



ANNUAL REPORT
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Art: A depiction of HIV, the virus that causes AIDS

UNIVERSITY OF
Nebraska
Lincoln | OFFICE OF RESEARCH
& GRADUATE STUDIES

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Cover Art:

This drawing of the Human Immunodeficiency Virus was created by Angie Fox, scientific illustrator for the University of Nebraska State Museum for use in the Explore Evolution Exhibit. The drawing of HIV was illustrated under the direction of John West and Charles Wood of the Nebraska Center for Virology.

UNL RESEARCH IS ON THE MOVE



Prem Paul, vice chancellor, and Harvey Perlman, chancellor

□ For the past year I have been saying that “University of Nebraska-Lincoln research is on the move!” and our accomplishments in 2004-2005 bear this out.

This report highlights some of the projects propelling this movement, from an NIH bioengineering partnership grant to develop innovative hemophilia treatments to a Department of Defense-funded MURI project to create diamond coatings for ships to a National Science Foundation-funded project to drill in Antarctica. We have won major grants from the Department of Education to help Spanish-speaking pre-schoolers learn to read and to create new curricula for teaching biology, and one of our faculty was chosen as the U.S. Poet Laureate and won the Pulitzer Prize for poetry.

Our external funding for research has doubled since 2000, and this year hit a record high of \$98.3 million. In addition, the University of Nebraska now ranks 81st in the National Science Foundation’s survey of Research and Development Expenditures, as a result of combined reporting of our research results with our medical school, the University of Nebraska Medical Center.

But funding success is only a part of the story. The more important story is the quality and breadth of our research, the degree of collaboration, and the new knowledge, creative activity and technologies that are being generated by UNL faculty.

New talent also is propelling us forward. Our new Associate Vice Chancellor for Research, Kimberly Andrews Espy, who joined us in August of 2005, brings to UNL a strong biomedical research background and a high-energy commitment to research development. New senior faculty hires working in high intensity lasers, infrastructure risk assessment, digital history, and climate modeling strengthen our strategic research areas with their innovation and expertise.

UNL research creates new technologies with the potential to attract businesses to the state and to benefit existing businesses. UNL recently signed long-term agreements with Monsanto, for a discovery involving herbicide-resistant soybeans, and with iDiverse, a California-based company, to explore ramifications of a gene discovered and patented by a UNL scientist that may play a key role in plant cell death. Both discoveries hold promise for developing crops with higher tolerances for drought, herbicides or disease. This adds to our growing inventory of products and processes invented and licensed by the university.

This report highlights only a few of our successes during fiscal year 2005. UNL scientists are conducting research not only in Nebraska, but also in the Antarctic and Zambia, truly working in all areas from A to Z.

I think you’ll agree that research is on the move in Nebraska.

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

UNL HEADS ANTARCTIC DRILLING PROJECT



David Harwood and Richard Levy

“The past will reveal much about the future and Antarctica’s role in the global climate machine, which affects all of us.”

David Harwood

□ University of Nebraska-Lincoln geoscientists will play a leading role in U.S. research efforts in Antarctica in the upcoming International Polar Year. UNL recently won a \$12.9 million National Science Foundation grant to lead a consortium of five U.S. universities that make up the American half of the multinational ANDRILL (ANtarctic DRILLing) consortium.

In October and November of 2006 and 2007, ANDRILL scientists will use a powerful new drilling system co-owned by UNL to drill rock cores in the McMurdo Sound area of the Ross Sea. Scientists in Antarctica and around the world will study the cores meter by meter to develop a detailed history of the Antarctic climate and the ice sheet of the area over the past 20 million years.

“Drilling for a sedimentary history of climate change adjacent to the Earth’s largest ice sheet will reveal a lot about how the Antarctic region responded in the past, and may respond in the future, to climate perturbations like global warming,” said geoscientist David Harwood,

director of the ANDRILL Science Management Office at UNL. “A team of 100 international scientists will work to establish how fast, how frequent, and how large were the past changes in the Antarctic ice sheet. The past will reveal much about the future and Antarctica’s role in the global climate machine, which affects all of us.”

Antarctica is covered almost totally by ice, in some regions more than 15,000 feet thick. The ice sheet accounts for some 90 percent of the world’s freshwater, and if it were to melt would raise the level of the world’s oceans by nearly 200 feet.

No one expects a catastrophe of that magnitude to happen in the foreseeable future, but some climate models project a greenhouse warming of the Earth’s atmosphere of roughly 10 degrees Fahrenheit in this century and no one knows how the Antarctic ice sheet might respond. ANDRILL should provide some important answers.



Sediment samples from the Antarctic are housed at UNL.

VIROLOGY CENTER EXTENDS ITS REACH

“NCV scientists are making significant contributions to the study of human, animal, and plant viruses, including HIV, herpesviruses, Porcine Reproductive and Respiratory Syndrome virus and the Chlorella viruses.”

Charles Wood



John West reveals the inside detail of the Human Immunodeficiency Virus model displayed at the University of Nebraska State Museum's Explore Evolution Exhibit.

□ In the five years since its inception, the Nebraska Center for Virology has extended its reach into new frontiers of research and new areas of the globe. Established in 2000 as a National Institutes of Health Center of Biomedical Research Excellence, the NCV won a \$10.6 million, five-year renewal grant from NIH/National Center for Research Resources in 2005.

The NCV links researchers at UNL, the University of Nebraska Medical Center, and Creighton University – Nebraska's three major biomedical research institutions.

“NCV scientists are making significant contributions to the study of human, animal, and plant viruses, including HIV, herpesviruses, Porcine Reproductive and Respiratory Syndrome virus and the Chlorella viruses,” said Charles Wood, UNL molecular virologist and director of the Nebraska Center for Virology.

New scientists hired in the past five years have expanded NCV research into the study of human papilloma virus, a major cause of cervical cancer; neurodegenerative diseases, such as Alzheimer's and Parkinson's; and new arenas of HIV research, including the evolution of the highly virulent clade C virus in Africa and creation of a novel mouse model used in vaccine development.

The Center also is broadening its international work. Wood conducts extensive research programs in Zambia focusing on the transmission of HIV from mothers to their infants, the relationship between HIV and human herpesvirus 8, which is linked to cancer, and the evolution of HIV. As a part of this work, Wood has built a laboratory and clinic at the Teaching Hospital of the University of Zambia and developed close ties with scientists there. This work was the impetus for the recent memorandum of agreement between UNL and the University of Zambia to collaborate in research and teaching programs.

Training the next generation of virologists is a critical component of the NCV's mission and continues to grow: a highly successful program to train Zambian researchers for work on AIDS and HIV, funded by the Fogarty International Program, was expanded to China in 2003. And the center won a five-year \$1.3 million NIH grant for research training in comparative viral pathogenesis to recruit and train graduate students, particularly those from minority and underrepresented groups.

The NCV's educational mission extends beyond the scientific community. The work of Wood and NCV researcher John West on HIV evolution is included in the Explore Evolution exhibit at the University of Nebraska State Museum, which was funded by the National Science Foundation.

“While a lot of people with complex diseases are frustrated by the apparent slowness of the development of new therapies, it takes a lot of scientists working a long time to understand the required processes.”

William Velandar

BIOENGINEERS DEVELOPING INNOVATIVE HEMOPHILIA THERAPY

□ Hemophilia B, a congenital bleeding disorder, can be managed by use of a blood coagulation protein called Factor IX. Without this therapy, severely hemophilic patients suffer crippling injuries and chronic pain, and often die in adolescence. But only a small number of patients receive prophylactic therapy due to high costs and limited supply of Factor IX; some 80 percent of patients worldwide receive no therapy.

A bioengineering partnership, funded by a \$9.9 million, five-year grant from the National Institutes of Health/National Heart, Lung and Blood Institute, aims to develop an abundant, pure, safe and effective therapy using recombinant human coagulation proteins produced in the milk of transgenic pigs. The project is led by UNL biomedical engineer William Velandar and is based on innovative bioengineering technologies that enable improved intravenous and novel oral delivery of hemophilic factors to patients.

For 17 years Velandar pioneered efforts to produce hemophilic medicines in the milk of transgenic pigs. Since he arrived at UNL in 2004, Velandar has elevated the project from bench-scale to late preclinical animal studies using Factor IX.

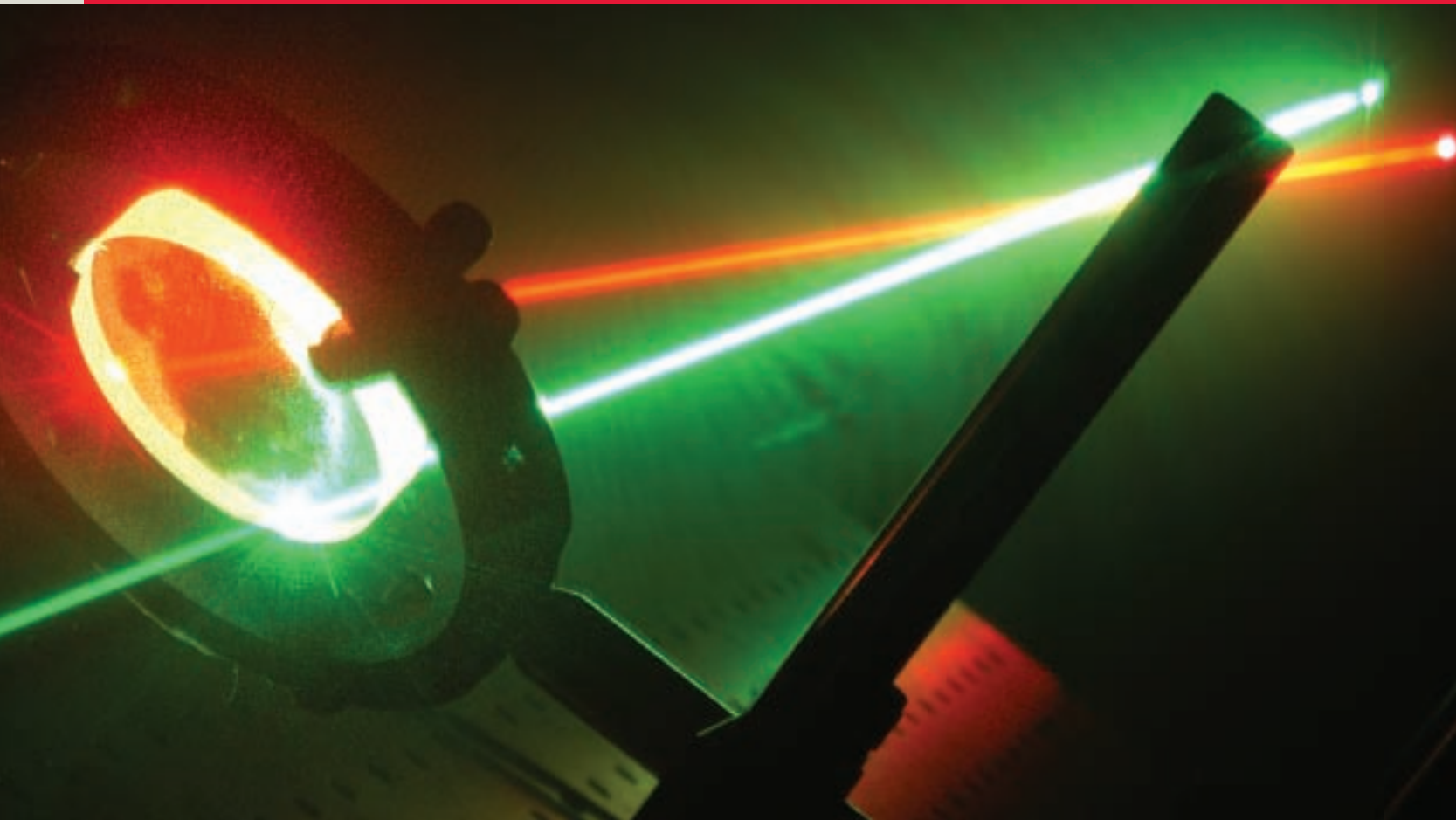
UNL scientists working with Velandar on the project include Kevin Van Cott, a professor of chemical engineering, as well as Todd Swanson and Michael Meagher of UNL’s Biological Process Development Facility. Paul Monahan and Timothy Nichols of the University of North Carolina at Chapel Hill will lead the hemophilic animal studies. Others sharing in the grant are Stephan Abramson, LifeSci Partners of California; Julian Cooper, ProGenetics LLC, of Virginia; and William Dernel and Mark Manning of Colorado State University.

“While a lot of people with complex diseases are frustrated by the apparent slowness of the development of new therapies, it takes a lot of scientists working a long time to understand the required processes,” Velandar said. “Even though the wait is long, there’s hope. There’s a glimmer of hope because we really can foresee clinical trials on this.”



William Velandar in his lab at UNL.

LASERS SHINE LIGHT ON DIAMOND FILM PROCESS



Laser light is the key to the newly developed diamond film process.

□ Layering a thin diamond coating on a ship's hull could significantly improve its ability to withstand corrosive sea water — or perhaps more dangerous weaponry. UNL engineers Yongfeng Lu and Xinwei Wang are leading a team refining a process to coat surfaces with thin diamond films. That team, which includes engineers from the University of Missouri-Rolla, received a three-year \$3 million grant from the Department of Defense Office of Naval Research. There's a possibility of an additional \$2 million in succeeding years.

The team is exploring a process developed in the mid-1990s by Michigan-based QCC, Inc. That firm used over-lapping pulsed lasers to deposit thin coatings of diamond and diamond-like carbon on surfaces. The underlying reasons for the process are unknown — the technology has preceded the science. That makes it hard to improve the process or extend it to other material systems. Lu's team will attempt to tease out the "how" of the technology.

"If we can understand the science of the phenomenon and understand the principles behind it, we can use it for other materials besides diamonds," Lu said.

"If we can understand the science of the phenomenon and understand the principles behind it, we can use it for other materials besides diamonds."

Yongfeng Lu



Xinwei Wang and Yongfeng Lu

The diamond coating increases the hardness of the surface and protects it from humidity, abrasion, corrosion or other deformations. The ability to coat surfaces — making them stronger, lighter and more resistant to corrosion or abrasion — has many applications. Military hardware is an obvious example, but surgical tools, auto bodies, airplanes or even golf clubs also could benefit.

The UNL-UMR coating technique will be customized to specific coating/substrate systems using three laser systems: a resonance absorption laser, a UV

laser, and a controlled plasma cooling and coating formation laser. The team will work to establish the knowledge of the physics behind the process and develop a way to do this in "open atmosphere" rather than a vacuum, allowing coatings to be deposited on large items like ships or airplanes. The team will test the system theoretically, using computer models, and experimentally, using the lasers.

The grant was one of 33 awarded through the DoD's Multidisciplinary University Research Initiative Program in April 2005.



Ken Bloom, Aaron Dominguez and David Swanson

UNL HOSTS CMS TIER 2 SITE

“The computing demands of this experiment are tremendous, larger than anything we have seen before in particle physics.”

Ken Bloom

□ It's a job with a data set so big that dozens of supercomputers crunching 24/7 will take years to analyze all the numbers. The international particle-physics project known as the Compact Muon Solenoid, or CMS, is an experiment for the Large Hadron Collider, the world's largest particle accelerator, at Centre Européen de Recherche Nucléaire (CERN). Physicists hope to discover new fundamental subatomic particles, and to understand the origins of mass. And UNL has a major piece of the computing action.

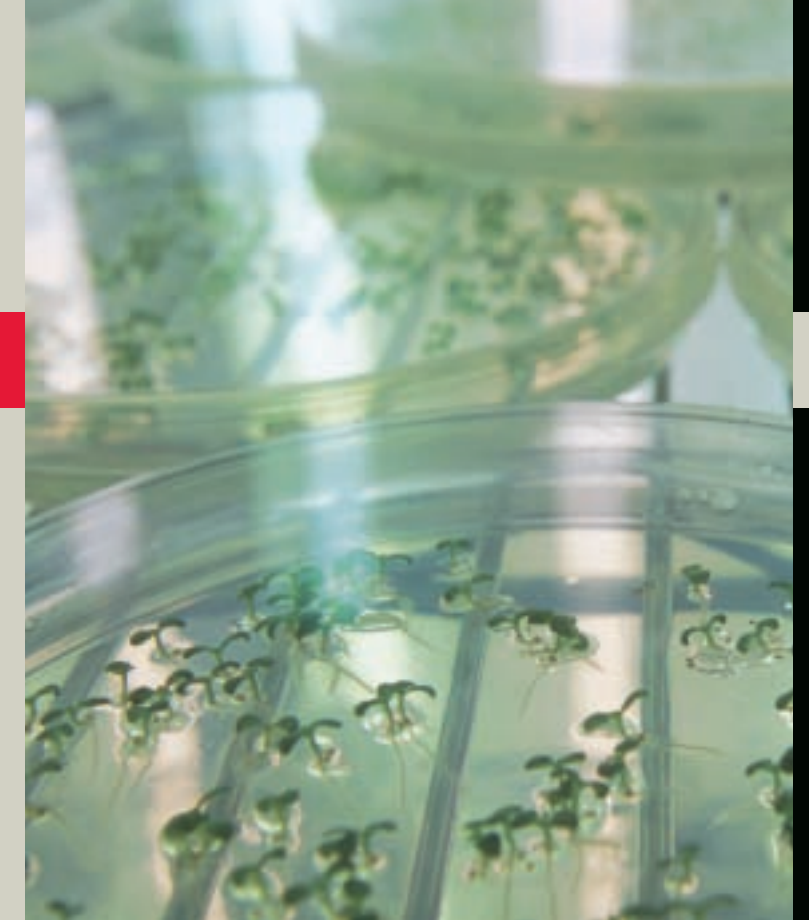
The data collected at CERN near Geneva, Switzerland, will be parceled to computing facilities around the world in a hierarchical grid. Tier 0 is at CERN; several international labs serve as Tier-1 sites. Fermilab, a Department of Energy facility in Illinois, is the United States' Tier 1 site; it will distribute data subsets to seven associated American Tier-2 sites, including UNL.

UNL's Research Computing Facility received a \$2 million, five-year grant from the National Science Foundation for the project. David Swanson, director of the Research Computing Facility and a research assistant professor in the Department of Computer Science and Engineering, is lead investigator for the grant, in close collaboration with Ken Bloom, Aaron Dominguez, and other faculty from the Department of Physics and Astronomy.

Other Tier-2 sites are at the California Institute of Technology, the University of California-San Diego, the University of Florida, the Massachusetts Institute of Technology, the University of Wisconsin-Madison, and Purdue University. Bloom is project manager for the entire Tier-2 project.

“The computing demands of this experiment are tremendous, larger than anything we have seen before in particle physics,” Bloom said. “Because the new physics processes we are looking for are so rare, we must record huge amounts of data, and we need large disk servers for storage. Then we must sift through the data for the rare processes, requiring a large amount of processing power.

“It makes us an important center for data analysis on CMS,” Bloom said. “It really puts us in the forefront in research into distributed computing, which is the use of computers that are spread around the world. We will be among the first to have access to the data and make discoveries about the fundamental measure of space and time.”



FINDING THE KEY TO PLANT STERILITY

□ A grant from the National Science Foundation funds a three-year study headed by plant geneticist Sally Mackenzie to investigate the role of recombination processes in plant mitochondrial genome maintenance and transmission.

Mitochondrial recombination activity is key to the natural development of a class of mutations that influence plant reproduction. The grant continues Mackenzie's work in studying changes in cells' mitochondrial DNA that cause sterility mutations in male plants. Mackenzie and her team have recreated the mutation in the lab using the plant *Arabidopsis*. Because all plants carry this gene, further studies may develop ways to induce male plant sterility. The agricultural seed industry is interested because male plant sterility improves the economics of producing hybrid seeds. The demand is growing as the industry looks for ways to prevent pollen dispersal from transgenic crops under development.



“To not be prepared for drought, when it occurs one out of every three, five or eight years, is idiocy.”

Don Wilhite



DROUGHT — PREPARING FOR THE INEVITABLE

□ Don Wilhite has preached the need for drought preparedness for more than decade — long before the recent droughts gripping the Midwest, parts of the Great Plains and desert Southwest.

“I’ve been up on this soap box talking to the government about how drought is part of our natural climate and how they aren’t doing anything about it,” said Wilhite, director of UNL’s National Drought Mitigation Center. “To not be prepared for drought, when it occurs one out of every three, five or eight years, is idiocy.”

Drought is the most complex of all natural hazards, and its impact in the United States alone is estimated to be between \$6 billion and \$8 billion annually, affecting the agriculture, transportation, recreation and tourism, forestry, and energy sectors and having significant social and environmental impacts. But society can reduce its vulnerability through preparedness, Wilhite said.

The Center, formed in 1995 with U.S. Department of Agriculture and National Oceanic and Atmospheric Administration funds, has become the world leader in drought preparedness. Wilhite and the center’s nine staffers are working with South Korea, China, Iran, Egypt, Morocco, Canada, Pakistan, Jordan and

Australia to develop drought mitigation centers and strategies for those countries.

Wilhite believes the weekly publication of the National Drought Monitor, a map that offers easy reference to current national drought conditions, has increased the center’s visibility. It runs in many newspapers and is frequently used by USDA.

“It has been a great public relations tool that has helped people understand drought and how severe it is,” Wilhite said.

The Center is collaborating with NASA and USDA to improve the drought monitor, using satellite images to create a national soil moisture network and applying remote sensing technology to detect vegetation stress. But the Center’s overall goal is to create an early detection and warning system, and to institute mitigation measures and reduce overall damage.

“We need to get people to understand that you can’t keep responding to natural disasters, including drought, in a post-impact setting,” Wilhite said. “Because dealing with impacts is much more expensive than taking a preventive approach.”

WATER INITIATIVE POURS BEST MINDS INTO TOUGH ISSUES

□ Water is the lifeblood of Nebraska. “Nebraska is second in the United States in the number of irrigated farmland acres, 10th in stream miles and 16th in wetland acres,” said Kyle Hoagland, director of UNL’s Water Center. And, most critical to the state and the nation, 65 percent of the largest underground body of water in the western hemisphere, the Ogallala Aquifer, lies beneath Nebraska.

Given these vast resources and their importance, water research is a priority at UNL. The Water Resources Research Initiative was established in 2003 to enable increased interdisciplinary research and pursuit of large projects for UNL faculty with water-related interests. The Initiative made a major commitment to the hiring of six new faculty members this year.

“The disciplines these faculty represent are integrative by nature, addressing ecosystem or larger scale water resource issues, new areas of inquiry and interfaces such as water-land-atmosphere and the human dimensions of water resources management,” Hoagland said.

The new faculty are:

Erkan Istanbuluoglu, surface hydrology, modeling and geomorphology;

John D. Lenters, climate modeling and surface water hydrology;

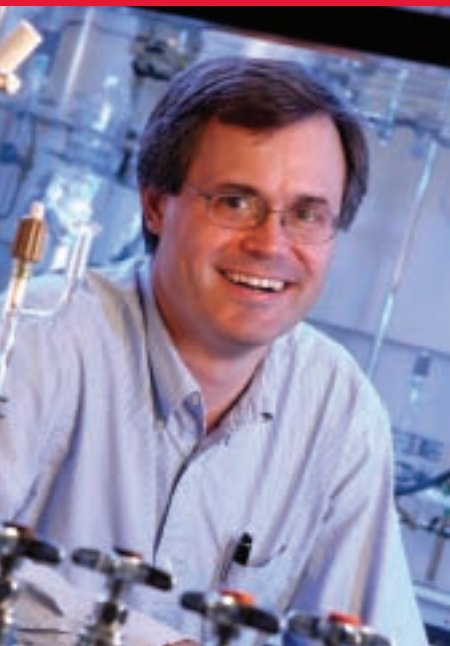
Robert J. Oglesby, climate modeling;

Karina Schoengold, water resource economics;

Durelle T. (“Scotty”) Scott, aquatic chemistry; and

Steven A. Thomas, river ecology.

HYDROGEN-ENERGY STUDIES COULD RELIEVE OIL DEPENDENCY



Steve DiMagno

“The main aim of our work is to attempt to address the hydrogen storage problem.”

Steve DiMagno

□ Steve DiMagno says that for once, his “science is right on time.” A chemist, DiMagno is interested in how to convert hydrogen from renewable plant sources — a process that’s becoming more intriguing as the race for energy heats up.

It’s that heating up that poses a problem, he notes. Aside from nuclear power, all energy used on Earth comes from the sun. Sunlight fuels photosynthesis in plants, which store solar energy by transforming carbon dioxide and water into carbohydrates and other reduced forms of carbon. Fossil fuels are the products of plants that captured sunlight long ago. “Basically, we’re mining the sunlight of yesteryear and releasing the carbon dioxide in fossil carbon,” DiMagno said.

But increases in carbon dioxide are heating the planet and there is a finite amount of recoverable fossil carbon, tightening supplies as world demand increases.

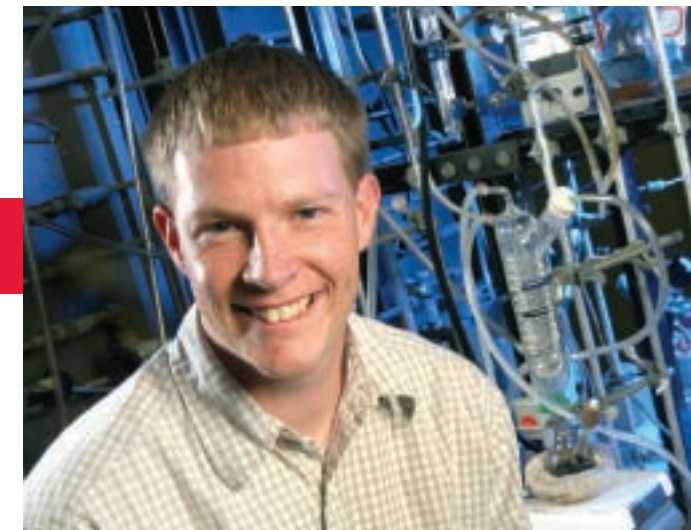
In a project funded by the Office of Naval Research, DiMagno and his team are using new catalysts to strip hydrogen from alternative fuels — particularly plant-based alcohols and acids. The work is well-suited to Nebraska, where a growing ethanol industry could provide the raw material for this hydrogen evolution process, DiMagno said.

Two advantages of this approach, often called “biomass reforming,” are that the carbon dioxide comes from a renewable source, and that hydrogen fuel cell technology is well developed.

“But the main aim of our work is to attempt to address the hydrogen storage problem,” he said.

Hydrogen has problems as a fuel source. In a hydrogen-powered vehicle the hydrogen must be stored under tremendous pressure or as a super-cold liquid. Both of these options are hazardous, particularly in a crash. A process that produces hydrogen from plant-derived liquids might solve the storage problem. As a bonus, the existing infrastructure for the gasoline economy could be readily adapted to this technology.

DiMagno and colleagues David Berkowitz and James Takacs are exploring different approaches to evaluating and assembling the chemical catalysts that will provide a steady stream of hydrogen. “Can we find a catalyst that allows a rate that’s fast enough to be useful for the application?” DiMagno said. “That’s the challenge.”



Andrew Nelson

FELLOWSHIP FUNDS HYDROGEN RESEARCH

□ Andrew Nelson, who studied with Steve DiMagno before earning his Ph.D. at UNL in December 2004, received a prestigious Petroleum Research Fund Alternative Energy Postdoctoral Fellowship from the American Chemical Society. The fellowship, worth \$100,000, is funding his work at Northwestern University. Only about a half-dozen of these fellowships are awarded annually.

Nelson is interested in solving the hydrogen storage problem. His work is focusing on developing carbon frameworks that absorb and release hydrogen at low pressure.

Nelson also received the Lowe R. & Mavis M. Folsom Distinguished Doctoral Dissertation Award from UNL.



Creating hydrogen from renewable plant sources shows promise in the lab.

WORKING TO SAVE LIVES ON THE BATTLEFIELD



David Allen

□ It's all about saving lives on the battlefield and UNL is on the frontlines of research that could prevent serious injuries, lower fatality rates and create better leaders.

Safer armor and tanks — “One way to predict the response of tank armor to ballistics is to create different thicknesses using different materials, then shoot projectiles at the armor to see what happens,” said David Allen, dean of the College of Engineering and Technology. But the cost is prohibitive.

Allen has a better way: design mathematical models that can predict the response of armor to ballistics and underground mines. The materials that perform the best in these hypothetical blasts can be used to build lightweight, stronger body armor and tanks to keep troops safer, and that will not bog down in desert sand.

Allen's team is working closely with researchers at the U.S. Army Research Laboratory on the blast mitigation project.

Stemming blood loss — Regardless of the armor troops carry on their vehicles or persons, in war there are always casualties. Fully 50 percent of all battle

fatalities are caused by loss of blood. So William Velandar, chair and professor of chemical engineering, developed bandages made from recombinant fibrinogen — a genetically modified blood protein.

“With combat wounds and other kinds of catastrophic injuries, the body can't mobilize enough fibrinogen and other clotting components to stop the bleeding,” Velandar said. Fibrinogen bandages rapidly stop the bleeding and promote clotting, keeping the wounded alive until medical attention is received.

But fibrinogen derived from human plasma is scarce and expensive, preventing commercial development of the bandage. Velandar solved this problem by helping to invent a process for producing an inexpensive and abundant supply using the milk of transgenic cows. This opens the possibility for an affordable bandage for battlefield use, and far fewer fatalities on the field.

Enhancing leadership — Bruce Avolio, a professor in the College of Business Administration, believes that leaders are the key to saving lives in battle. He and his team are working to create “transformational leaders,” who are ethical, inspiring, intellectually challenging and considerate.

“These leaders create a psychological climate in which followers feel safe to voice opinions, challenge what is being done and look out for each other,” Avolio said.

Avolio co-authored the Multi-factor Leadership Questionnaire, shown to predict highly effective leadership in organizations, including the military. “We have shown in other research that such leadership is probably only 30 percent genetics. The rest is how one is ‘made.’” The MLQ highlights people with leadership aptitude, then the military develops those skills to train leaders who are more self-aware and in tune with troops' needs.

These troops and leaders perform better and smarter in a battle situation, Avolio said, producing fewer casualties and fewer lives lost.



Tom Marley and Judy Walker

MENTORING MATHEMATICIANS TO SUCCESSFUL CAREERS

□ Students who earn bachelor's degrees from research institutions seem to have a leg up in graduate

school. A \$2.5 million, five-year National Science Foundation grant to UNL's Department of Mathematics, “Mentoring through Critical Transition Points,” funds mentoring programs for mathematicians entering graduate school, those making the move from graduate school to an academic position, and early-career faculty.

The core of the program, led by UNL mathematicians Judy Walker and Tom Marley, is Intensive Mathematics: a Mentoring, Education and Research Summer Experience. The program aims to strengthen the preparation of students entering their first year of graduate study, and to develop the teaching, research, and mentoring skills of graduate students and early-career faculty.

“We found by experience that (undergraduates) who came from schools that had a graduate program were

better prepared when they came into our graduate program,” said Marley. “They had taken part in research seminars and maybe took a graduate class. Those who didn't seemed to start out a little behind.”

Sixteen students entering graduate school in the fall will take two intensive, six-week summer courses led by UNL faculty and structured around the study of research papers typically pursued in graduate school.

Early-career faculty participants will be teamed with UNL faculty research mentors and collaborate on a research project that will carry over into the academic year via email and research visits.

Other programs include assisting math majors in developing portfolios for graduate school and helping doctoral students concentrate on career advancement issues. The grant also supports a regional math and science workshop, a conference for undergraduate women in mathematics, and a summer workshop for recent Ph.D.s interested in intensive research collaborations.

“An important part of my research is protecting the food chain from bio-security threats.”

Harshavardhan Thippareddi

BIOMEDICAL STUDIES EXPLORE NUTRITION-HEALTH CONNECTION



Harshavardhan Thippareddi

From developing innovative natural products to cut cholesterol to research on a nicotine vaccine, UNL researchers are pioneering new frontiers in human health and nutrition.

Cholesterol buster

Nutrition scientist Tim Carr has discovered a way to meld two Nebraska products — beef tallow and soybeans — into one cholesterol-busting compound.

Scientists have known the cholesterol cutting-ability of plant sterols found in soybeans for decades, but sterols don't dissolve in water and are not easily absorbed by the body. Carr discovered that stearic acid — a “good” saturated fat found in beef tallow — also lowers cholesterol.

Carr combined soybean sterol and stearic acid to form a compound that in hamster-feeding trials lowered “bad” cholesterol by 70 percent, while a commercial sterol additive produced a 10 percent decline. Carr's compound — which can easily be made into a powder and added to foods — could become an alternative to the statin drugs now taken by millions of Americans.

While tests continue, Carr is exploring commercialization of the compound, which is being patented by UNL.

Nicotine vaccine

Psychologist Rick Bevins is studying nicotine addiction and a potential nicotine vaccine. In studies on rats, Bevins found that nicotine's effects are different than other drugs, making the habit more difficult to kick.

“When we talk to addicts, we find they have profound cravings and of those who try to quit, 95 percent fail,” Bevins said.

Bevins is teaming with University of Nebraska Medical Center scientist Sam Sanderson to create a nicotine vaccine. In rats, the vaccine induces the immune system to generate antibodies specific to nicotine. The antibodies prevent nicotine's access to brain receptor sites. Rats immunized with the vaccine show marked reduction in nicotine addiction behaviors.

The broad goal, Sanderson said, is to develop a human vaccine as a smoking cessation aid.

Histone and cell aging

In one of the most competitive fields of DNA research, nutrition scientist Janos Zemleni is using vitamins to help the body repair itself at the cellular level.

Zemleni and his team add biotin to specific histones — proteins that play a role in gene regulation — allowing the DNA strands to better repair damage. The team has developed technology that identifies histones receptive to biotin. That technology has been licensed by UNL and has implications for cancer therapies and slowing cell aging.

Safer foods

Food scientist Harshavardhan Thippareddi works with Nebraska's meat and poultry industries to reduce the chance for biological or chemical hazards to be introduced into food lines.

Thippareddi focuses on developing better methods to detect microbial pathogens in processed foods. One of his major pushes is to help the industry



Creating safer, more healthful foods is part UNL's nutrition and health focus.

better control listeria — a contaminant of processed meats — through an additive that reduced the bacteria's ability to reproduce.

Thippareddi has landed more than \$2.9 million in grants in the past two years and is establishing an international collaborative food safety research program that works closely with the food industry. “An important part of my research is protecting the food chain from bio-security threats,” he said.

NEXT GENERATION TRANSPORTATION, SURFACES AND STRUCTURES



Michael Reischman, deputy assistant director of NSF's Directorate for Engineering, tours the National Bridge Research Organization lab with its director, Atorod Azizinamini

□ Engineers at UNL are developing the next generation of transportation surfaces and structures. Their ultimate goals: make monitoring networks more efficient and build less expensive and safer roads and bridges.

About a third of the nation's 650,000 bridges are considered deficient. The National Bridge Research Organization (NaBRO) — established at UNL in 1998 — is bringing academia, government agencies and design professionals together to forge better designs.

"Our job is to develop the next generation of bridges so they are stronger, longer lasting and cost effective," said Atorod Azizinamini, civil engineer and NaBRO director.

Working with the Nebraska Department of Roads, NaBRO has erected three next-generation bridges in Nebraska. One, located in Grand Island, uses an inverted box girder design that provides a safer, more stable construction platform and allows for easy transportation. NaBRO also has a growing international role. A deal with South Korea-based Posco — the fifth largest steel manufacturer in the world — includes UNL researchers in a five-year program to revamp bridges in Korea.

Structural Reliability

Civil engineer Andy Nowak's expertise is the reliability of structures, particularly bridges and buildings. Using

computer models, Nowak hopes to develop a hazard mitigation plan that simulates the effects of natural disasters, collisions and even terrorist attacks on roadway structures and buildings.

Nowak has developed a new set of safety standards for overbuilding roadways and buildings based on technological improvements in materials. Computerized mixtures and other technologies have improved concrete consistency and increased strength and overall quality.

"Knowing this, we can change the rules for load bearing and overbuilding of bridges," Nowak said. "With stronger materials, we can use less material, resulting in less expense."

Intelligent Transportation Systems

At the Mid-American Transportation Center, Larry Rilett is guiding an effort toward better transportation operations and design.

Rilett directs the center, whose researchers based at UNL's Lincoln campus and the Peter Kiewit Institute in Omaha develop Intelligent Transportation Systems that use communication and computer technology to make transportation safer and more efficient.

The center's virtual ITS laboratory includes a sophisticated data collection van and trailers that allow research to be conducted anywhere in Nebraska.

"We are developing ITS testbeds in Lincoln, Omaha and central Nebraska," Rilett said. "The results will be of use to Nebraska and the nation as a whole."



Dwight Mosby

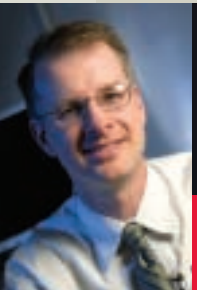
SLOAN SCHOLAR IMPROVES RAILWAY SAFETY

□ A former NASA specialist who trained astronauts to conduct research on the space shuttle and international space station, Dwight Mosby is pursuing a more "down to earth" research project as UNL's first Sloan Scholar.

Mosby, working with civil engineer Aemal Khattak on a project funded by the Nebraska Department of Roads, is looking to improve safety at railway crossings. He is developing a warning system that would let drivers know of upcoming trains, enabling them to take alternative routes. He also is designing a barrier that would discourage u-turns.

A civil engineering doctoral student, Mosby received a \$30,000 award from the Alfred P. Sloan Minority Ph.D. Program, which aims to prepare men and women from historically underrepresented groups for leadership in engineering, technology, math and science disciplines.

Before joining UNL Mosby worked with NASA and the Italian space agency, where he helped develop research projects and train astronauts, including the Columbia crew lost in 2003.



BIOMEDICAL RESEARCH IMPROVES TOOLS FOR CURES



Shane Farritor (above left). Surgical robots will link surgeons to injured patients in the field.

The Intuitool allows doctors to perform minimally invasive surgery with less stress on themselves and the patient.

Susan Hallbeck

□ Through a small incision, a paramedic inserts a three-inch long robot into the abdomen of a victim at the scene of an accident. Miles away in a hospital, a human surgeon takes control of the robot and stabilizes the patient.

During laparoscopic surgery, a doctor smiles as her thumb manipulates the Intuitool, quickly finishing her work. In previous surgeries, awkward tools caused stress on her hands, arms and shoulders, forcing the need for rest and lengthening the surgery.

Sitting in the oncologist's office, a patient hears the good news — remission. She leaves without knowing that drug-carrying nanoparticles helped defeat her breast cancer.

Through biomedical research conducted jointly at UNL and the University of Nebraska Medical Center all three of these fictional scenarios are on a path to reality.

Surgical robots

In his mechanical engineering lab at UNL, Shane Farritor maneuvers one of three newly developed surgical robots, showcasing how the three-inch by five-eighths inch aluminum robot can maneuver inside an abdomen.

"That is two years of hard labor," Farritor said. "You don't know how slick, hilly and soft it is in there. But we've developed a wheel design that allows for the necessary mobility."

His lab has also created two stationary robots for internal surgery. The first holds a camera that can tilt, relaying internal images through a small incision. The second is a tiny box that monitors internal body conditions relaying information on temperature, pressure and humidity to surgeons.

The three robots have been developed with the assistance of UNMC surgeon Dmitry Oleynikov.

Improved laparoscopic tool

Also working with Oleynikov, industrial engineer Susan Hallbeck developed the Intuitool. The tool's handle uses a roller-ball to guide distal pincers or cutters, rather than the scissors-like handles currently in use.

The Intuitool allows doctors to perform minimally invasive surgery with less stress on themselves and the patient.

"Current tools are essentially regular surgical tools on a long stick," Hallbeck said. "Essentially, the Intuitool gives you a wrist on the tool."

Patented and trademarked by UNL, the tool has been licensed to the Minneapolis-based Gyrus Medical to develop, manufacture and market and could be available as soon as 2006.

Nanoparticles as drug vectors

In the battle against cancer, a group headed by UNL's Diandra Leslie-Pelecky and UNMC's Vinod Labhassetwar has developed iron oxide nanoparticles that enable sustained delivery of anticancer agents for breast and prostate cancers.



Susan Hallbeck demonstrates the Intuitool.

Although many magnetic nanoparticles are being developed as drug carriers, the Nebraska group's formulation allows magnetically targeted delivery of multiple anti-cancer drugs that can be released over a period of weeks.

Magnetic targeting preferentially directs the anti-cancer drugs to tumors, minimizing damage to normal, healthy cells. Use of multiple drugs may allow lower-dose treatments. And the nanoparticles also may be used as magnetic resonance imaging agents to confirm delivery of the drugs.

All three new technologies are awaiting FDA approval.

Ten percent of children entering first grade have moderate to severe speech disorders.

Jordan Green

CAMERAS, COMPUTERS AND THE MYSTERY OF HUMAN SPEECH



A close-up screen reveals the voice pattern analysis in real-time.

□ Adapting computer technology developed by Hollywood, a UNL speech scientist is hoping to learn how very young children's motor development affects their speech and language.

Jordan Green is using a \$1.8 million grant from the National Institutes of Health/National Institute on Deafness and Other Communication Disorders for a five-year study conducted at a specially equipped laboratory in the Institute for Rehabilitation Science and Engineering at Madonna Rehabilitation Hospital in Lincoln.

Ten percent of children entering first grade have moderate to severe speech disorders. Little is known about how children's motor development affects the acquisition of sound, Green said.

By using a sophisticated system of eight cameras wired to a computer, Green will be able to watch and analyze the complexity of human speech development.

"Human speech is very fast – up to 15 sounds per second – and we are coordinating up to 70 muscles while we are talking – and most of these muscles are very small," Green said. It's been impossible to capture and analyze speech movements from very young children until recently because the movements are too small and too fast to be analyzed by simple visual observation.

The new technique involves sticking small reflective dots on a subject's face; cameras fixate on individual dots and transmit the subject's movements to a computer. The computer creates a real time, three-dimensional representation of the movements, which can be studied in fine detail.

"It's essentially how (the film industry) created Gollum in 'Lord of the Rings,'" Green said.

The goal is to understand how various factors affect speech development in young children, particularly the impact of facial growth and parental speech habits.

Green said the work will be the foundation for future studies. Knowing what is typical, he said, can help identify children at-risk for speech-motor impairments and can eventually lead to new treatments for speech impairments.

Green's research takes advantage of an on-going partnership between UNL and the Madonna Institute. That partnership, established in 2000, blends the institutions' strengths to maximize the ability to compete for large research grants. This is the largest grant generated by the partnership to date.



Jordan Green operates a sophisticated system of eight cameras to track and analyze the complexity of human speech development.

'PORTALS TO READING' OPENS DOORS TO LEARNING



Ron Nelson teaching pre-reading skills.

□ Once a child falls behind in learning to read, she can spend the rest of her life struggling to learn. A new program developed by UNL education researchers and educators from aims to give every child a good start by teaching essential early reading skills.

"Often preschools don't emphasize early literacy instruction, so kids go to kindergarten unprepared for learning to read and they are already falling behind," said Ron Nelson, co-director of UNL's Center for

At-Risk Children's Services. "Our program focuses on those important pre-reading skills and follow-up to make sure the kids are prepared."

A \$2.6 million grant from the U.S. Department of Education Early Reading First program funds the project, called "Portales a Aprender Leer" (Portals to Reading), in five South Sioux City preschools serving predominantly Spanish-speaking children and their families. The project is a partnership between UNL and the South Sioux City Community Schools. Nelson and Michael Epstein, his co-director at the Center for At-Risk Children's Services, a research center in UNL's College of Education and Human Sciences, lead the project. Jorge Gonzalez, formerly a post-doctoral researcher in the Center and now at Texas A&M University, helped develop the program and will aid in its implementation.

The three-level program offers teachers new methods to develop early reading skills. The first level is a core preschool curriculum, developing cognitive, social and literacy skills. The second and third levels involve interventions to help children who aren't making sufficient progress.

"We have well-defined benchmarks that help us identify kids who are falling behind," Nelson said.

A comprehensive evaluation of the program's effectiveness is a critical part of the grant, Nelson said. "Our project is one of several model demonstration sites throughout the country, and the Center for At-Risk Children's Services will serve as the lead evaluator for the other sites," he said.



Todd Glover and Susan Sheridan

CONNECTING RESEARCH WITH TEACHERS AND KIDS

□ **Fad or Effective? Testing Interventions** — "Education is full of fads that have been picked up and abandoned with no empirical evidence," said Sue Sheridan, UNL educational psychologist. "We want to look systematically and carefully at whether these interventions work."

Funded by a \$1.5 million grant from the U.S. Department of Education Institute of Education Sciences, Sue Sheridan and Todd Glover are leading a team that will assess an educational service model called "conjoint behavioral consultation." CBC uses structured, collaborative problem-solving techniques where teachers and parents work together to identify, address and evaluate shared concerns about a child.

Parents and teachers like the model and field studies seem to support it, Sheridan said. Yet while the CBC model has been used nationally for 15 years, this will be the first large scale experimental study conducted to see if it has the intended positive effects on children, parents and teachers.



Sheridan, Glover and their team from UNL's Center for Research on Children, Youth, Families and Schools will work in partnership with several schools, 270 students and their parents over three years. The overall goal is to improve the chances for at-risk children to succeed in school.

Inspiring Inquiry — Fewer and fewer American students are pursuing careers in science. One problem is the struggle to engage younger students in science, a challenge tackled by UNL educational researchers.

"We think alternative ways of learning science by doing will make it possible for kids to love science," said Beth Doll, lead investigator on the Inspiring Inquiry project, recently funded with a \$1.26 million grant from the U.S. Department of Education Institute for Education Sciences. "We are reacting to studies that show that kids learn a lot of facts but not a lot of process," she added. Co-investigators are Roger Bruning, Ron Bonnstetter and Christy Horn.

For the project, middle school teachers will use inquiry methods to develop a biology curriculum and test it during a two-week summer field experience for middle school students and in their own classrooms in the fall. Some 72 rural school district teachers will participate and more than 3,000 students will benefit from what the teachers learn. Teachers will continue to collaborate throughout the year using distance-learning technologies.

"This helps bridge the divide between research and practice," Bruning said. "The teachers will carry out the actual research."

U.S. POET LAUREATE

□ “Is this a good time for poetry?” the questioner asked Ted Kooser at a poetry reading in the dead of winter. “It’s a good time for this poet,” Kooser responded.

Indeed. In August 2004, Kooser, a long-time visiting professor of English at UNL, learned he had been nominated as 13th Poet Laureate Consultant in Poetry to the Library of Congress. The nomination caught him off-guard and quite by surprise. He began the eight-month appointment in October, 2004 at ceremonies in Washington, D.C.

In April 2005 came another surprise: Kooser’s most recent collection of poetry, “Delights and Shadows,” had won a Pulitzer Prize. At the time, he had just learned he was to be appointed to a second eight-month term as Poet Laureate.

Not bad for a retired insurance executive from tiny Garland, Neb.

Kooser is the first Great Plains poet named Poet Laureate. Called a “poetic voice for rural America” Kooser’s poetry is anything but stereotypical “Hee-Haw and corn pone.” His work is sophisticated, spare, descriptive, accessible and universal. It speaks of time and place – 21st century Nebraska – but also has a timeless quality.

“One thing that poets commonly do for us is give us fresh ways of looking at the world,” Kooser said. He’s not really interested in writing for academic peers. He writes for folks in the Garland coffee shop, for his former



Ted Kooser, U.S. Poet Laureate and Pulitzer-Prize Winner

secretary, for anyone interested in a laser-focused slice of life captured in words. Often after he ends a poem at a reading, the entire audience emits a quiet sigh of recognition.

In addition to “Delights & Shadows,” Kooser has written 10 collections of poetry and prose, including “Local Wonders, Seasons in the Bohemian Alps” (2002) and “The Poetry Home Repair Manual” (2005), both published by the University of Nebraska Press. Kooser grew up in Ames, Iowa, and earned his bachelor’s degree at Iowa State University in 1962. He taught

“One thing that poets commonly do for us is give us fresh ways of looking at the world.”

Ted Kooser

CALLS NEBRASKA HOME

school for one year before moving to Nebraska to pursue his master’s degree at UNL, which he received in 1968. He has lived all of his life in Nebraska and Iowa.

Among Kooser’s other awards and honors are two National Endowment for the Arts fellowships, the Pushcart Prize, the Stanley Kunitz Prize, the James Boatwright Prize and a Merit Award from the Nebraska Arts Council.

Kooser teaches poetry and nonfiction writing at UNL and is on the faculty of the Nebraska Summer Writers’ Conference. Since his appointment as the U.S. Poet Laureate, he has traveled extensively to readings and literary conferences, while attending to his office in Washington, D.C.

In the spring, he unveiled the “American Life in Poetry” public service project. In collaboration with the Poetry Foundation and the Library of Congress, the initiative offers a free weekly newspaper column called “American Life in Poetry” to any paper. Each column features a poem by a contemporary American poet and a brief introduction by Kooser.

In May, University of Nebraska President James B. Milliken named Kooser the first recipient of the University of Nebraska Presidential Professorship. As Presidential Professor, Kooser will serve for one year, visiting Nebraska communities and University of Nebraska campuses to lecture, participate in discussions, read poetry and participate in the life of the entire university and state.



John Struloeff, 2005 Wallace Stegner Fellow

STRULOEFF IS UNL’S FIRST STEGNER FELLOW

□ John Struloeff, a 2005 Ph.D. in English, was selected as a 2005 Wallace Stegner Fellow by Stanford University. He was one of 10 named from a pool of 1,400 candidates. The fellowship, for a two-year working artist program of study at Stanford, includes tuition and a \$35,000 stipend. Struloeff plans to finish a collection of poems and work toward improving his craft. He is the first UNL student to win the prestigious fellowship named for the late Pulitzer-prize winning author and former director of the Stanford Creative Writing Program.

The Salish People and the Lewis and Clark Expedition

The Salish-Pend d'Oreille Culture Committee
and Elders Cultural Advisory Council
Confederated Salish and Kootenai Tribes

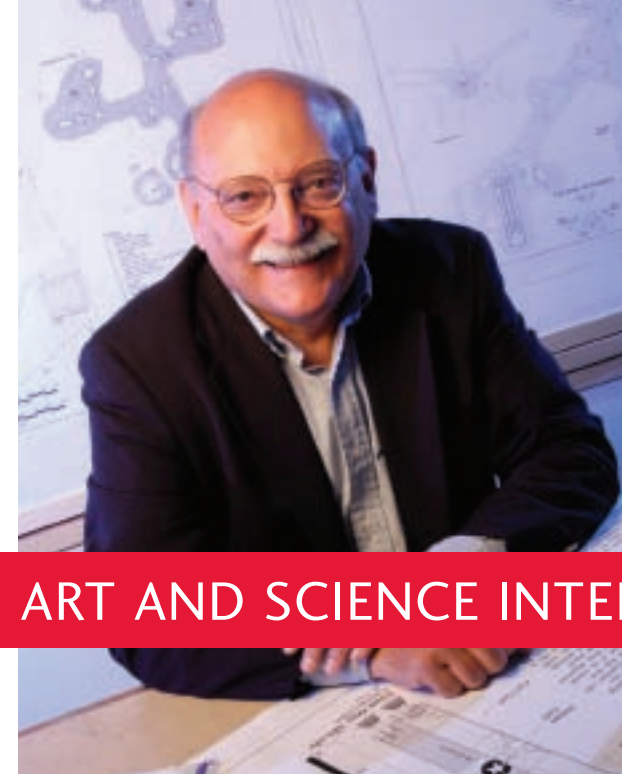
NU PRESS, TRIBE CELEBRATE PUBLICATION OF UNIQUE HISTORICAL DOCUMENT

□ In celebration of a unique University of Nebraska Press publishing event, a UNL delegation led by Vice Chancellor for Research Prem Paul and Press Director Gary Dunham visited the Confederated Salish and Kootenai Tribes of the Flathead Reservation in Montana in July. The delegation presented the book "The Salish People and the Lewis and Clark Expedition" to the tribes. Written by the Salish-Pend d'Oreille Culture Committee and Elders Cultural Advisory Council, Confederated Salish and Kootenai Tribes, the book describes the Salish people's encounter with Lewis and Clark. The Press

has long collaborated with the Salish-Pend d'Oreille Culture Committee on the project.

This book offers for the first time a Native American community's in-depth examination of the events and historical significance of its encounter with the Lewis and Clark expedition. The result is a new understanding of the event and its place in Native history.

"This book enables the Salish people to tell our own stories. It is our own words and our own stories," said Tony Incashola, director of the Culture Committee.



Ted Ertl

ART AND SCIENCE INTERSECT

□ UNL faculty and students are creating exciting new collaborations at the points where art and science intersect.

The musical web

Internet 2 offers extraordinary capabilities to enhance and expand opportunities for musical collaboration. UNL musicians and engineers are working to develop the ability to webcast live performances, allowing artists at different sites to perform together in real time. Initial collaborations involve the New World Symphony Orchestra in Florida, a leader in the area of musical tele-presence. Musical collaboration demands extremely high fidelity, and transmission issues must be resolved to allow broadcasts in real time and at high quality.

"If we are able to develop this technology, it will make collaborations possible that were previously cost prohibitive," said John Richmond, director of the School of Music.

Nexus Project

In its first year, the Nexus Competition allowed students the opportunity to showcase artistic visions of science exploration, said Ed Forde, chair of Art and Art History.

The joint effort between Hixson-Lied College of Fine and Performing Arts and the Office of Research drew 25 submissions. The three winning entries — a series of small prints, a diptych and a DVD installation — will be publicly displayed.

Preserving Cold War history

Students in the College of Architecture preserved a forgotten piece of the Cold War using computer-assisted design drawing expertise to map an abandoned Titan I Missile base in northern Colorado.

The U.S. Air Force is disposing of the base, deemed historically significant by the Colorado State Historical

Preservation Office. Funded by the National Park Service, the student drawings documented the historic structure and will be filed with the National Archives in Washington, D.C.

"This type of training is good for students who want to go into architectural preservation," said Ted Ertl, historical architect. "On a project like this, students get out in the field and get the opportunity to do hands on work measuring buildings, drawing them up and researching history."

Elevating Science Journalism

Writing about science is often as much about the art of translation as of writing. In the College of Journalism and Mass Communications, Carolyn Johnsen teaches journalists and scientists how to break down communication barriers and write clearly and accurately about complex science.

The goal of the science writing program, funded in part by the Office of Research, is to improve science reporting and the public's understanding of science.

"The program is designed to teach journalists and researchers how to communicate with each other and the public more effectively," Johnsen said. An equal number of scientists and journalists took the initial class in 2004-05.

The project is gaining support and publications. A \$25,000 grant from the National Science Foundation is funding student science writers to cover topics in nanomaterials science at UNL. And the Lincoln Journal Star is publishing a series of stories on Nebraska water issues developed by the class.



Colleen Medill

MAKING POLICY DECISIONS ON HEALTH CARE, RETIREMENT PLANS

Health care policy and retirement plans are among the thorniest issues facing the nation. The complexity of laws governing retirement plans and the skyrocketing costs of health care combine to form a mix that perplexes citizens and divides lawmakers.

Legal scholar Colleen Medill is looking at how people make decisions regarding retirement funding and the use of their health insurance.

For years, she said, such plans were paternalistic — companies or the government made the decisions and workers assumed decisions were made for their benefit. But cost-cutting has changed the metric, Medill said. Workers are asked to be more responsible for decision-making, but many lack the knowledge or information to make choices.

Along with Richard Wiener and Brian Bornstein of UNL's Law and Psychology Program, Medill is studying the long-term policy ramifications of current decision models.

"Some plans, for instance, are lower cost but don't pay for preventive care," she said. "If employers and employees choose that, are we laying the national groundwork for an explosion of full-blown disease in 10 to 20 years that might have been prevented today?"

Federal retirement and health care policy generally assumes workers behave rationally, she noted. But economists, sociologists and psychologists know that isn't always the case.

"Perhaps the law and public policy should be based on how people actually behave, rather than how in an optimal world of perfect rationality they should behave," Medill said.

Medill's study is funded by the Employee Benefit Research Institute and the Commonwealth Fund.

"Workers are asked to be more responsible for decision-making, but many lack the knowledge or information to make choices."

Colleen Medill



John Anderson

John Anderson, an economist in UNL's College of Business Administration, was appointed as a senior economist with the President's Council of Economic Advisers in Washington, D.C. He will serve as an adviser with the council, with particular duties related to public finance policy issues, including tax reform, social security and other federal revenue and spending programs.

ECONOMIST ANDERSON ADVISES WHITE HOUSE

Anderson has extensive international expertise in the re-development of former communist countries, having acted as economic adviser to the parliament of Moldova and as an economics educational adviser in Russia and Bulgaria. The author of the best-selling economics textbook "Public Finance," Anderson has been commissioned by state governments to study the effects of property tax rates, economic development incentives and tax increment financing.

The Council of Economic Advisers was established by the Employment Act of 1946 to provide the president with objective economic analysis and advice on the development and implementation of a wide range of domestic and international economic policy issues.

In addition to the chairman and two other members, the council has a professional staff of about 10 senior staff economists, generally professors on one- or two-year leaves from their universities, and 10 advanced graduate students. Four permanent economic statisticians assist the economists in the interpretation and identification of economic data.

The academic nature of the staff and of most council members distinguishes the council from other government agencies. Members and staff also use their strong links to the academic community to obtain advice on technical issues during their time in Washington.



NEBRASKA LICENSES PROCESSES AND PRODUCTS TO INDUSTRY

□ Moving products and processes from labs to licensing is the goal of UNL Technology Development.



Don Weeks

Dicamba-resistant soybeans

After identifying a gene that can make broadleaf crops, particularly soybeans, herbicide-tolerant, UNL biochemist Don Weeks and colleagues sowed exclusive licensing and research agreements with Monsanto. Worth up to \$2.5 million to Weeks' lab, the research agreement is to develop broadleaf crops that can tolerate dicamba, a widely used herbicide.

"This is a good example at how academic interests and basic science mesh with practical applications," Weeks said. "And, this technology has a number of potential uses that have yet to be exploited."

Weeks began research into developing dicamba-resistant plants more than a decade ago, working to introduce a specific genetically engineered bacterial gene into plants, which can then degrade the herbicide. More work is needed as dicamba-tolerant broadleaf crops are not expected to be commercially available until the first part of the next decade.

Reducing E. Coli contamination

Cattlemen and consumers are poised to benefit from a new vaccine and feed additive that each reduce E. Coli O157:H7 in feedlot cattle herds, helping stave off deadly infections caused by consumption of beef tainted with the bacteria.

Terry Klopfenstein, UNL animal scientist, said the two appear to make a significant difference in controlling the organism, which is especially dangerous to children and the elderly.



In UNL studies, vaccination reduced E. Coli an average of 59 percent per year compared to unvaccinated cattle. A two-year study showed that feeding *Lactobacillus acidophilus* as a feed additive reduced E. Coli by an average of 35 percent, compared to cattle not given the friendly bacteria.

When the vaccine and bacteria were combined for a third study, the dual treatment showed an added effect in reducing E. Coli.

The *Lactobacillus* additive is commercially available, while the vaccine continues to be developed.

Detecting allergens in food

UNL food scientists have developed and commercialized a test that detects the presence of soy flour. The test helps food processors better protect consumers who are

allergic to soy. The new test is the latest developed by a UNL team that earlier devised tests for peanuts, milk, eggs, almonds and wheat gluten. The tests give processors a quick, reliable way to ensure their products contain only ingredients listed on the label by quickly detecting traces of an allergenic food on manufacturing equipment or in food processed on shared equipment. Neogen Corp. of Lansing, Mich., recently announced that kits based on the latest UNL test are available to processors. Food toxicologist Susan Hefle directs the research for UNL.

Buffalograss turf

Powered by a need to reduce water, fertilization and pesticide application, a grant from the United States Golf Association in 1984 is continuing to reap rewards for turf buffalograss research at UNL.

Turfgrass specialist Terry Riordan said buffalograss needs about half the water of Kentucky bluegrass, requires less mowing and fertilization and grows in poor soils.

Since 1990 nine UNL-developed turf buffalograsses have been commercialized for sale to the general public. Two of those varieties — Legacy and Prestige — have helped Todd Valley Farms in Mead, Neb., expand their sales across the nation and overseas.

While already providing an economic benefit for the university and state, future research will look to expand turf buffalograss availability through the development of varieties that can be established via seeding. While some varieties can be seeded, the main way of establishing turf buffalograsses is via plugs or sod.

In addition to economic benefits, turf buffalograsses have drawn over \$1 million in grant funds from the U.S. Golf Association.

"Their interest in reducing water, fertilizer and pesticide use showed a lot of foresight," Riordan said.

UNL RESEARCH MAKES TOP 100



□ Findings of two research projects involving UNL scientists were named among the 100 most important discoveries and developments in science in 2004 by *Discover* magazine.

Each year, *Discover* selects the 100 top science stories of the year to feature in its "Year in Science" issue. Research involving UNL physicists Greg Snow and Dan Claes and agronomist Ken Cassman made the 2004 list, which featured global warming research at the top spot.

Snow and Claes were part of an international team at Fermi National Accelerator Laboratory near Chicago that established the mass of the top quark, a discovery that ranked as *Discover's* No. 57 story.

Snow said the real significance in finding the mass of the top quark is in narrowing the search for a particle called the Higgs boson, which is believed to endow all particles with mass.

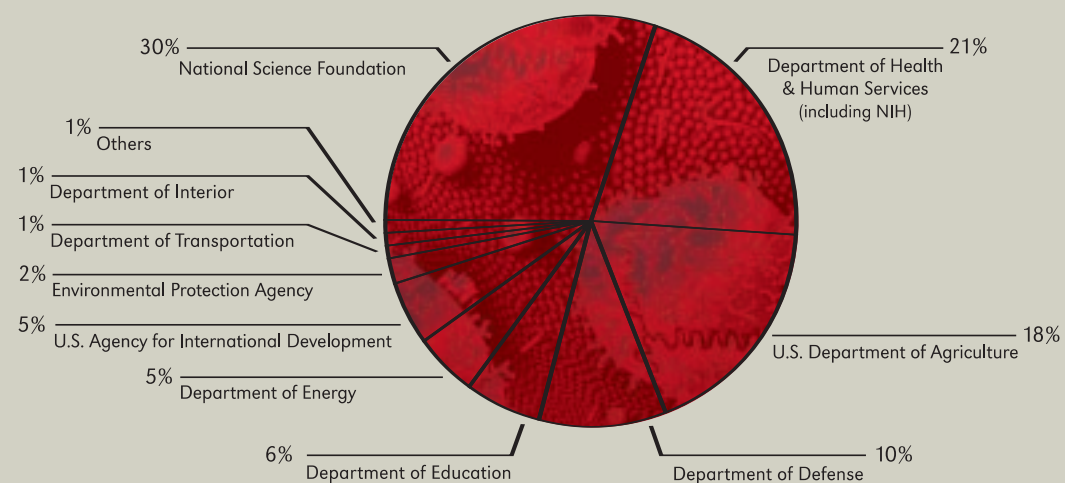
Research by Cassman and agricultural scientists at the International Rice Research Institute in the Philippines provided some of the first evidence that global warming could hurt food production. Their findings were *Discover's* No. 68 story.

This 11-year field study found that rice yields decrease 10 percent for every 1.8-degree Fahrenheit increase in nighttime temperatures when solar radiation and temperature are the only factors limiting yields.

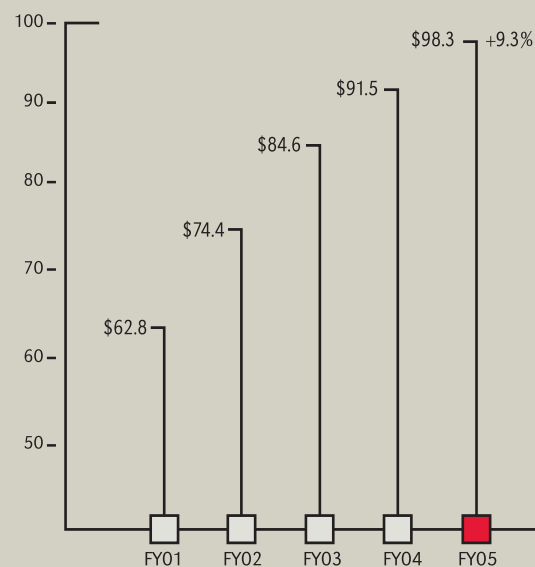
"Meeting world food demand in the next 30-40 years is going to be a challenge without global warming," Cassman said. "With global warming, it's like an additional headwind facing scientists trying to ensure food security."

FINANCIALS

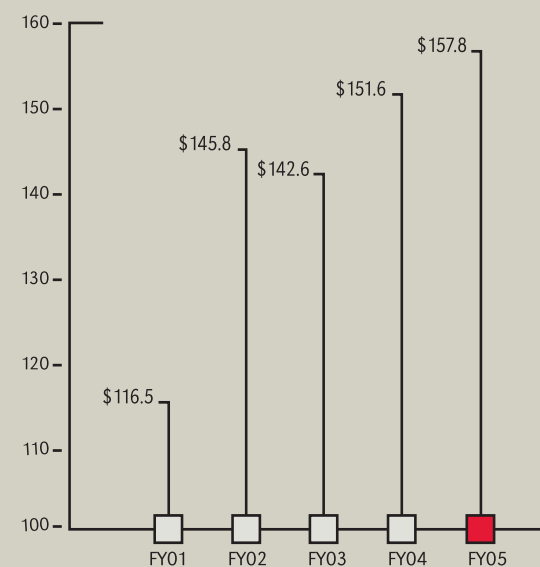
Federal Research Funding by Agency



Five-Year Total Research Funding (In Millions)



Five-Year Total Sponsored Programs Funding (In Millions)



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