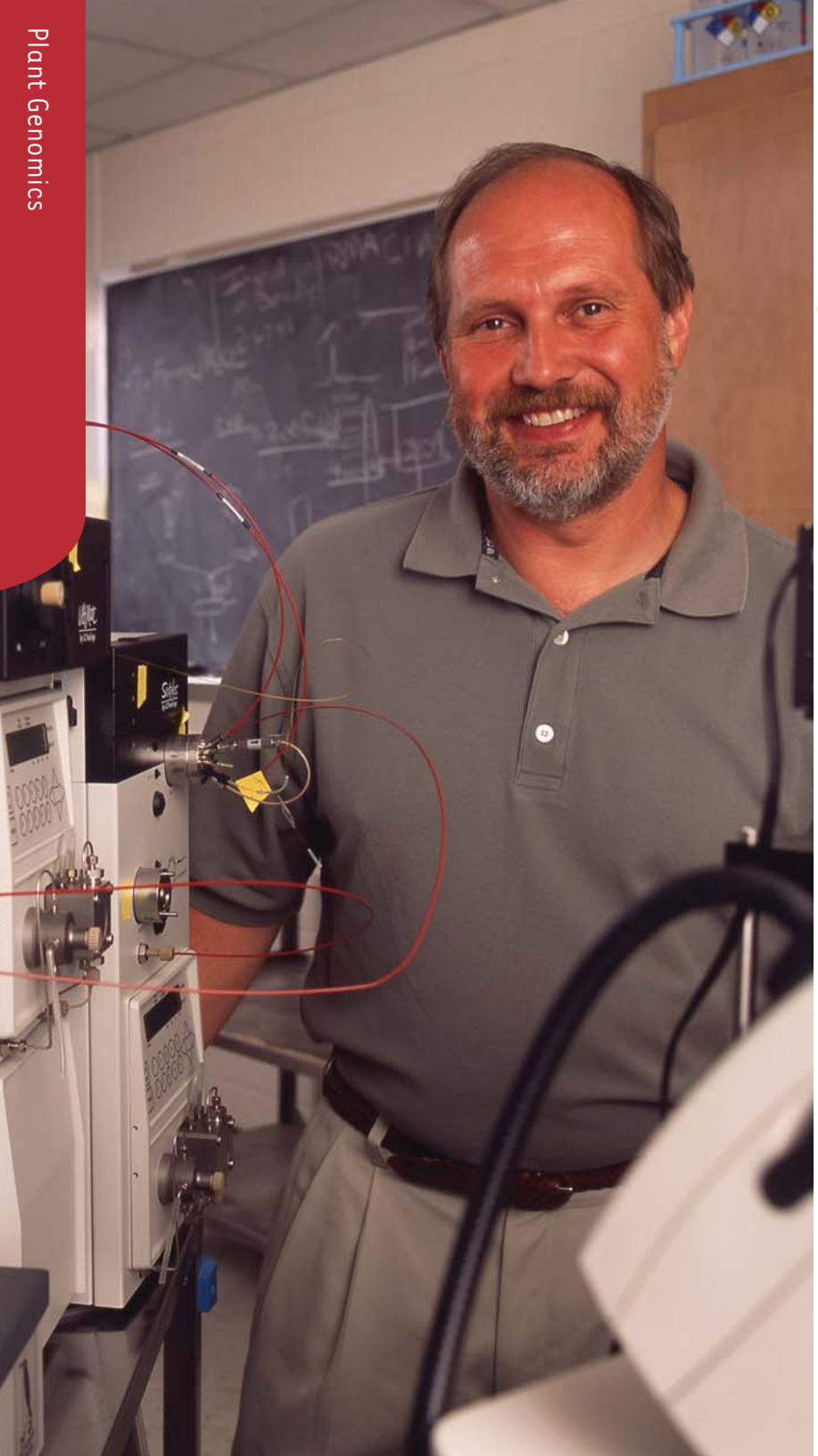
Tularemia, also known as "rabbit fever," is caused by a naturally occurring bacterium found typically in wild animals. The inhalation variety has a death rate as high as 60 percent and the bacterium is classified as a Category A bioterrorism agent.

UNMC is authorized by the government to "grow" the bacterium in its labs and has developed the very pure strains necessary for genetic studies.

Using this material, UNL researchers Cirillo and Andy Benson are doing comparative genomic studies on two *Francisella* subspecies. The studies compare all of the genes from both subspecies to determine nearly all of the differences present. Cirillo is comparing the functions of the various genes to learn how these bacteria cause disease. Other research groups are looking at specific proteins in the bacterium that may be vaccine candidates or targets for better therapeutic agents than current antibiotics, which have significant side effects and are not highly effective.

"UNL is committed to research that is beneficial to the state and the nation. Our bioprocessing research is at the forefront in developing defensive measures against bioterrorism and has tremendous potential for applications in biomedical engineering."

David Allen
Dean, College of Engineering and Technology



Genome Center Studies Protein Kinase Interactions

Water is often the limiting factor in agriculture, when drought can quickly take a promising bunker-busting year to a yield closer to zero. Understanding how plants recognize and respond to drought could lead to the development of crops with more tolerance to drought and other environmental stresses.

A new Plant Genome Center at UNL funded by a $6 million National Science Foundation grant teams scientists from six institutions to study how plants perceive and react to drought and other environmental stresses. The center will focus on the study of protein kinases in plants. Protein kinases are enzymes that modulate protein behavior, affecting the way plants perceive and react to their environments. Manipulating kinases could be a way to regulate plant tolerance of disease and environmental stresses, such as drought and cold.

Michael Fromm, director of UNL's Center for Biotechnology and a member of the UNL Plant Science Initiative, is the principal investigator on the team comprising scientists from UNL, the University of California-Davis, the University of Arizona, the University of California-San Diego, the University of Florida and the University of Missouri.

They will study protein kinases in rice, the first cereal crop whose genome has been completely sequenced. It is an important model for other cereal crops critical to Nebraska agriculture, such as corn, sorghum and wheat.

"The main questions we are trying to answer are what are the kinases' role in the rice plant, how they are involved in signaling and how kinases interact with each other and with what they interact," Fromm said. "We hope that through rice protein kinases, we can create a blueprint for other cereals."

The new center grows in part from the research capabilities of UNL's Plant Science Initiative, established to conduct interdisciplinary research in the basic plant sciences. Fromm and other researchers associated with the Initiative use genomics technologies to gain new understanding of how plants work and how they can be improved for value-added agricultural applications.

Ron Cerny

A key factor in winning the grant is UNL's strong track record in using mass spectrometry in the study of proteomics, the identification of proteins and determination of their function in an organism. Mass spectrometry is used to analyze the proteins once they have been isolated. UNL's high-quality mass spectrometry center with seven instruments is one of the best academic centers in the nation, said Ron Cerny, director of mass spectrometry services at UNL and a member of the Plant Genome Center research team.

The grant also includes $200,000 for a program to encourage under-represented students to pursue scientific careers and equip them to do advanced research. Promising students take a graduate-level summer course in research techniques and work with center scientists in the laboratories.

Inducing Male Sterility in Plants

Sally Mackenzie

A team of UNL researchers led by plant geneticist Sally Mackenzie has found a gene in the nucleus of *Arabidopsis* cells that affects male sterility and offers broad potential for producing non-transgenic male sterile plants.

Scientists have long known that changes in the cells' mitochondrial DNA cause the sterility mutation. Mackenzie and her team followed that genetic trail to re-create the mutation in the lab.

The team found a gene in the cell's nucleus that controls genetic changes in the mitochondria. By inserting foreign DNA into this gene, they turned it off, observed changes in the mitochondria and pinpointed which change actually triggers male sterility.

Mackenzie's team was working in *Arabidopsis* because its entire genome has been sequenced. Because all plants carry the gene affecting the mitochondria, their findings have broad applications.

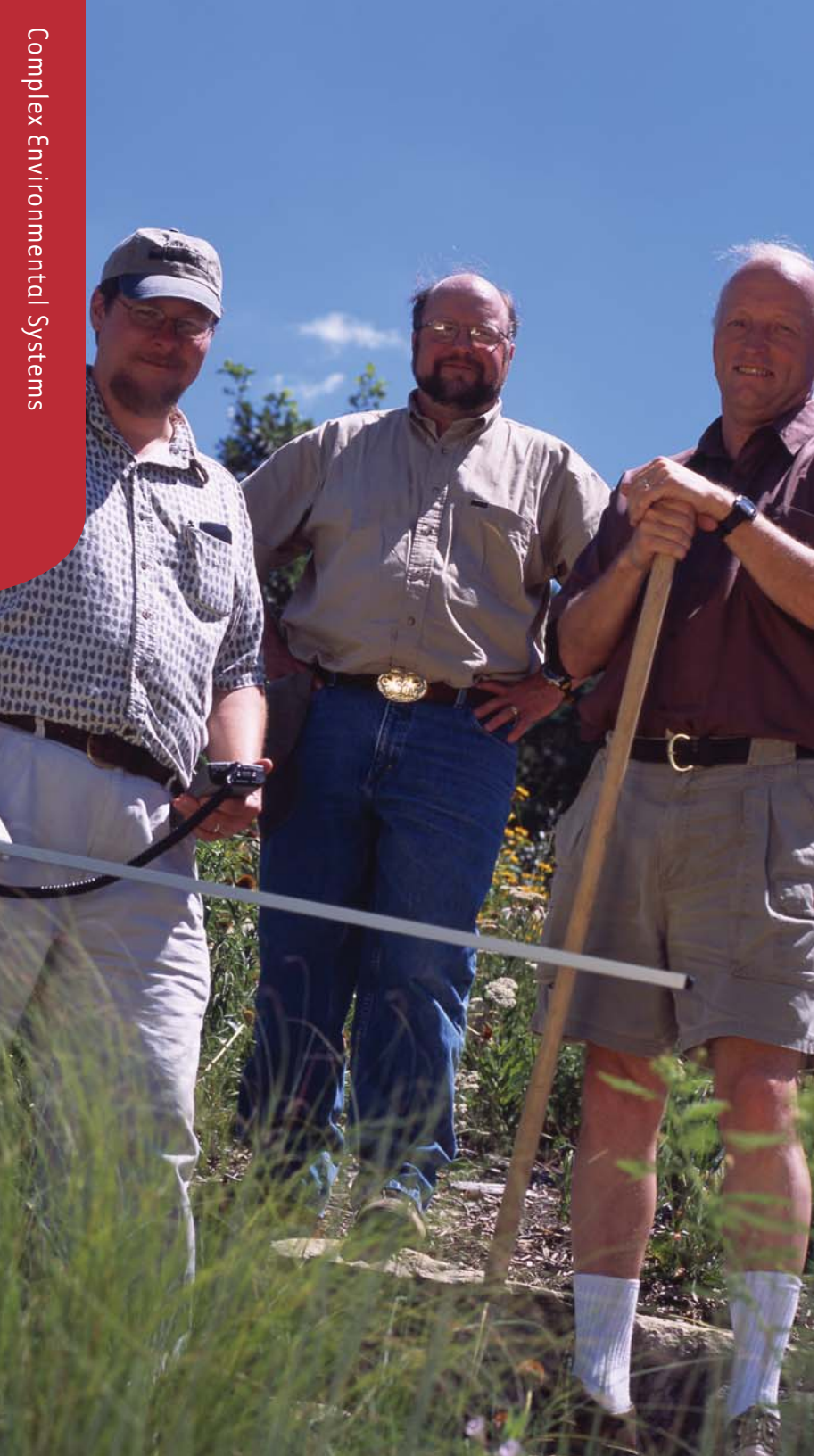
Male sterile plants are important in plant breeding and hybrid seed production and sterility also eases concerns that genetically modified crops will spread enhanced genetic characteristics to wild plants. But sources of male sterility are nonexistent in some crops, such as soybeans, and limited in others, and the trait can be unstable, with some sterile plants reverting to fertility.

Mackenzie's technique creates stability, and by removing the foreign DNA that caused the original genetic change, the plant is no longer considered transgenic.

UNL has filed for a provisional patent on the technique. The National Science Foundation and U.S. Department of Energy helped fund this research.

"Genomics, proteomics and related technologies are tremendous tools for the rapid genetic improvement of plants. Understanding genes that control important traits enables plant scientists to enhance expression of those genes at many levels, from molecular biology to conventional plant breeding."

Darrell Nelson
Dean and Director,
Agricultural Research
Division



Sand Hills Ecosystem Is a Desert in Disguise

Rolling, grass-covered hills separated by lush wet meadows cover the Barta Brothers ranch in north central Nebraska. Grazing cattle dot the dun-colored hills, red-winged blackbirds dart among the reeds in the meadows, a red-tailed hawk soars above. But the overwhelming feature is the vast, unbroken expanse of grass and sky.

This is a small corner of a huge, unique ecosystem – the 20,000-square-mile Sand Hills of Nebraska, the largest sand dune area in the western hemisphere, covered and stabilized by native grasses. But the grasses' hold is tenuous, and the ranchers who live here fiercely fight blowouts – bare areas of exposed sand – fearing their spread.

"The Sand Hills are a desert in disguise," said UNL geoscientist David Loope. "When processes like drought, overgrazing and fire devegetate this massive sand dune system, the dunes can become destabilized and begin to move."

The geologic record shows that the Sand Hills have gone through several periods of movement in the past 10,000 years – the most recent about 900 years ago – when drought caused loss of grass cover and left the area vulnerable to winds, Loope said.

"We want to know how climate and vegetation interact to stabilize the system," said UNL systems ecologist Dave Wedin. The biocomplexity of the Sand Hills is the focus of a $1.8 million, four-year National Science Foundation award to Wedin and UNL co-investigators Loope and Geoffrey Henebry, a landscape ecologist. They lead an interdisciplinary team of 15 scientists studying "sand, grass and water, their interactions, and the stability of the . . . Sand Hills over the last few thousand years."

The Sand Hills' stability is important because they lie atop the High Plains aquifer, the world's second largest, and are a major factor in the recharge of this huge water supply.

The research team believes the aquifer and the wet meadows it supports stabilize the dunes, an interaction that is a major component of the research project. "We want to know, 'How does the landscape interact with the groundwater and the

Geoffrey Henebry, Dave Wedin & David Loope

atmosphere and what happens when you change the vegetation covering the dunes?'" Wedin said.

The team will use a combination of techniques to answer these questions, including devegetation studies of the dunes, taking cores of Sand Hills lake beds that reveal droughts and landscape changes over 2,000 years, an optical technique for dating dunes combined with aerial mapping and satellite imagery to determine the age and structure of dunes, and climate modeling studies using advanced computer simulations.

Although most of the project's scientists have studied aspects of the Sand Hills, this is the first integrated, cross-disciplinary study of the ecosystem.

UNL's investment of $50,000 to support initial studies and a new laboratory for optically stimulated luminescence measurement, one of four such U.S. labs that can date windblown sand deposits, also helped lay the foundation for this project.

Storing Carbon in Cropland

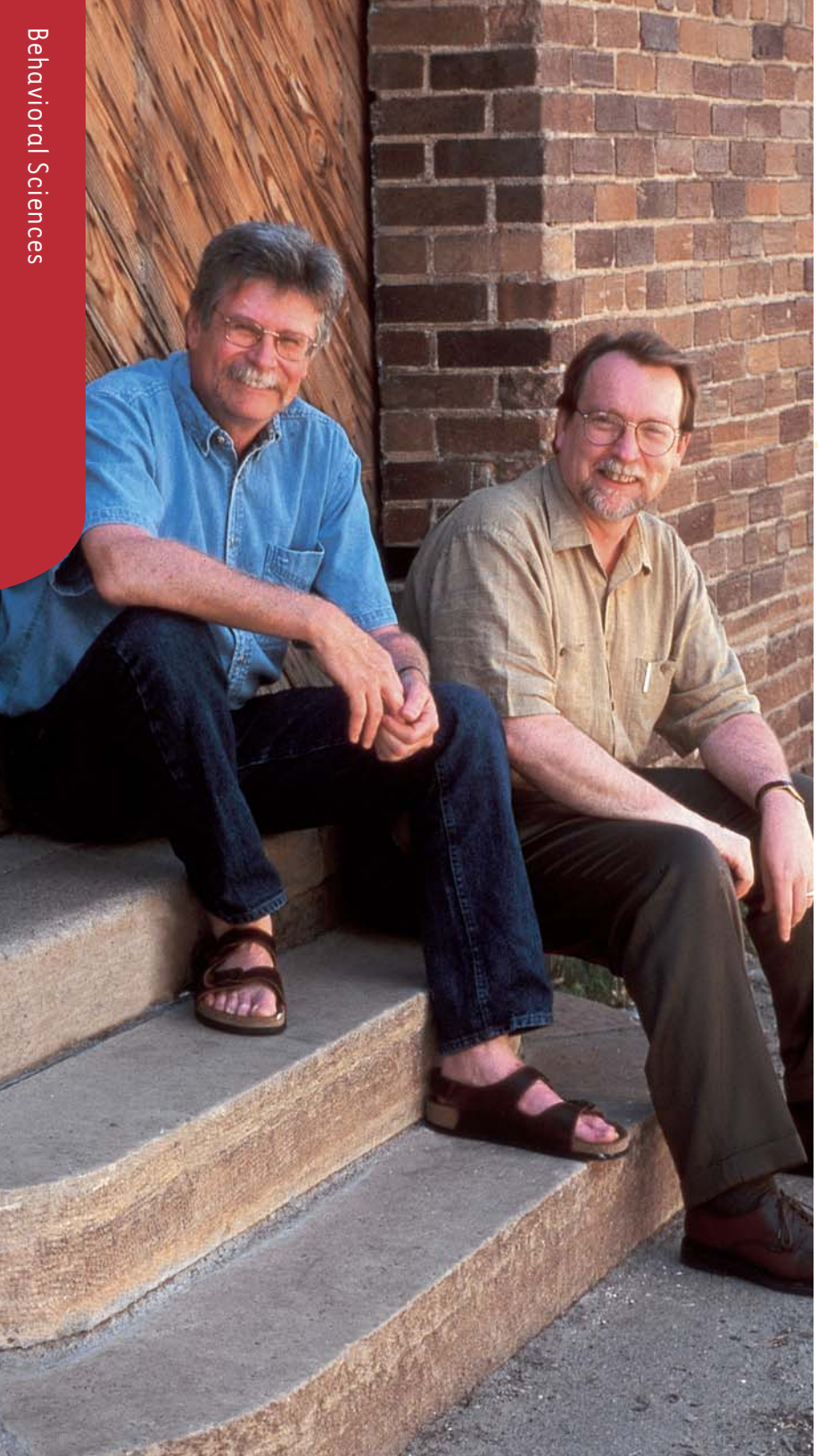
A green wall of 12-foot-tall corn almost obscures the instrument tower in the distance. The tower, sampling the air for carbon dioxide (CO_2) and other gases as often as 10 times per second and feeding the data to computers, is the only hint that these 480 acres of Nebraska farmland have become a unique high-tech laboratory.

This huge laboratory is dedicated to measuring and understanding how CO_2 cycles through the atmosphere, plants and soil. The ultimate goal: to find a way to reduce the CO_2 in the atmosphere – a major factor in projections of global climate change – by storing more of it in the soil, a process called carbon sequestration.

"This project is the only one of its kind in the world examining an agricultural system," said Shashi Verma. The UNL agricultural meteorologist is co-leader, with agronomist Ken Cassman, of the carbon sequestration project, established with an initial $1.8 million grant from the U.S. Department of Energy and funded again in 2003 with a $1 million DOE grant.

Finding ways to increase CO_2 storage in cropland is critical because more than 35 percent of the CO_2 increase in the last 100 years results from deforestation and conversion of natural ecosystems to agriculture. As the Earth's population has exploded to 6 billion people, the need for arable land has grown with it.

"The quality of life people will enjoy 30 years from now will depend in large part on whether we can produce food in a way that improves the quality of the environment. This is one small step in that direction," Cassman said.



Listening and Trusting: A Research Partnership

A collaborative research partnership among a team of UNL sociologists and Native American and First Nations peoples in the upper Midwest and Canada lends empirical proof to the idea that embedded cultural values promote resilience among Native people.

The team, headed at UNL by Les Whitbeck and Dan Hoyt and funded by the National Institute on Drug Abuse and the National Institutes of Mental Health, worked closely with tribal elders and councils on three reservations to develop culturally sensitive and specific tools to measure levels of traditional practices, Native spirituality and cultural identity. They learned that the level of enculturation (how deeply one is involved in his or her culture), the risk factor of historical loss (the daily feelings of trauma arising from past and continued ethnic cleansing) and constant feelings of discrimination are strong risk factors associated with substance abuse and other negative behaviors.

"Now, when the tribes are developing prevention and intervention projects, if they build this knowledge into their programs, they should have good results," Whitbeck said. "In fact, if they are successful in increasing enculturation, they do have good results. The Natives intuited this. But now we have persuasive evidence for funders."

Whitbeck and his team worked closely with tribal elders, basing programs on that knowledge. Cultural knowledge was not empirically tested, but the knowledge of generations has stood the test of time, he said.

"Our contribution to the research really more than anything else has been listening to and trusting the elders," Whitbeck said. "We listened and trusted the culture and what it had to say." Native American or First Nations individuals conducted the research and focus groups, which increased trust and promoted participation.

"Our work grows out of, gives back and stays with the culture," Whitbeck said. He added there is urgency among Native Americans to pass on the knowledge of elders – a generation that is aging – before their wisdom is irretrievably lost.

Among several successful projects designed and used by the tribes is one that helps connect children with cultural practices, such

Les Whitbeck & Dan Hoyt

as use of a "talking circle" where problems are discussed and solved as a family.

The more often these cultural practices are used, he said, the more resilient children become against behaviors such as alcohol or drug abuse.

The most exciting breakthrough, Whitbeck said, is recent work that empirically validates the idea of historical trauma and loss and links them to day-to-day symptoms. The studies show that Native Americans have frequent thoughts about historical losses of language, homelands and spirituality that they associate with negative feelings – anxiety, depression, anger and avoidance.

Whitbeck cautioned that the findings can't be generalized across all Native cultures, but they were significant and prevalent in the study's participants and suggest that policy and treatment plans should acknowledge the existence and effects of historical trauma and loss.

Government, Community and Faith-Based Groups Join Hands

Mark DeKraai

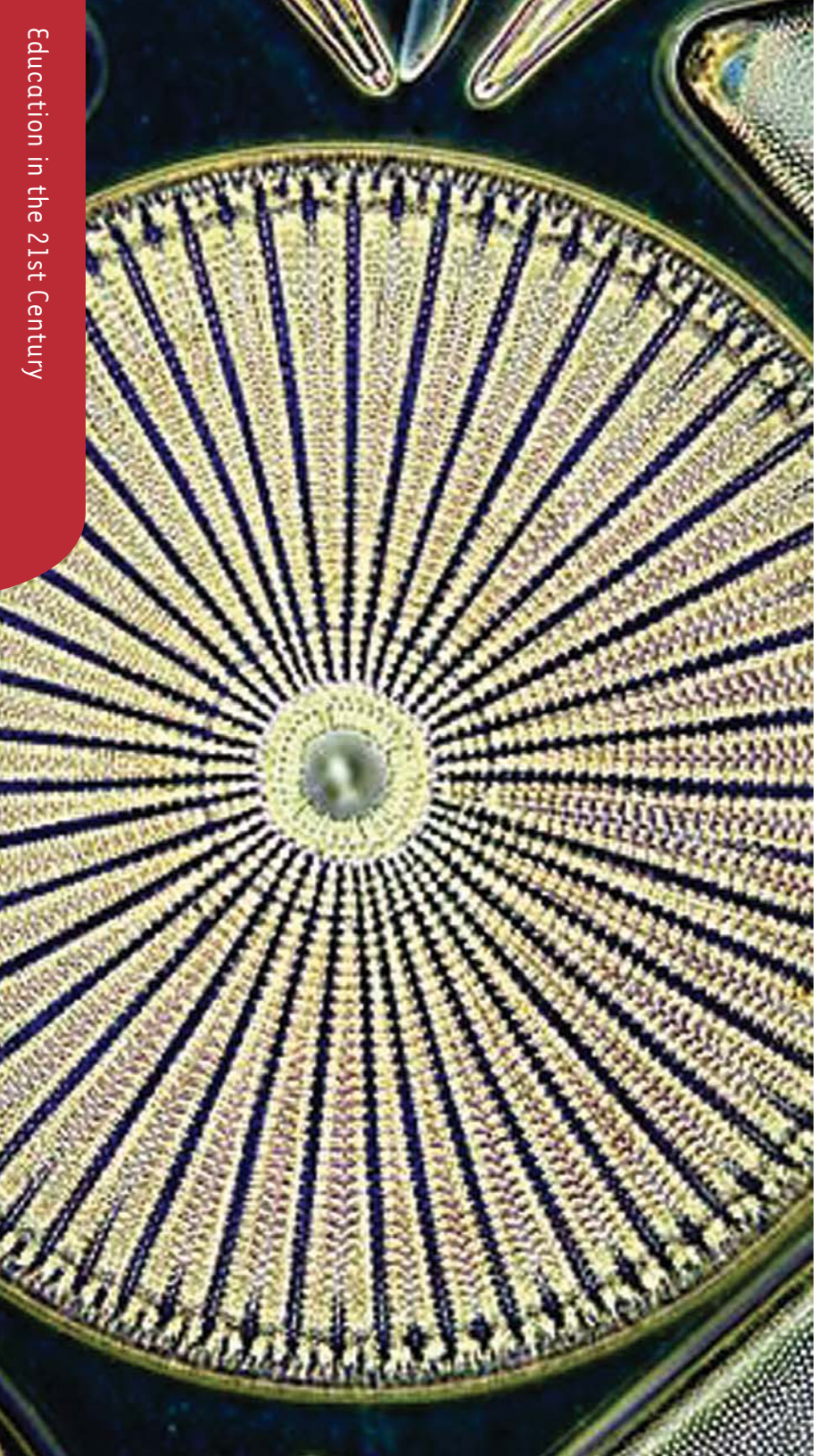
Each year, some 275,000 Nebraskans struggle with behavioral health problems. Many turn first to a church or community agency for help, yet often these valuable groups lack expertise or are unable to help individuals navigate barriers.

NEBHANDS (Nebraskans Expanding Behavioral Health Access through Networking Delivery Systems) is a project coordinated by the University of Nebraska Public Policy Center to create a behavioral health care system that integrates the services of government, faith-based and community organizations. The project is funded by a three-year, $3.7 million Compassion Capital Fund grant from the U.S. Department of Health and Human Services. Alan Tomkins, director of the Public Policy Center, is principal investigator on the grant.

Mark DeKraai, project director, said more than 100 agencies, ranging from higher education institutions to the state departments of Health & Human Services, Agriculture, Corrections, and Education, to the Interchurch Ministries of Nebraska and other faith-based organizations, are involved.

"If you look back 100 years, almost all human services were delivered by faith-based or community-based groups," DeKraai said. "Increasingly, government has become the major player . . . but churches are still involved. About 25 percent of people who access behavioral health services made an initial contact through a church. That's particularly true of elderly, minority or rural people."

The project, initiated in October 2002, is focused on coalition building and developing the capacity of faith-based and community organizations to participate in the behavioral health system. Cash sub-awards and technical assistance – such as how to fund raise or how to identify and refer individuals – for partner organizations are key aspects of the project.



Exploring Evolution Through Diatoms, Finches and Whales

Explore Evolution, a collaborative project led by the University of Nebraska State Museum and funded by a $2.8 million grant from the National Science Foundation, will bring to the public interactive exhibits demonstrating that research on evolution continuously changes how we think about the natural world.

"We know that many people think of evolutionary theory as a series of static ideas," said Judy Diamond, museum associate director for public programs and principal investigator of the three-year Explore Evolution grant. "They also think that new research in evolution 'proves' those ideas are wrong. In fact, research in evolution is a dynamic, changing field. New ideas and observations are changing our thinking, adding to our theories about evolution."

Six museums in the middle and mountain west and six state 4-H programs are collaborating with UNL on the project. Each of the museums will host eight to 10 permanent exhibits on evolution and disseminate the Explore Evolution activity kits through its educational programs and web sites.

The exhibits will highlight the latest research in evolution, focusing on viruses, diatoms, fungi, fruit flies, finches, humans and whales.

"We will be using a unique viewpoint, going from the smallest to the largest organisms, to show how evolution works and how at every level there are common principles," Diamond said.

An example is recent research by two Princeton University scientists showing that evolutionary changes in the bill sizes of Galapagos finches, used by Darwin as an example of evolution, occur rapidly in response to environmental changes. Darwin posited that evolutionary changes only occur slowly and over long periods of time. New research shows that both kinds of evolutionary changes occur.

"We want to show that scientific research strengthens evolutionary theory," Diamond said.

Cooperating museums in the Explore Evolution project are the UNL State Museum; the Exhibits Museum of the University of Michigan; the Kansas Museum and Biodiversity

Diatom *Arachnoidiscus ehrenbergi*

Center at the University of Kansas; Texas Memorial Museum at the University of Texas at Austin; the Sam Noble Oklahoma Museum of Natural History at the University of Oklahoma; and the Science Museum of Minnesota. 4-H organizations in Iowa, Michigan, Minnesota, Montana, Nebraska and Wyoming are participating.

Educational materials developed by the project will include an activity book with information on the scientists and their research and free activities that can be downloaded from the Internet. The materials include experiments that students can conduct with adult direction in any setting and can be used as stand-alone tools; a visit to one of the museums hosting an Explore Evolution exhibit will augment learning but will not be required for users to benefit from the materials.

The exhibits will be designed and built at the Science Museum of Minnesota. Public feedback on the prototype exhibits will occur in late 2004, and installation will begin in 2005.

Career Ladder Trains Bilingual Teachers

Bill Lopez

Northeast Nebraska has nearly 12,000 school children whose first language is not English and a desperate need for bilingual teachers.

A new partnership led by UNL will begin to fill that need by helping up to 30 bilingual para-educators earn bachelor's degrees in teaching and endorsements in English as a Second Language.

The Northeast Nebraska Para-Educator Career Ladder Project, funded by a five-year $1.97 million grant from the U.S. Department of Education, brings together educators and students from UNL, Northeast Community College of Norfolk, Central Community College-Columbus, and Wayne State College.

"We're cutting-edge here," said Bill Lopez of the UNL College of Education and Human Sciences and the grant's primary investigator. "No one's ever seen four different campuses with such distinct missions working together to deliver a four-year degree."

Para-educators in the project will study at the community colleges the first two years, then finish their baccalaureate degrees at UNL and Wayne State, with most of the upper-level coursework delivered by distance education.

Twenty-seven para-educators from seven school districts have joined the project since January 2003 and all but one of the participants are female and most are Latina, said Vicky Jones, UNL's Northeast District extended education coordinator and director of the project.

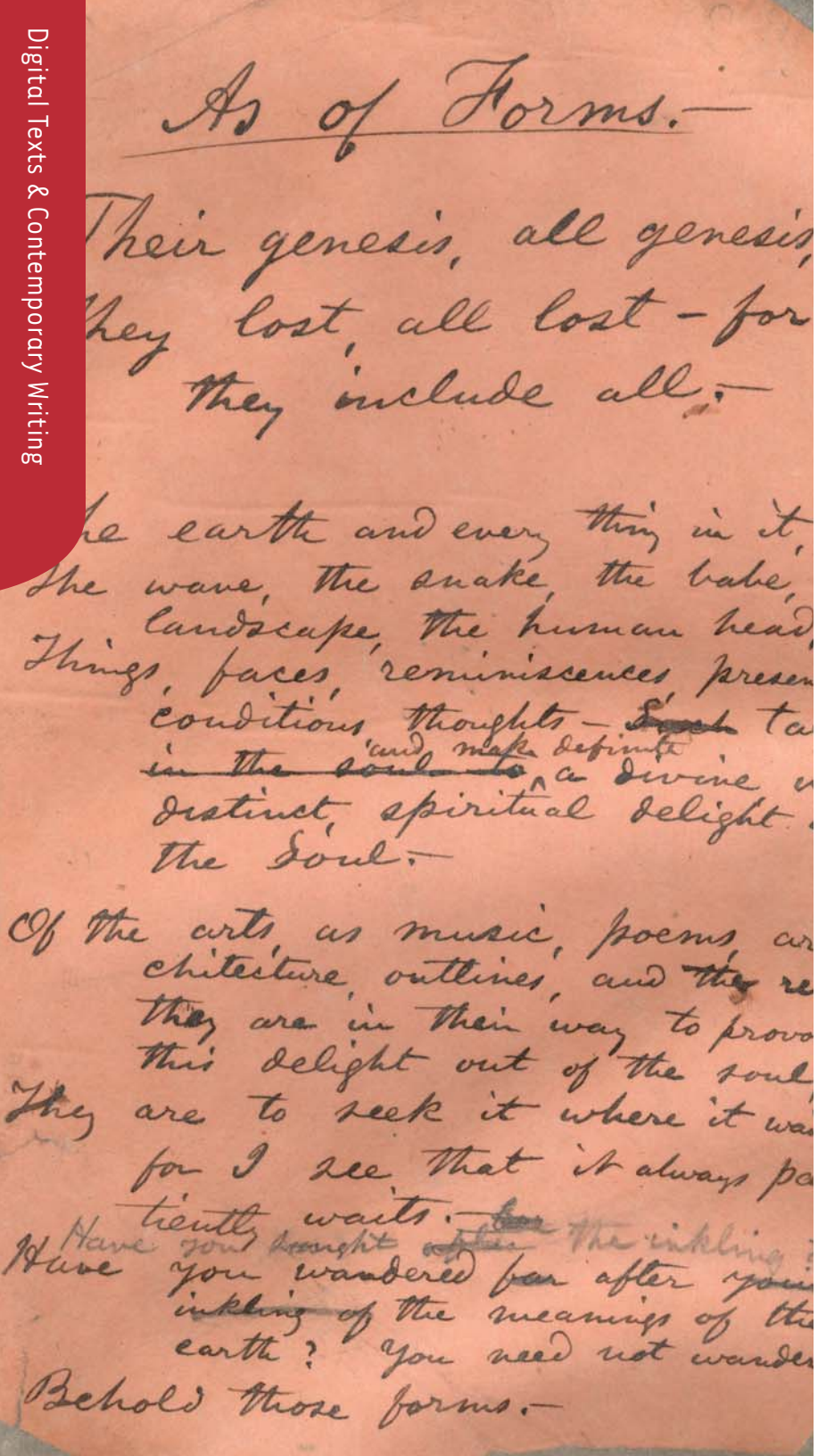
"We're pushing them at an aggressive pace because we want them to complete their degrees in five years," Jones said. Each receives a laptop computer and a lot of social and emotional support and encouragement.

None of the seven school districts currently has any minority teachers, Jones said.

"This is kind of a 'grow your own' model."

"We represent a research continuum from work performed at the cellular level to people taking action in the community. All our work is focused on enhancing people's quality of life. It's a collective effort that can make a difference."

Marjorie Kostelnik
Dean, College of Education and Human Sciences



Whitman Archive Links Scholars with Virtual Manuscripts

In the 1950s, a group of scholars set out to create an enormous work to be known as the *Collected Writings of Walt Whitman*. More than 50 years later, the project collapsed, despite reaching 22 volumes. Incomplete and chaotic, it contained misinformation, was never updated and it had huge gaps – never touching Whitman's mass of poetry drafts.

Whitman, one of the most important writers in American literature, amassed a huge volume of work. Some 70,000 manuscripts are housed in about 80 locations, although the vast majority is known to be in just five libraries. The logistics of merely finding documents, let alone assessing their content and relevance, are daunting.

Ken Price, Hillegass Chair of 19th Century American Literature and professor of English at UNL, and a team of scholars are building an electronic archive of Whitman's works that uses advanced technology to make documents available to anyone with a computer. The archive not only makes documents easily accessible, the documents are electronically scanned so users can view high-quality color images of the works. Two substantial grants, from the National Endowment for the Humanities and the Institute of Museum and Library Services, are funding the project, which is accessible at www.whitmanarchive.org.

Price and his project co-director, University of Iowa Whitman scholar Ed Folsom, are collaborating with Katherine Walter, special collections and preservation chair in University Libraries, who is co-investigator with Price on the IMLS grant. Walter also directs UNL's Etext Center, staffed by Brian Pytlik Zillig, digital initiatives librarian, Mary Ellen Ducey, the university archivist at Love Library, and Brett Barney, text encoding specialist at the University Libraries.

Using Encoded Archival Description, records in various locations are electronically encoded to allow a researcher to comb through all the databases simultaneously to find where relevant manuscripts reside.

Image from the Walt Whitman Archive

"We are using EAD to create for the first time an integrated finding guide for the dispersed manuscripts," Price said. Instead of searching for documents one by one at any of 70 different places, they will link all finding guides into one that represents the totality of all the collections, he said. In related work, the team is working to edit, analyze and annotate all of Whitman's writings available on the web.

"It may be that one of the most important things to come out of this project will be the scholarly discussion list that is accompanying the scholarship," Price said. "Our work is as much a process as a product – a process that we can pass onto the next generation of scholars. We are self-consciously documenting our choices and thinking and decision-making processes."

Summer Writers' Conference Attracts Top Faculty, Students

UNL's Creative Writing Program has a reputation for outstanding graduate education and for faculty and students who are prolific publishers of their work.

This past July that reputation was enhanced by the inaugural Nebraska Summer Writers' Conference, which offered a faculty of 12 distinguished writers including Pulitzer-winning author Robert Olen Butler, acclaimed poet Mark Doty, Nebraskans Mary Pipher and Ted Kooser, and Emmy-winning screenwriters Rita Mae Brown and Jane Barnes leading a week of workshops for 200 conference participants.

Supported by UNL's Programs of Excellence, the conference is critical to building a nationally prominent writing program in UNL's Department of English.

Jonis Agee, UNL professor of English and conference director, said the Nebraska Summer Writers' Conference attracted distinguished faculty to campus and also drew new students to the program.

"Summer writing conferences generate applicants for creative writing programs and bring national prestige to their host institutions," Agee said, noting the success of the Iowa Summer Writing Festival. "Our conference drew registrations from all over the country, and it will continue to make a significant contribution to the national community of writers, enhance Nebraska's voice in the literary community, and establish UNL as a major center for creative writing.

"The national community of writers has never been more aware of UNL, and this is good news for the university," she said. "Not only did the conference enlarge the pool of applicants and attract possible new endowments, but writers everywhere increasingly regard UNL as a desirable destination."

"The digital revolution in communications – away from the printed page toward the electronic screen – is transforming teaching and scholarship. UNL's digital projects are expanding access, democratizing learning and making possible intellectual inquiries that were previously unimaginable."

Richard J. Hoffmann
Dean, College of Arts & Sciences

Producing Nanofibers for Advanced Materials

As scientists have explored the nanoworld, where materials are fabricated at the molecular level and measured in billionths of a meter, they have found that extremely small size can produce extreme properties of strength, flexibility and toughness.

Nanofibers with these enhanced properties offer the potential to produce advanced composite materials with aerospace, military, biomedical and electronics applications. But manufacturing offers challenges that have to be overcome before these revolutionary materials find their way into airplanes, combat gear and operating rooms.

A team of UNL engineers led by engineering mechanics researcher Yuris Dzenis is developing nanomanufacturing and modeling techniques to produce high-performance nanofibers for advanced materials.

"Recently we have demonstrated several pioneering nanomanufacturing methods that produce highly aligned continuous nanofibers," Dzenis said. "Continuous, oriented fibers have many advantages when you are using them to make advanced composites and other materials and devices."

Carbon nanotubes, the most well-known advanced nanomaterials available, are short, discontinuous fibers that are very difficult to use in making composites because they have a tendency to tangle, Dzenis said. The UNL team has overcome this problem by developing a modified electro-spinning process that pulls a continuous nanofiber out of a bulk liquid.

"Ours is a top-down process, where we start with a bulk liquid and work down to extremely small fibers – 50 to 500 nanometers in diameter, or 1 to 2 orders of magnitude smaller than commercial advanced carbon fibers," Dzenis said. In contrast, carbon nanotubes are produced using a bottom-up process, "growing" from atoms to tubes, he said.

A challenge Dzenis and other nano-technologists still face is how to orient the fibers to produce the enhanced properties of stiffness and strength.

"The electrospinning process produces a nanofiber sheet, but the fibers in the sheet are randomly oriented and don't show spectacular properties," he said. "We have been working on orienting the fibers during the electro-spinning process."

Yuris Dzenis

Another approach the group is using is to develop nanocomposite materials that use small amounts of the expensive nanofibers to make the materials stronger and stiffer but keep the total cost down. The team will use nanofibers to toughen and reinforce the interfaces where the layers that make up composite materials meet.

"The layers of laminates can come apart – a problem first seen in military aircraft crashes," Dzenis said. "For 30 years people have tried to solve this problem but the solutions have either made the materials too heavy or too expensive. We think we have the solution to the problem."

The UNL team's work in nanofibers, composites and nanomanufacturing is funded through the National Science Foundation, the Army Research Office and the Air Force Office of Scientific Research.

Neutron Detector for Security Applications

A highly sensitive, hand-held neutron detection device developed by UNL researchers could be used for locating hidden nuclear materials, monitoring nuclear weapons storage and other national security applications.

The device, built around a boron-carbide semiconductor diode and smaller than a dime, can detect neutrons emitted by the materials that fuel nuclear weapons.

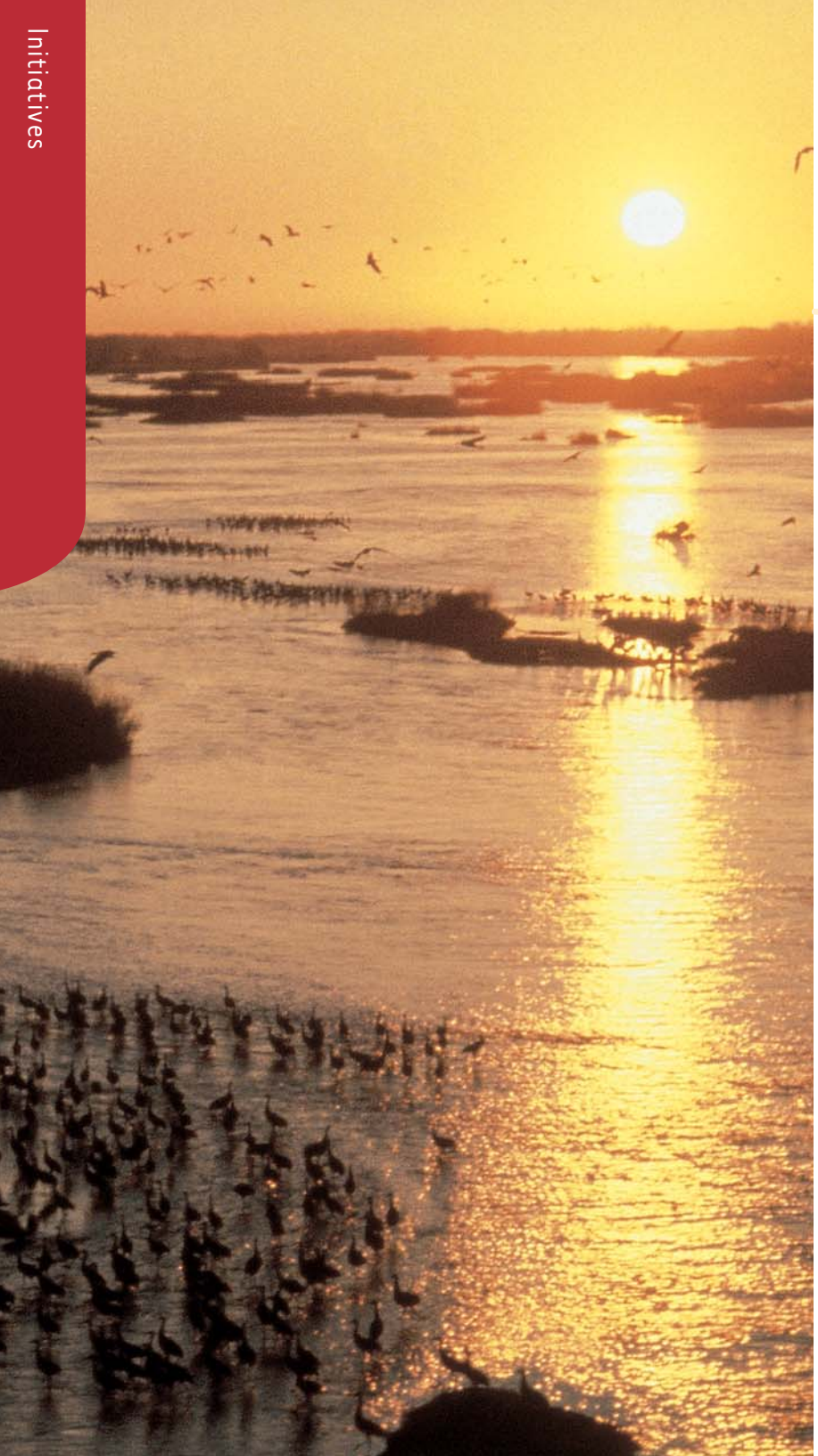
"This is a leapfrog technology in neutron detection," said Peter Dowben, UNL physicist who was the first to fabricate a boron carbide semiconductor. Using Dowben's semiconductor, the research team has built a device that is more efficient, smaller, lighter, and tougher than most existing detectors and has an extremely low incidence of false positives – a major drawback with other neutron detectors.

"This device is very small, it can be powered with small batteries or even solar cells, and it can withstand corrosion and extremely high temperatures," said mechanical engineer Brian Robertson.

Five patents are held by UNL or are pending on the processes for producing the semi-conductors and on the device itself. The team is continuing to refine the device and is exploring commercialization.

Physicist Shireen Adenwalla said NASA wants a low-mass, thin device like this to measure the hydrogen content of comets. The device also has uses in experimental medical radiation treatments for cancer and for "scattering" experiments performed in basic neutron research.

The research team, all affiliated with UNL's Center for Materials Research Analysis, also includes Jennifer Brand, engineering.



Water Initiative Examines State Resources

Water is Nebraska's lifeblood. It fuels agricultural production, sustains rangelands and wildlife habitats, and enables the growth and development of communities. Preserving the quality and quantity of water resources is a critical need in Nebraska and throughout the world.

To meet this need, in 2003 UNL launched the Water Resources Research Initiative to focus the extensive expertise of more than 45 water-related researchers on the complex issues surrounding water and the environmental systems it supports. The initiative will develop a premier research program that draws together UNL scientists and scholars to explore key groundwater and surface water issues, to develop the tools and information needed to guide decision-making, to test possible solutions to challenges in managing water quality and quantity, and to communicate findings to the stakeholders and citizens of Nebraska.

The initiative will be led by Kyle Hoagland, director of the UNL Water Center, Sherilyn Fritz, a paleolimnologist in the Department of Geosciences, and Sandy Zellmer, visiting professor in the College of Law, working closely with Prem Paul, vice chancellor for research, and other administrators. An investment of $300,000 from NU Foundation funds will finance the initial activities of the initiative.

Nebraska's wealth of water resources includes some 2 billion acre-feet of water making up 65 percent of the water in the High Plains aquifer, the world's second largest aquifer which reaches from South Dakota to Texas, and the state ranks tenth in the nation in the number of stream miles. Because of the dynamic, interactive nature of these surface and groundwater systems, decisions regarding Nebraska's water resources may have far-reaching implications for water use and management across the central Great Plains.

Researchers in the initiative will bring a multi-disciplinary approach to the large issues surrounding water use – conflict between the distribution of water resources and water demand, inefficient use of water resources, the need to balance competing uses, increasing degradation of surface and groundwater, conflicts among users, and legal and institutional barriers to management – which are important not only in Nebraska and the region, but nationally and globally.

Platte River

Initiatives Provide Resources for Collaborative Research

In 2003 the Office of Research continued three major internal grants competitions aimed at building collaborations and enhancing competitiveness for extramural funding.

Nebraska Tobacco Settlement Biomedical Research Enhancement Fund awarded $1.9 million in funding for recruitment of key faculty, research clusters and minority health research projects.

Arts and Humanities Research Enhancement Fund awarded more than $40,000 to projects focusing on research, scholarship and creative activity.

Strategic Research Cluster Grants awarded $180,000 to interdisciplinary research groups aimed at pursuing major center grants.

Bioterrorism Focus of UNL/UNMC Grants

The UNL/University of Nebraska Medical Center Research Collaboration Grants program was established in 2002 to increase collaborative research among scientists at the two institutions and to generate NIH-funded projects. The 2002 competition awarded a $118,000 grant to a team studying *Francisella tularensis*, a Category A bioterrorism agent. In 2003, the grants competition will focus on biosecurity research, including food safety; human, animal and plant diagnostics; vaccines and countermeasures against bioterrorism agents; cybersecurity; and transportation security.

Madonna Hospital and UNL Join Forces

A partnership between UNL and the Madonna Rehabilitation Hospital's Institute for Rehabilitation Services joins the expertise of UNL researchers with the resources of a nationally prominent hospital. The institute, directed by Madonna's Bill Shuart, is the nation's first devoted to studying comprehensive, holistic rehabilitation therapies. UNL researchers Sharon Evans, David Beukelman and Lance Perez are leading the institute's three centers.

In 2003, the partnership launched a new research initiative in health bioinformatics led by UNL psychologist Will Spaulding.

Inaugural Research Fair Builds Collaborations

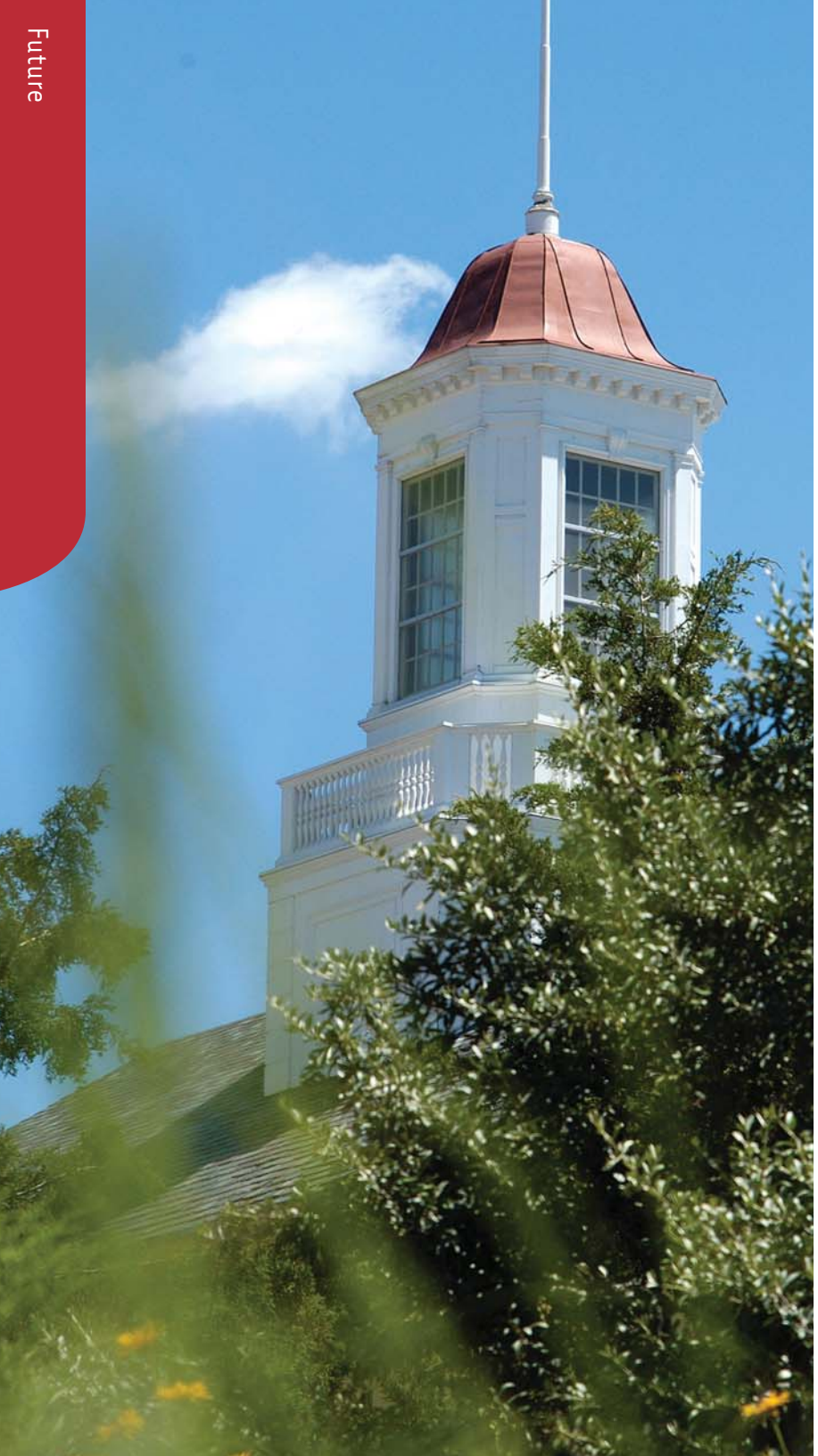
UNL's first Research Fair brought together federal officials and program officers from the federal funding agencies, faculty and graduate students on April 23 and 24. The Research Fair was organized by the Office of Research and Graduate Studies to inform faculty of the federal agencies' funding priorities and opportunities, to foster research collaboration among colleagues from various disciplines and to educate the public about the university's research accomplishments.

Kathie Olsen

Kathie Olsen, associate director for science in the White House Office of Science and Technology Policy, was the featured speaker and outlined the national research and development priorities of the White House in her lecture, "Federal Science Policy and the Role of Universities." Representatives of the federal funding agencies speaking at the Fair were: Margaret Cavanaugh, National Science Foundation, NSF Advisory Committee on Environmental Research and Education; Frank Anger, NSF, deputy director, Division of Computer-Communications Research; Stephen Ross, National Endowment for the Humanities; Rita Rodriguez, NSF, Division of Experimental and Integrative Activities; Brad Fenwick, U.S. Department of Agriculture, chief science adviser, National Research Initiative Competitive Grants Program, Cooperative State Research, Education, and Extension Service; and Randall Haley, director, EPSCoR Centers Development Initiative.

Information from Carole Heilman, National Institutes of Health/ National Institute of Allergy and Infectious Diseases, director, Division of Microbiology and Infectious Diseases, was delivered via satellite connection.

UNL's Office of Undergraduate Studies and UNL's Academy of Distinguished Teachers presented workshops on curriculum innovation grants in the humanities and the sciences and a faculty panel discussed preparing and administrating major center grants.



CAREER, K Awards Jumpstart Faculty Success

Three junior faculty members were awarded CAREER or K01 Awards during 2002-03. Currently, 13 faculty at UNL have received these development grants.

CAREER grants, awarded by the National Science Foundation, recognize research and education of the highest quality. They require a four-to-five year plan for the scientist's development as both a researcher and educator.

K01 Awards, granted by the National Institute of Mental Health, are intended to assist new investigators in a mentored sponsored research experience. The goal of the three-to-five year grant is to prepare the researcher to win a single investigator award.

Kimberly Tyler, assistant professor of sociology, in her project, "Neglect and Abuse Histories Among Homeless Young Adults," will follow a group of young adults long-term to see how their histories of sexual and/or physical abuse and neglect influence their life trajectories.

"This is a critical transition period in their lives when work patterns are established and marital relations are formed," she said. "Failure to successfully establish oneself as a young adult may have lifelong repercussions." Tyler's hypothesis is that those who don't make a successful transition during young adulthood will have significantly difficult lives. Her long-term goal is developing prevention or intervention strategies, she said.

David DiLillo, assistant professor of psychology, in his study, "Family Functioning of Adults Maltreated as Children," will look at how prior abuse history affects an adult's interpersonal relationships.

DiLillo will study about 200 newlywed couples; because almost 25 percent of females experience sexual abuse as a child, he expects that about a quarter of those couples may experience some problems.

The ultimate goal of his research, DiLillo said, is to develop interventions and strategies to help couples. Currently there is no empirically supported treatment, he said. Although,

Stephanie Adams David DiLillo Kimberly Tyler

studies have shown that rates of depression, anxiety and substance abuse are higher for individuals who have experienced child sexual abuse, a gap exists in determining whether that history has an impact on other aspects of adult functioning, particularly interpersonal or marital functioning.

Both K01 awards are worth approximately $630,000 over five years.

UNL's most recent CAREER award recipient is Stephanie Adams, assistant professor of industrial and management systems engineering and interim associate dean of Graduate Studies.

Over the next five years, Adams will use the $587,568 award to implement her proposal, "Designing Effective Teams in the Engineering Classroom for the Enhancement of Learning." Adams hopes her research will strengthen the ability of engineering educators to fully prepare students to work in teams. The study will test her hypothesis that teams enhance learning and better prepare students for the workplace.

Other UNL faculty with CAREER awards active in 2002-03 are Berthe Choueiry, computer science and engineering; Bernard Doudin, physics and astronomy; Gustavo Larsen, chemical engineering; Diandra Leslie-Pelecky, physics and astronomy; Guillermo Orti, biological sciences; Lance Perez, electrical engineering; Stephen Scott, computer science and engineering; and Lily Wang, engineering technology. In addition, Don Becker joined the biochemistry faculty with an active CAREER grant and Peter Angeletti joined the biosciences faculty with a K01 Award. Both joined UNL in the fall of 2003.

Bessey and Cather Professorships Awarded

Charles Bessey and Willa Cather Professorships are awarded to scholars who have demonstrated an exceptional record of distinguished scholarship and creative activity. Their work reflects the highest levels of achievement, quality and importance. Willa Cather, a University of Nebraska alumna and winner of the 1922 Pulitzer Prize for fiction, is widely recognized as one of America's premier authors. Charles Bessey, an NU professor and administrator at the turn of the 20th century, was a pioneering botanist and educator who was president of the American Association for the Advancement of Science and editor of *Science* magazine. Cather and Bessey professorships are granted for five-year, renewable appointments.

The 2003 class is:

David Cahan, Charles Bessey Professor and Professor of History

Patricia Cox Crews, Willa Cather Professor and Professor of Textiles, Clothing and Design

Martin Dickman, Charles Bessey Professor and Professor of Plant Pathology

Carolyn Pope Edwards, Willa Cather Professor and Professor of Psychology and Family & Consumer Sciences

Karen Kunc, Willa Cather Professor and Professor of Art

Marshall Olds, Willa Cather Professor and Professor of Modern Languages

Stephen Ragsdale, Charles Bessey Professor and Professor of Biochemistry

Susan Sheridan, Willa Cather Professor and Professor of Educational Psychology

Robert Spreitzer, Charles Bessey Professor and Professor of Biochemistry

Graduate Studies Promotes Research Opportunities

Both local and national data clearly suggest that low-income, first-generation and minority students are under-represented in all levels of postsecondary education in the United States and especially at the doctoral level. Concentrated efforts to support and mentor such students show success at encouraging them to pursue undergraduate and post-graduate studies. UNL is part of that trend toward mentoring and support.

In June, 2002, the Department of Education awarded a four-year, $1 million grant to the UNL McNair Project. “This program will serve 25 low-income, first-generation or under-represented students in intensive two-year cohorts,” said Ellen Weissinger, executive associate dean of Graduate Studies and the grant’s principal investigator.

The program prepares upper-level undergraduates to complete the baccalaureate degree, enroll in graduate education and complete a doctoral degree. Stephanie Adams, interim associate dean of Graduate Studies, directs UNL’s McNair Project.

The UNL McNair Project offers an innovative program of experiences designed to provide students with the full range of academic, research and teaching skills necessary for success in doctoral study. Each student will benefit from a professionally designed personal educational plan that defines academic, financial and social support needs.

A central focus of the UNL McNair Project is to enhance the research skills and accomplishments of McNair participants. Every student will participate in high-quality research experiences, including: training in research methods, statistics, grant writing, research technology, and presentation skills; matching students with experienced research faculty mentors; training mentors in the skills and knowledge necessary to be effective with McNair participants; providing opportunities for participants to submit their research to scholarly periodicals and to present their research at conferences. Students will also complete a summer research internship, in which they will conduct a research project under the guidance of their mentor and prepare an article abstract and conference presentation. They will present at the McNair Research Conference at Penn State University.

Calecia Hutchinson, Tacoma, Wash., & Tierra Gilbert, San Diego, Calif.

Graduate Studies also coordinates UNL's Summer Research Program. This intensive eight-week research experience attracts undergraduate scholars nationwide with an eye toward preparing them to pursue a doctoral degree. Seminar topics include research methods, expectations of graduate students, admissions and applications processes, resume writing and funding opportunities. Each scholar prepares a final research paper and makes a poster presentation.

During the 2003 Summer Program, 36 scholars from 10 schools and 16 disciplines participated. In addition to several students from historically Black institutions, students from UNL and regional schools also attended. Disciplines represented included: Architecture, Biology/Biological Science/ Biochemistry, Business Administration, Computer Science and Engineering, English, History and Political Science.

THE CARNEGIE FOUNDATION *for the* ADVANCEMENT *of* TEACHING

Math a Partner in Carnegie's Doctoral Reform Initiative

UNL's Department of Mathematics is one of eight math departments nationwide selected to participate in a project to review and overhaul doctoral education.

The Carnegie Initiative on the Doctorate is a five-year research and action project aimed at improving doctoral education at American universities. The project is funded by the Carnegie Foundation and Atlantic Philanthropies. The initiative connects 32 partner departments from four disciplines: chemistry, education, English and mathematics. The goal, as stated by the Carnegie Foundation, is to make doctoral education more purposeful and adapted to the demands and needs of the 21st century.

The Carnegie Foundation believes that doctoral education is a linchpin in continued improvement at all levels of American education because doctoral education prepares the next generation of college teachers. Those involved in the initiative are expected to develop new models for doctoral education, analyze their success and develop recommendations for adoption nationally.

Jim Lewis, former department chair, and Roger Wiegand, the department's graduate chair, will co-direct UNL's efforts.

Partners in the math project are Duke University, Ohio State University, State University of New York at Stony Brook, University of Chicago, University of Illinois at Urbana-Champaign, University of Michigan, University of Southern California and UNL.

As a partner department, UNL will analyze all aspects of its doctoral program and link specific activities to desired outcomes. The first step is to clarify departmental goals and then begin to create "design experiments" in doctoral education to better meet identified goals.

"Graduate programs at Nebraska are creating learning environments that not only take students to the productive boundaries of research in their disciplines, but also reflect the best models of how graduate students develop into scholars and professionals."

Ellen Weissinger
Executive Associate Dean
of Graduate Studies

SAFER Barrier Makes R&D Top 100 List

A technology invented at UNL proven effective at improving auto racing safety was named one of the top 100 products introduced in 2002.

Research and Development Magazine selected the Steel and Foam Energy Reduction barrier as a winner in the 2003 R&D 100 Awards program. The SAFER barrier, which is used on racetracks as an auto racing safety feature, is a development of the Midwest Roadside Safety Facility at the University of Nebraska-Lincoln. According to *Research and Development Magazine*, an independent judging panel and editors of the magazine selected the SAFER development as one of the 100 most technologically significant products introduced into the marketplace over the past year.

The SAFER barrier, also known as "soft wall" or "energy-absorbing wall" technology, was developed in 2001-2002 by the MwRSF and its director, Dean Sicking, under sponsorship from the Indy Racing League, Indianapolis Motor Speedway and NASCAR. The SAFER wall's design and materials help absorb the energy created when a car crashes into it, dissipating the impact energy and distributing it over a longer distance of the wall without propelling the vehicle back into traffic, helping to make race-car crashes less dangerous. The outer wall is made of structural steel tubes, while underneath is as much as 14 inches of energy-absorbing plastic foam in polystyrene blocks spaced behind the steel skin.

The technology earned international headlines in May 2002 when the Indy Racing League became the first to install it at Indianapolis for the Indianapolis 500. Talladega Super Speedway installed the barrier on one wall in the fall of 2002 for NASCAR, and in 2003, Richmond International Raceway, New Hampshire International and Homestead-Miami speedways are installing the barrier.

Car racing is growing in popularity, and the deaths of notable drivers Dale Earnhardt, Adam Petty and Kenny Irwin Jr. give impetus to the need for safer technology. NASCAR president Mike Helton recently said the goal is to erect the SAFER barrier at several tracks by next spring.

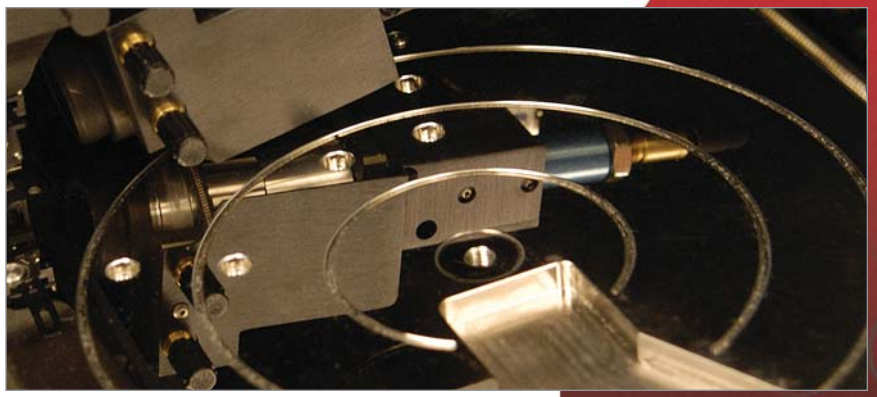
Dean Sicking

Midwest Roadside Safety Facility engineer Ronald Faller said the barrier has performed exceptionally well so far. In two years, the barriers have been struck more than 20 times without no serious injuries or fatalities.

The scientists are looking at modified versions for tighter radius speedways. UNL's Midwest Roadside Safety Facility team designs and tests roadside safety structures and equipment such as guardrails and sign posts. Team members are thought to be the top experts and engineers in the field at a top-rated facility.

The full list of R&D 100 winners are published in the September 2003 issue of *Research and Development Magazine*. In addition to Sicking and Faller, the Midwest Roadside Safety Facility development team includes John Rohde, John Reid, Jim Holloway, Karla Polivka and Bob Bielenberg.

New Leadership Positions UNL's Technology Development for Growth



With more than 10 years of professional experience, Kannan Grant is ready to ratchet the University of Nebraska-Lincoln's technology development activities to a new level. Grant joined UNL in September 2003 as associate vice chancellor for technology development.

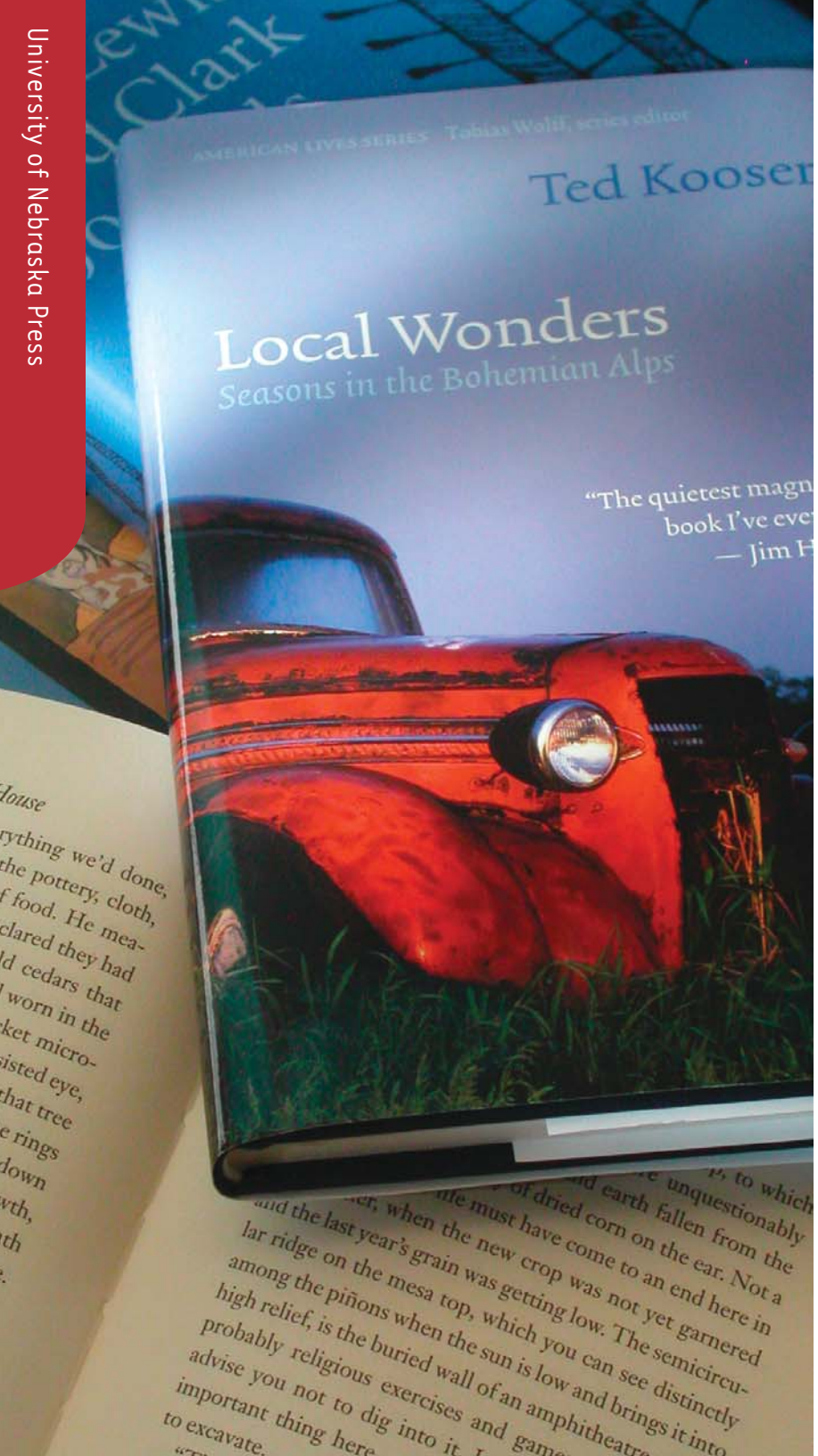
Kannan Grant

Grant has been associated with the Purdue Research Foundation at Purdue University since July 2000, and since June 2002, directed its engineering and physical sciences division. Among his duties were the management of a portfolio of more than 300 technologies and negotiation of more than 20 license agreements.

At Nebraska, Grant will oversee all activities associated with technology development, including creating a new strategic plan for commercialization of research technologies and enhancing relationships with the business community and external constituents. Grant also will work closely with the UNL Technology Development Corporation and the Technology Development Advisory Board.

Grant reports to Prem Paul, UNL's vice chancellor for research and dean of graduate studies.

Grant earned his bachelor of science in electrical engineering in 1986 from the University of North Dakota in Grand Forks. He earned a master's of business administration in telecommunications and technology management in 1993 from Texas A&M University.



University of Nebraska Press

Kooser's *Local Wonders* Wins Acclaim

Ted Kooser, University of Nebraska Press author and visiting faculty member in the UNL Department of English, won multiple honors this year for his memoir, *Local Wonders: Seasons in the Bohemian Alps*. Kooser took third place in the nonfiction category at the Barnes & Noble Discover Great New Writers Awards ceremony in March, was a finalist for *ForeWord Magazine's* Book of the Year Award in the autobiography/memoir category, and won the 2002 Literary Award of the Friends of American Writers-Chicago Association.

Press Collaborates to Create On-Line Lewis and Clark Journals

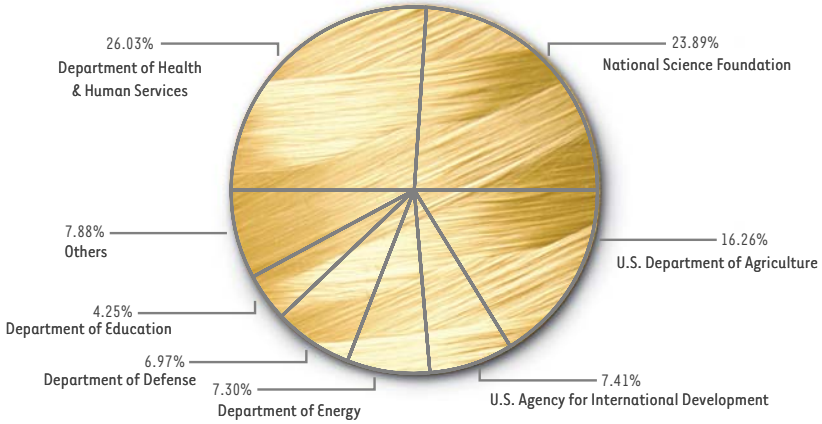
The text of the celebrated Nebraska edition of the Lewis and Clark journals, edited by Gary E. Moulton, will be available on-line through a joint project involving the NU Press, the Center for Great Plains Studies, and the UNL Libraries Electronic Text Center. The Lewis and Clark Expedition Online (http://lewisandclarkjournals.unl.edu/) makes available Moulton's edition of the journals, one of the major scholarly achievements of the late 20th century. The web site will eventually feature the 5,000 pages of the journals, a gallery of images and audio files of poet William Kloefkorn reading selected passages.

Paul Royster Directs NU Press

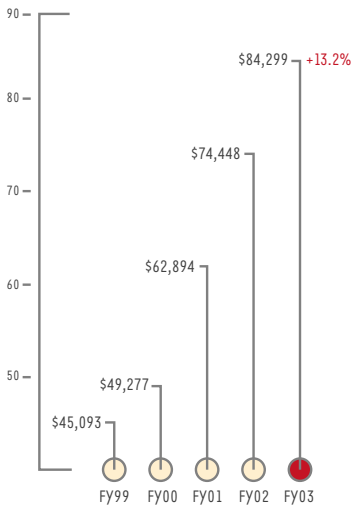
Paul Royster became director of the University of Nebraska Press Dec. 1, 2002. Royster was design and production manager for the Yale University Press in New Haven, Conn., a position he had held since 1994. Prior to joining the Yale Press, he was a project editor for Barron's Education Series Inc., and from 1987-93, was chief financial officer and director of production for the Library of America, a not-for-profit publisher in New York City. Royster earned his Ph.D. in English and comparative literature from Columbia University in 1984.

Financials: FY 2002-03

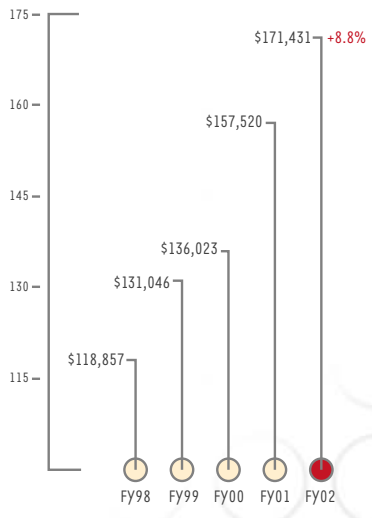
Research Funding by Federal Agency



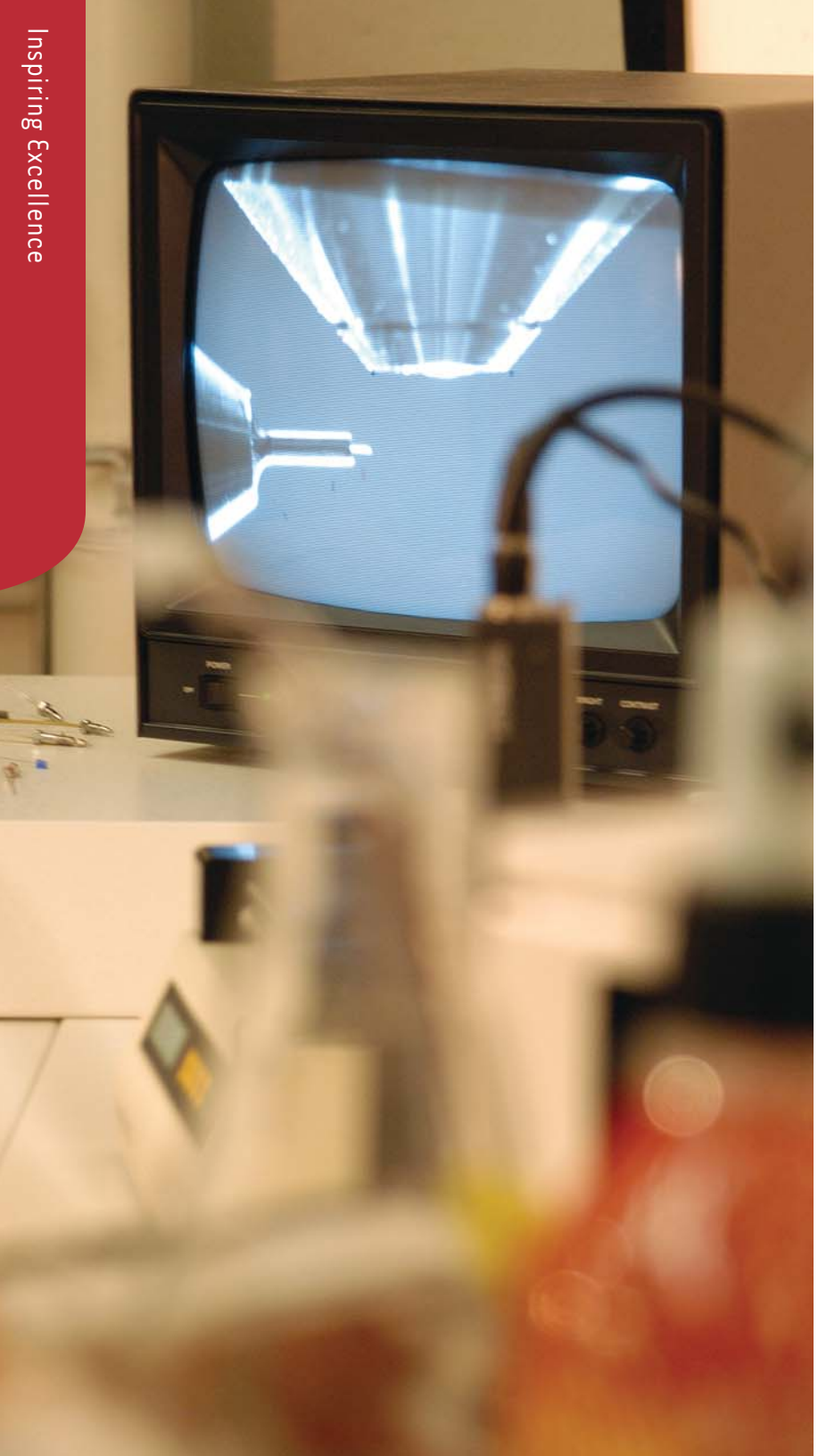
Total Research Awards



Total R&D Expenditures



(all figures in millions)

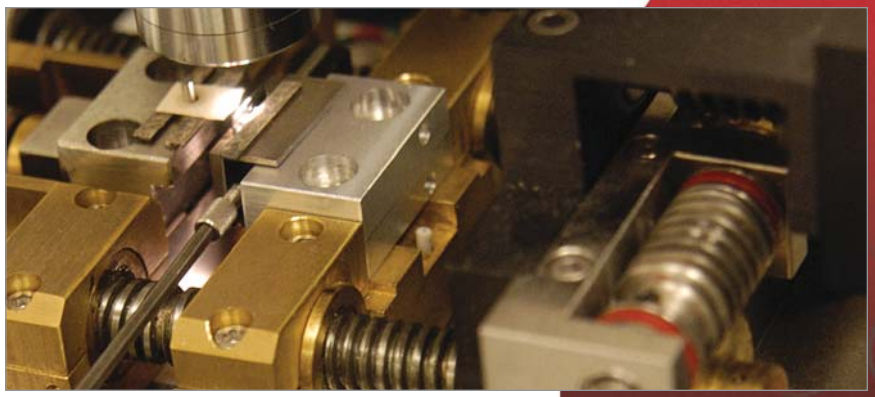


Inspiring Excellence

In 2000, the University of Nebraska Regents launched a process to identify the highest priority programs on each of the university's four campuses. The regents established Program of Excellence funding, through budget reallocation, to build strength in these priority programs. Some returns will take the form of research based on leveraged external grants. Some will benefit communities. Others are expected to benefit students through improved educational offerings.

In 2003, UNL announced its highest priority programs to be funded with the first round of Program of Excellence Funding. These programs are:

- Nanoscale Science and Technology
- Proteomics, Functional Genomics and Structural Biology
- Atomic, Molecular and Optical Physics
- Bioengineering
- Bioinformatics and Biological Modeling
- Business Leadership
- Cather Studies
- Children, Youth, Families and Schools
- Creative Writing
- Food Safety
- Math and Science Teachers for the 21st Century
- Simulation, Computing Engineering and Information Technology
- Survey Methodology and Statistics
- Nebraska Rural Initiative
- Enhancing Undergraduate Education



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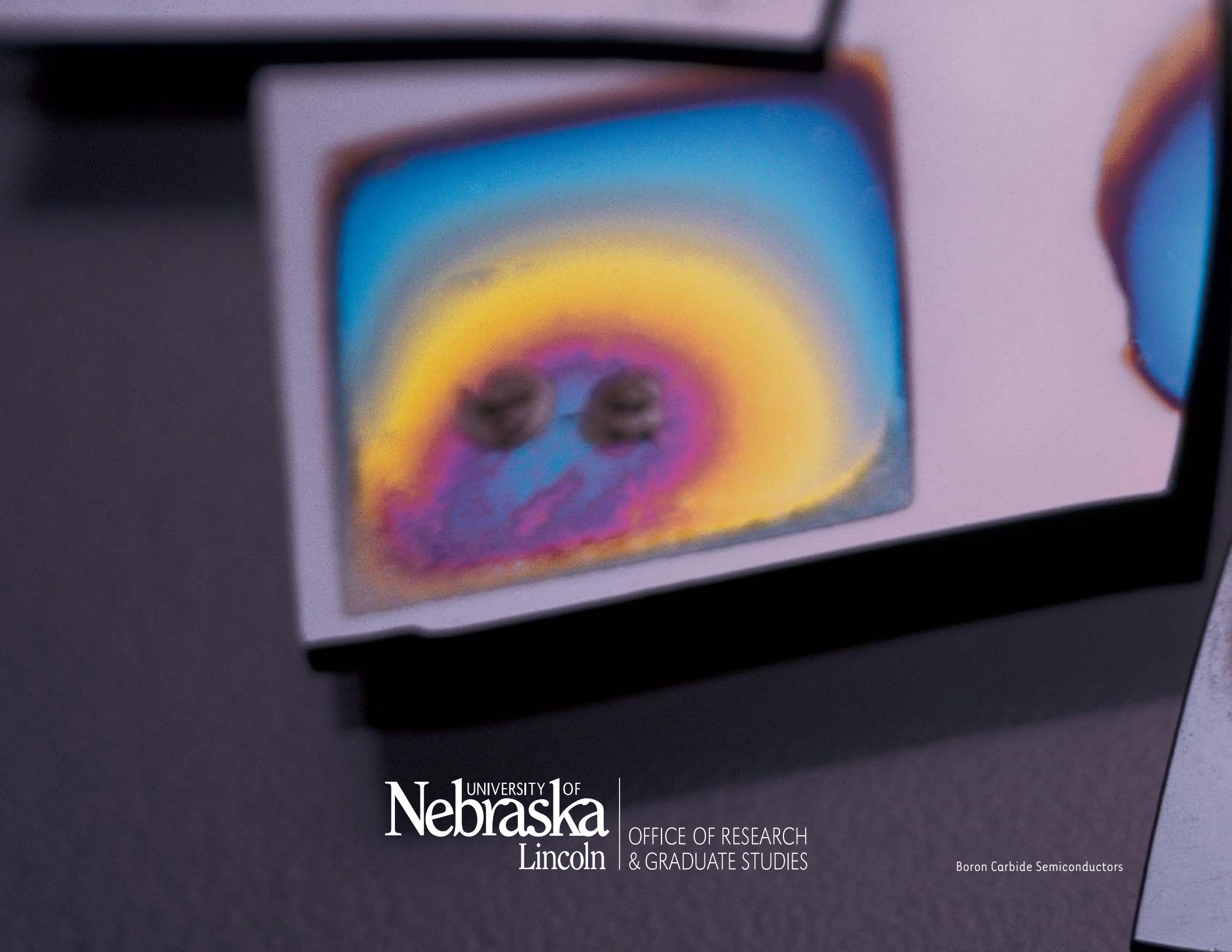

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