

STRATEGIC DISCUSSIONS FOR **nebraska**

OPPORTUNITIES FOR NEBRASKA



University of Nebraska–Lincoln
College of Journalism and Mass Communications

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Dear Readers:

This *Opportunities for Nebraska* magazine is the first in a series of four annual publications of Strategic Discussions for Nebraska that will explore the impact and relevance of research at the University of Nebraska-Lincoln.

You'll find our presence on the Web at www.unl.edu/sdn; look for the publication and the video clips. You can watch and listen as UNL experts tell the stories of research and innovation at one of the top research universities in the United States.

University research is sometimes so complex that it's difficult to understand, but the stories and photos in these publications will capture the passion of discovery and the significance of new ideas – and how research affects you, me and the world.

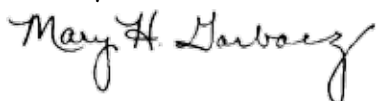
We'll look at why research into food, fuel and water impacts not only land and lives in Nebraska, but also the land and lives of people throughout the world. We know it's not possible to conduct research without educating the state's people, so we'll explore education throughout the four magazines, as well. After all, that's what we do at the university – teach students, conduct research – and take that research to people throughout the state and the world.

In this magazine, you'll find a sampling of various kinds of research going on right now at the University of Nebraska-Lincoln. These selected stories are meant to help readers become better-acquainted with research and the people who devote their lives to creating a better world. We also hope you'll look for our upcoming magazines!

We are grateful to the Robert and Ardis James Family Foundation for funding the Strategic Discussions for Nebraska research program and for placing it in the UNL College of Journalism and Mass Communications, which also provides support for the program. The James family believes in the power of change through discussion and dissemination of information.

Thank you for your interest!

Sincerely,



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Niobrara River near Valentine, Nebraska

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Western Nebraska



Opportunities for Nebraska

A Brief History of the Land Grant Model of Public Education

By Mary Garbacz

The University of Nebraska is one of more than 100 land grant institutions in the United States and its territories. Although the University of Nebraska-Lincoln was the original campus of the University of Nebraska, the land grant mission extends to all four campuses of the University of Nebraska system.

The land grant college system was established by the passage of the Morrill Act, which was signed into law on July 2, 1862 by President Abraham Lincoln. Named for Congressman Justin Smith Morrill of Vermont, the purpose of the Morrill Act was to establish a college in each state “where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.”

The Morrill Act gave each state 30,000 acres of federal land for each sitting Senator and Representative in Congress, based on the 1860 census – thus the name “land grant.” The land grant system formed the framework for the land grant institutions’ missions of teaching, research and extension.

Twenty-five years after the Morrill Act was passed, Congress passed the Hatch Act – on March 2, 1887. The Hatch Act established agricultural experiment stations in connection with the land grant colleges so research could be conducted and applied in practice. Named for Congressman William Henry Hatch of Missouri, the Hatch Act established not only experiment stations, but also distribution of information to the people of the United States on subjects connected with agriculture. The Hatch Act also provided an annual payment to each state and territory for the expenses of research, as well as for printing and distributing the results.

(Taken from the Historical Sketch of the U.S. Department of Agriculture, compiled by Charles Howard Greathouse and published in 1907 by the U.S.D.A. Office of Publications, Government Printing Office, Washington, D.C.) ●

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Land Grant Mission Strong in Today’s NU System

This article features excerpts from a March 22, 2010 interview with University of Nebraska President James B. Milliken. He explains the land grant system and how it impacts Nebraska.

“The Morrill Act of 1862 – also known as the land grant act – is one of the three most important events in the history of American higher education. It’s the first, and it is, perhaps, one of the most important events in the history of higher education around the world. It did several things, but perhaps the most important was to make a statement that higher education is important for a much broader group of people than historically had been the case.

“Higher education had been a privilege; it had been for the wealthy, to train clerics, but it hadn’t been available for the public at large. So the land grant act really said ‘we’re going to create a system, a public system of higher education in this country, for the sons and daughters of mill workers and farmers and others, and provide broad access to higher education.’ Now, it also said that ‘we’re going to create a system of education in liberal arts but also in agriculture and the mechanic arts; that there would be a practical dimension to this education, which was not the case prior to the middle of the 19th century. So, it has created what is the world’s leading model of higher education in this country: the (public) research university in America.

“Abraham Lincoln signed the land grant legislation in the middle of the Civil War in a week with three of the most bloody battles in the Civil War, but still, our government had the foresight to create this great opportunity for future generations, and we are still reaping the benefits of that today.

“Originally, the federal government granted land to every state to use for the purpose of establishing this university. It could be used to help finance the institution, or it could be built on that land. There are all different models across the country for how that was done.

“In Nebraska, five years after the Morrill Act, we became a state – in 1867 – and two years after that, the land grant University of Nebraska was established, in 1869. Land grants, with very few exceptions, are what we consider to be public universities. Generally, they’re supported by their states. Nebraska traditionally has a great heritage of supporting higher education. Nebraskans have been very generous since the beginning and have recognized the need for a strong public university.

“Because it’s public, the state and the federal government support the institution, but the main distinction is that the state does – and students have a great opportunity to get a

Education is what's going to make the difference in the 21st century when human talent is the basis for everything.”

- James B. Milliken
University of Nebraska President



Left: James B. Milliken, President, University of Nebraska (Photo by University of Nebraska) Above: the UNL C.Y. Thompson Library on East Campus

first-rate education, to go to a world-class research university and pay a fraction of the cost of their education.

“In the 21st century, economic competitiveness is going to be largely based on talent. In the past, natural resources, location and approximation to a port, transportation were important and are still important today, but the single most important thing is human talent, and universities are magnets for human talent and hubs of creative activity, of innovation, of economic activity.

“We spend almost \$350 million a year on research and development activities at the University of Nebraska. It's a great source of economic activity for the state. The estimates are that for every million dollars invested in research and development at a university, you generate more than 30 jobs in the state.

“Education is what's going to make the difference in the 21st century when human talent is the basis for everything.”

The Land Grant System: At Work for Nebraska

When you enter a building on the University of Nebraska-Lincoln east campus, you'll find these words on the door:

“The Morrill Act of 1862 established a Land Grant University in each state where the Leading Object would be instruction in agriculture and related fields.”

“The land grant university system is really a very special thing, rooted in the absolute depths of the Civil War, when the country was at war with itself in literally every way,” said John Owens, who served as NU vice president and Harlan Vice Chancellor of the Institute of Agriculture and Natural Resources from 2001 until June 2010. “In the summer of 1862, Congress passed an act that established land grant colleges, which then grew into these wonderful land grant universities today,” Owens said.

The land grant model was created to make education more affordable for a state's people through federal, state and county support for land grant institutions.

“The whole notion of the land grant model is having a responsibility, not only to deliver academic programs to students in the classroom and in the laboratory, but also having an obligation

to take knowledge to the people of the state,” Owens said. “It’s been part of Nebraska from the very beginning, this notion of the people, the taxpayers who work in businesses and farms and ranches and in the professions, and expect their tax dollars to be well-spent, that they have taken it upon themselves to invest in the future of the state through making the University of Nebraska as strong as it can possibly be.”

The taxpayers’ partial financial support of the land grant system helps to make education affordable for people who live in that state or territory, but it goes a step further. The land grant system “extended” the reach of the land grant university to the rest of each state. In Nebraska, there are University of Nebraska-Lincoln Extension offices in nearly every county in the state. Extension educators in these offices make university research available, free of charge, to anyone who requests information.

“In a knowledge-based economy, we want a strong, educated population here in Nebraska. The world is competitive today, and it’s going to be more competitive tomorrow,” Owens said. Generally speaking, he added, education gives people a broader viewpoint of the world and with that viewpoint, they are likely to make better decisions.

The Hatch Act of 1887 ensured that federal dollars would be invested in agricultural research, so each state and territory in 1887 received \$10,000 in federal funds. That was a huge amount of money in 1887, Owens said, and the lure of those funds played a role in other states’ interest in adopting the tenets of the land grant act.

From Owens’ point of view, the federal government used money as a reason to get the states interested in supporting research, teaching and later, with the adoption of the Smith-Lever Act of 1914, Cooperative Extension. “The larger amount of the investment in traditional land grant programs comes from the state itself,” Owens said. “They meet the match and then provide considerably more dollars than the basic match. But over time, the federal investment has grown to be so large that we all depend on those dollars.” The funds are called ‘formula funds’ and according to Owens, “is about the only part of the federal funding system for the entire country where money comes to an educational enterprise based on a formula.” The formula funds are allocated to various states in different proportions based on the size and importance of the state – particularly its agricultural importance.

Funds allocated by the state government are even more important, Owens said. “We simply could not open the door on an enterprise like this if we did not have those funds from the taxpayers of Nebraska.”

County government funds also are extremely important, Owens said. The land-grant component of the university is very often delivered to the people through extension and very often, that delivery is through an extension office associated with a county. Extension offices are operated in 83 of Nebraska’s 93 counties – the other 10 counties are in two-or three-county partnerships to provide extension services to each county’s people. Nebraska’s Unicameral, Owens said, now supports the salaries of the University

of Nebraska-Lincoln faculty who work in the extension offices, but each county provides office space and funds to run the office. “On any given day, some county, state or federal government has a budget problem, but over time it always seems to be worked out. It only gets worked out because these programs are important to people,” he said.

The land grant mission extends to young people, too, in the national 4-H charter that is held by Congress and allocated to various land grant institutions in each state. Nebraska has 135,000 young people involved in 4-H, along with 10,000 volunteers, making Nebraska the state with the highest 4-H involvement per capita of any state in the country. Nationally, the 4-H Foundation has a goal called One Million New Scientists. One Million New Ideas.™ which is intended to educate one million new scientists by 2013. To achieve that goal, 4-H is delivering educational programs to young people in the areas of science, technology, engineering and mathematics – STEM education – which is a national focus. In Nebraska, the emphasis is on building and programming robots with the support of corporations and volunteer leaders.

It is expensive to fund and deliver university programs in science, technology and engineering, so scholarships for university students are “just huge” in making public education a bit more affordable for students, Owens said. “In agriculture and natural resources and related areas, the generosity of Nebraskans has just been phenomenal in how many scholarships we have and how important they are in the lives of the students.” Even more will be needed in the future, however, because the world has become more competitive, Owens added.

An independent study by Battelle of Columbus, Ohio indicates that for every Nebraska tax dollar invested, there’s a return of \$15 in the Institute of Agriculture and Natural Resources alone, Owens said.

“I believe this totally – the difference between an adequate public university and an excellent public university is always, always, always found in the generosity of its friends, its alumni and its clientele or supporters. Nebraskans have really stepped up to the plate in a big way to do that,” he said.



Dr. John Owens

Morrill Scholars Program Educates Students about Land Grant Mission

Teaching students about the land grant mission of the university through a special program for land grant scholars is unique to the University of Nebraska-Lincoln. Its director hopes the UNL Morrill Scholars Program grows so hundreds of students can learn about the system founded to provide education to all people, as well as the service and leadership traits of the man who established the system.

"We are the universities of the people, and we should always focus on that. We have a very important responsibility to provide the education to the American citizens who can only make democracy work if they're educated," said F. Edwin Harvey, a UNL Professor of Hydrogeology who is also Director of the UNL Morrill Scholars Program.

The Morrill Scholars Program is an undergraduate learning community and leadership program based on the life and service of Justin Smith Morrill of Vermont, who originated the Morrill Act of 1862. That act established the land grant college system in the United States. Morrill was a member of the U.S. House of Representatives at the time he wrote the bill that would become the Morrill Act.

The students in the Morrill Scholars Program study Morrill as a model of leadership, Harvey said. Morrill was a blacksmith's son and blacksmiths were the engineers of the time, creating implements and tools for the farming community. It was a humble beginning, Harvey said, even though blacksmiths were well-respected. Morrill worked in his father's blacksmith's shop as a boy, but when he was 16, he went to work for a local merchant, Judge Harris (who would become Morrill's mentor and later, business partner). During this time, Morrill took the opportunity to discuss politics with the people in the store. "He learned how the common people thought," Harvey said. Morrill was not born into wealth and his father couldn't afford to send him to college, so Morrill taught himself by reading books on a variety of subjects. "When he went to Congress, he did the same thing – he taught himself the things he needed to know to be a good congressman and later, a senator," Harvey said.

The Morrill Act of 1862 established the land grant college system to educate the "industrial class" of people who might not be able to afford an education otherwise. The Morrill Act specified that the industrial class should be educated in the areas of agriculture, mechanic arts (now known as engineering), as well as military tactics, but did not exclude other fields of study. Thirty thousand acres of land was granted to each sitting member of Congress in 1862 as a foundation for each state's land grant institution.

Harvey said UNL Morrill scholars focus on leadership engagement, service and politics. He believes it's important to re-connect students with the land grant university and why it came to be, so Morrill scholars take a trip to Morrill's home town of Strafford, Vermont, study Morrill's biography and learn ways they can apply what they've learned. In the five years the Morrill Scholars Program has existed, 40 students have gone through the program.



Dr. F. Edwin Harvey

Harvey's vision is to have a learning community of Morrill scholars that lives in a dorm together, takes classes and does things together and is very active in the community. He also would like to take the program nationally, establishing a Justin Smith Morrill Scholars Program in each land grant institution. "It would be thought of as the premier service and civic engagement organization across the country," he said.

The land grant institution was set up to provide education for the common people and Harvey said "we've seen that blossom into the giant system we have of more than 100 universities that are doing that. They're doing that not just for white males, but for females and African Americans and Native Americans – it's across the board, a way to educate everyone." The land grant institutions were originally free, Harvey said. Even though tuition has become more a part of the university system, he said "I think it's still the state university where students in the state can come and not be, in any way, fettered by race, gender, sex, creed or anything else."

Students can benefit from associating with researchers that are doing applied, practical research and university programs allow students to become involved immediately. "We put the students not only in the seats, but we put them in the field, we put them in the lab and we put them into the action right away so they can be involved," Harvey said.

It takes a certain kind of professor to want to work in a land grant institution, Harvey said. Professors who come to a land grant university unsure of the mission quickly discover that the mission is service to the people of the state. "You learn very quickly how important what you do is to them, and you sort of develop that mindset early on that 'I work for the citizens of Nebraska, so I should be giving back to them and have my research be relevant to them,'" he said. "I think most of the faculty that I encounter on the campus think that way." ●

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NU Funding Sources: A Breakdown of the University's Budget

By Nkem Kalu

Signs of momentum are everywhere on the four University of Nebraska campuses. New buildings are being built, existing ones are being updated, internationally-recognized research is being conducted, thousands of students are collecting diplomas each year. Where does the university get the resources to fuel this momentum?

According to the Office of the President of the University of Nebraska, each state dollar returns 300 percent through economic growth. The Institute of Agriculture and Natural Resources alone generates \$15 for every one dollar of Nebraska tax investment.

The University of Nebraska is largely funded by taxes, tuition, auxiliary entities, federal funds and private gifts and has careful guidelines in place about how each funding source is spent. Figure 1 includes two pie graphs showing funding sources and comparing 1989-1990 and 2009-2010.

Altogether, the university system has a budget of \$1.9 billion, but more than 60 percent of those dollars are restricted or designated for specific uses.

Where does the money come from, and how is it spent?

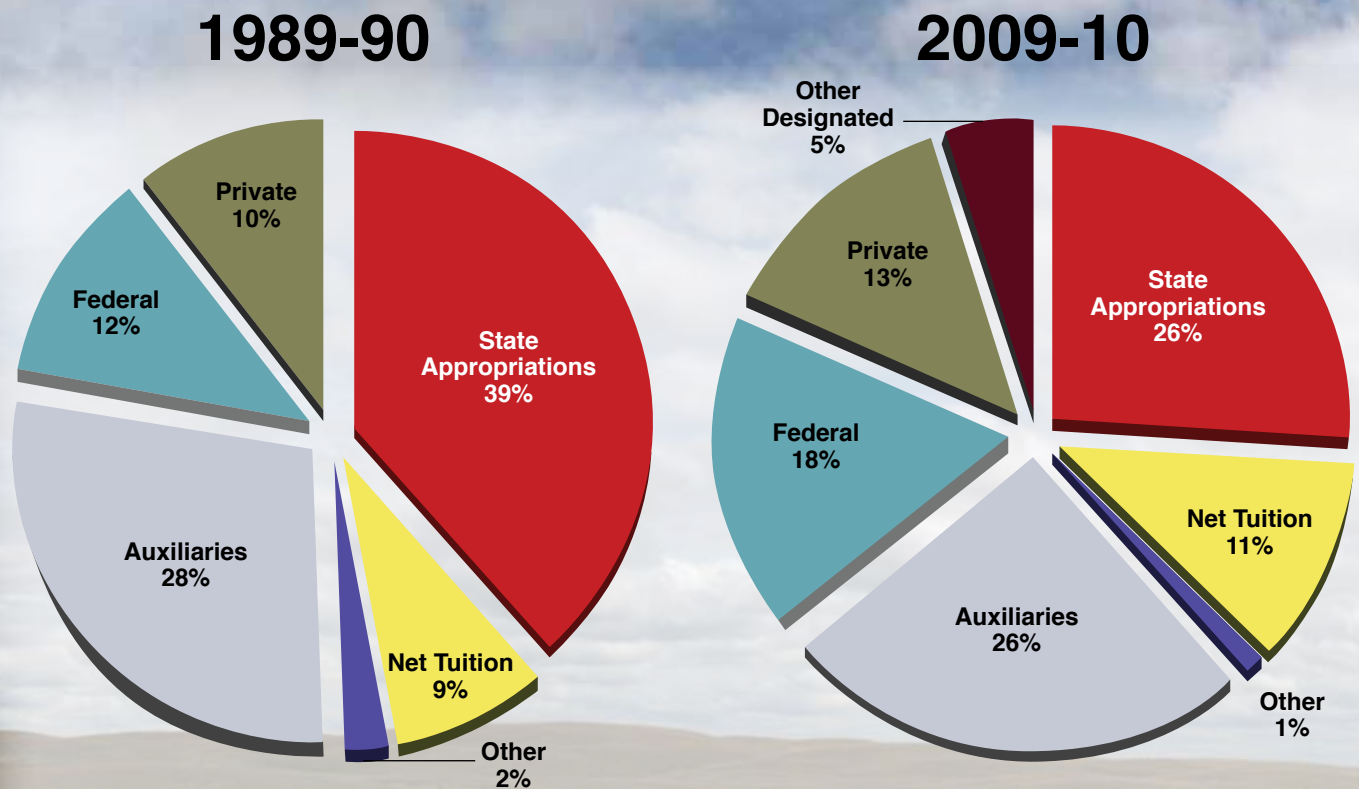
State-Aided Funds: Taxes and Tuition

State appropriations and tuition are considered to be "state-aided" funds by the university's budget office and together, they accounted for about 37 percent of the 2009-2010 NU budget (\$729 million), compared to nearly 50 percent in 1989-1990. State-aided funds provide a stable, predictable base of support and pay for teaching and general university operations, including instruction, student services, outreach (such as Cooperative Extension), administrative support and facility costs.

State appropriations accounted for 26 percent of the budget in 2009-2010, compared to 39 percent in 1989-1990.

Stable state support allows all of the University of Nebraska campuses to rank significantly below their peers in tuition and fees, according to the Office of the President. Tuition dollars made up 11 percent of the 2009-2010 budget, compared to 9 percent in 1989-1990.

For 2009-2010, resident undergraduate tuition at the



Charts courtesy of University of Nebraska

University of Nebraska-Lincoln was 25 percent below UNL's peer average. The University of Nebraska at Omaha ranked 12 percent below its peer average and the University of Nebraska at Kearney was 21 percent below its peers. The University of Nebraska Medical Center also ranks below its peers; tuition rates vary by college.

Auxiliary Entities: Self- Supporting

Auxiliary funds make up 26 percent (about \$483 million) of the 2009-2010 budget, compared to 28 percent of the 1989-1990 budget. Auxiliary funds and revolving funds are self-supporting and do not receive taxpayer or tuition support. They are dollars generated and used by specific university entities such as University of Nebraska-Lincoln athletics, student housing, parking services, course fees and lab fees.

Expendable Restricted Funds: Federal and Private

Federal and private funds together are called expendable restricted funds because the providers designate how their money is spent. Expendable restricted funds accounted for 31 percent of the university's budget (about \$583 million) in 2009-2010, compared to 22 percent in 1989-1990. The money comes from

research grants and contracts, the University of Nebraska Foundation, endowments and gifts. The money pays for research, scholarships and fellowships and endowed professorships.

The federal fund part of the expendable restricted funds category includes grant and contract dollars and makes up 18 percent of the university's 2009-2010 budget, compared to 12 percent in 1989-1990.

The private fund part of the expendable restricted funds category includes private gifts and accounts for 13 percent of the university's 2009-2010 budget, compared to 10 percent in 1989-1990. Private gifts are often designated for specific purposes, such as new buildings for specific purposes, scholarships, research or student travel. Private gifts are restricted to uses outlined in fund agreements.

Designated Funds

Designated funds amount to 5 percent of the 2009-2010 budget (about \$90 million). These funds come from the indirect cost of sponsored research, clinical patient revenues and Tobacco Settlement research funds. Designated funds pay for research and clinical activities at the university. ●

For more information visit www.unl.edu/sdn/opportunities



The Nebraska Sandhills

U.S. Economic Power Hinges on Research Universities

By Mary Garbacz

The top research universities in the United States, including the University of Nebraska, are largely responsible for the economic power of this country and to keep this momentum, the United States must make sure its economy is growth-oriented and competitive, according to Prem Paul, Vice Chancellor for Research and Economic Development at the University of Nebraska-Lincoln. That requires support for research and for the pool of talented, well-educated people who create innovations and turn those innovations into employment opportunities.

Paul said the U.S. has long been a respected world leader in education, technology and creation of new knowledge. But many other countries are duplicating the U.S. model and are investing heavily in education, research and technology development – and are catching up fast.

The U.S. must continue to supply a pool of well-educated people to take the jobs of the future, Paul added. This talent development is essential, as is strong support for research that benefits students directly so they will be more competitive in the marketplace and able to compete for the high-paying jobs that will contribute to economic development, Paul said.

Talent development is one reason university research is important. “The other reason that universities have to do research is that no one else is doing it,” Paul said. Even basic research projects may take 10 or more years to achieve results, which isn’t feasible for private companies that may need to show a profit sooner, he added.

Understanding Research – The Circle of Innovation

Paul said research is the starting point of what he calls a Circle of Innovation. That circle begins with basic research, expands to applied research, then to new business creation, then to new products, more jobs, a larger number of well-trained workers and finally, to economic growth, Paul said.

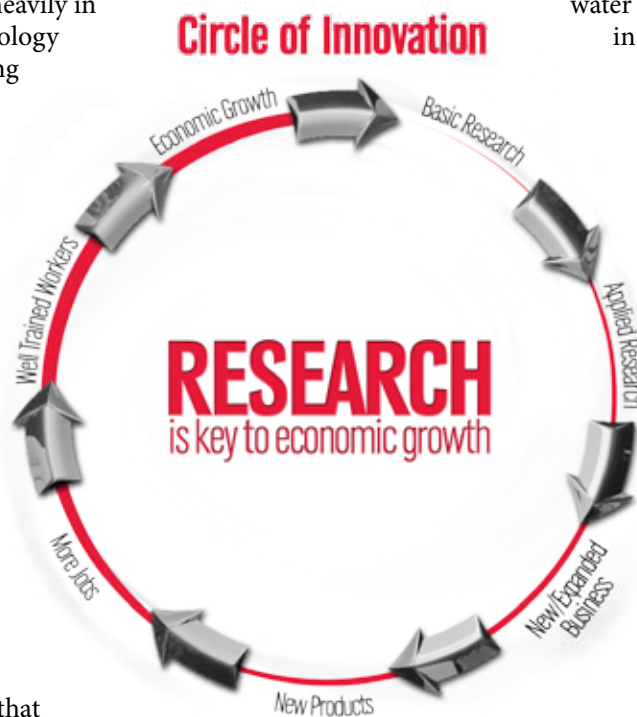
Basic research is driven by curiosity. It’s the research that results in the major innovations we take for granted, such as the World Wide Web and all sorts of electronic gadgets, Paul said. Basic research also finds the answers to scientific questions. One example of basic research is finding the genetic makeup of a wheat plant.

Applied research expands on basic research and finds answers that improve the way people live, such as uses for the World Wide Web or for those electronic gadgets. Taking the example of the wheat plant’s genetic makeup a step further, applied research might create a new wheat hybrid that prospers using less water. That changes the way people live,

because the creation of such a hybrid would save water and make it possible to grow crops in areas where it was not previously possible. [Creating a new wheat

hybrid takes 12 years, according to P. Stephen Baenziger, Ph.D., UNL Eugene W. Price Distinguished Professor of Small Grains Breeding and Genetics.]

Applied research, such as developing that wheat hybrid, takes basic transformational concepts and discoveries and converts those into products, then into jobs, Paul said. Those jobs require well-trained workers who earn good wages, then contribute to economic growth.



Work at the University of Nebraska-Lincoln

The University of Nebraska-Lincoln “is a powerhouse in material science, food, plant genomics, water and energy,” Paul said. “What we need to do now is capitalize on that to grow jobs, either with existing companies or by having new companies form, then keep our young, talented people right here in Nebraska and grow Nebraska’s economy.”

Paul said areas of increasingly important research and product development include biomedical research; development of higher-quality food for less cost; improving the environment; water quality and sustainability; and new energy sources.

“Not only do we do good science and produce products and support and grow industry, but how do we communicate



Photo Illustration by Adam Wagler and Nkem Kalu

to people how important food is?” Paul said. The challenge in communicating the importance of research is in teaching people what it takes to produce food; people in larger, urban communities often don’t know what it takes to produce the food they eat, Paul said.

“In the last 10 years, we were blessed with our faculty working very hard. We’ve attracted the top-talent faculty and what we’ve seen is a growth in research enterprise here,” Paul said. Research funding at UNL is one way to look at that; UNL research funding went from less than \$50 million in the year 2000 to more than \$122.5 million in 2009, Paul said.

“Money gives us resources to be able to do the research, but it also tells us we are in a better position to compete for very hard-to-get grants,” Paul added. Those hard-to-get grants, often for many millions of dollars, are awarded to top researchers who have the ability to carry out the proposed work. As a result, faculty members are making new discoveries, receiving awards and publishing, Paul said, and now those assets will be converted into jobs.

The Mission to Educate Scientists

The United States needs to make sure there is a future workforce that understands STEM education, Paul said – Science, Technology, Engineering and Math. “Our ability as a nation – and our state, competing in the new economy – it

is very, very important that we have good teachers in those areas and that we’re inspiring young people to pursue those careers,” he added. The 4-H initiative called One Million Scientists. One Million New Ideas™ is the goal of the 100+ land grant institutions in the U.S. and its territories and promotes the education of one million new scientists by 2013. Nebraska’s 4-H program, administered through the University of Nebraska-Lincoln Extension office, has one of the nation’s leading programs, involving one in three of Nebraska’s young people as well as 10,000 volunteers.

Teaching, research and extension are the three basic missions of the University of Nebraska-Lincoln; often, those missions are combined. Almost every research project being conducted at the University of Nebraska-Lincoln, Paul said, involves undergraduate students and graduate students working shoulder-to-shoulder with professors. “Not only are they learning from the very best, but they’re helping to create new knowledge,” he added. Connecting research and education is important, he said; “if research is stored on the shelves in professors’ offices, then we missed our opportunity to educate people and make an impact. That’s where extension comes in. It’s very, very important.” ●

Cirlce of Innovation graphic on page 12 courtesy of University of Nebraska-Lincoln Office of Research

For more information visit www.unl.edu/sdn/opportunities

Nebraska Innovation Campus Means More Jobs, Keeping Talent in Nebraska

By Mary Garbacz

UNL's Vice Chancellor for Research and Economic Development excited about new opportunities for Nebraska

"Number one, if a state of 1.8 million people can win national championships in football and volleyball, why not in research? Why not capitalize on research and convert that into jobs and grow our economy and keep our young people here?" asked Prem Paul, Vice Chancellor for Research and Economic Development at the University of Nebraska-Lincoln.

Keeping talented young people in Nebraska and growing the state's economy is where Nebraska Innovation Campus comes in, Paul said. Experts who specialize in the impact of research find that the majority of the impact is in the area where the inventions are produced, and that bodes well for new jobs and other opportunities for Nebraska. "We need to be confident, we need to have vision and we need to invest," Paul said.

The vision of Nebraska Innovation Campus is to create a public-private partnership that capitalizes on the expertise of UNL faculty and research growth. Studies indicate the best way to foster a public-private partnership is to have a corporate sector right next to the university, Paul said. "So there's not once-a-year or twice-a-year interaction," he said. "The professors, students, scientists from companies, they're rubbing shoulders, there's a relationship being built."

There are national precedents for this type of development, and they've been successful. One is in Silicon Valley, California; another is The Research Triangle Park in North Carolina; yet another is the creation of Google by some students at Stanford University.

"If you read about what happened in Silicon Valley... there are a number of strong universities in the area, but what it really took was creating a space near the universities where people come together to talk. All of a sudden the new ideas come and then they go back and test them out," Paul said. Silicon Valley in California was originally known as the location of many silicon chip manufacturers and now has expanded to include a concentration of various high-tech industries. The Research Triangle Park is located in North Carolina in the tri-city area of Chapel Hill, Raleigh and Durham, home to more than three million people. The Research Triangle Park has created more than 42,000 jobs in the area.

"I think the Nebraska Innovation Campus vision is to create that type of environment, that type of space, that type of culture so the content experts in science and the business experts who know how to look at (new) products can capitalize on research and create jobs," Paul said. "When that vision is realized, it'll impact the entire state of Nebraska."

UNL Chancellor explains impact on tax base, agriculture

"Any economic growth anywhere in the state of Nebraska helps everyone in the state of Nebraska," said Harvey Perlman, Chancellor of the University of Nebraska-Lincoln. "Anyone who works contributes to the state tax base, so the more people there are, the less of a burden it is to each of us."

Perlman expects that tax base to expand with the implementation of Nebraska Innovation campus, which will develop 1.8 million gross square feet on the former site of the Nebraska State Fair in Lincoln. The basic concept behind Nebraska Innovation Campus is to leverage University of Nebraska research to create growth and jobs for the people of Nebraska, Perlman said. Nebraska Innovation Campus will also physically align the city and east campuses of the University of Nebraska-Lincoln.

The development will take 20 or 25 years to complete and is expected to attract a large number of private companies, as well as government facilities. These companies will undoubtedly bring some talented people to Nebraska, but will also hire highly-trained Nebraskans, Perlman said, which will contribute to growth of the state's economy.

"A major emphasis of Innovation Campus will be food, energy and water. Those are activities that obviously, play off the importance of agriculture to the state of Nebraska," Perlman said, adding that it's reasonable to expect that some of those companies and government facilities will focus on agriculture.

"If you're in agriculture, it's just like the Institute of Agriculture and Natural Resources here – we do research in Lincoln, but we have facilities across the state that attempt to scale the field conditions to see whether the research is workable in the field or on the farm," he said, adding that there's every reason to think that companies who locate on Nebraska Innovation Campus could do the same thing.

The global Water for Food Institute will be located on Nebraska Innovation Campus, Perlman said. The institute has been in existence for two years, with a temporary office on the UNL city campus. In April, the university received a \$50 million founding gift from the Robert B. Daugherty Charitable Foundation to allow the institute to expand its work and create more permanent offices.

"While there is a lot of work going on around the world in respect to water, there was no one location that focused on the agricultural component," Perlman said. "The hope is that the institute will have an impact by being a source for two things – one, research that relates to how we can grow more food with less water and second, to produce the human talent that is necessary across the world in order to implement that research."

NU President looks at global challenges related to university's research strengths – food, fuel and water

"We didn't get into this to compete with Silicon Valley or to compete with The Research Triangle Park," said James B. Milliken, President of the University of Nebraska. "We want to compete in areas that are important to Nebraska and the region and in areas where the university has great strength and competitive advantages – hence, the themes for Innovation Campus of food, fuel and water," he said.

"We happen to be at a great point in history that we can say these are the great strengths of the University of Nebraska, but they're also the most important issues in the world right now...the most important global challenges," Milliken said. "How we solve these issues of feeding a world population that's going to grow by 50 percent over the next 50 years, where the food demand is going to double for the world population and the same amount of land and water are available to produce the food for the world," he said. "This is something that fits tremendously well with the interests of Nebraska from Scottsbluff to Omaha."

The University of Nebraska's land grant mission includes the extension program, Milliken said. "We have four research and extension centers located across the state of Nebraska, which are hubs of intellectual activities and innovation. That's part of the strength of a land-grant institution," he said. The Morrill Act of 1862 established a land grant institution in each state. Nebraska agriculture creates the opportunity for Nebraska to be globally important in the areas of research into food production, sustainable fuel sources and techniques for conserving and sustaining the world's water.

Milliken hopes that NU can continue to play a role in creating and helping to support economic activity throughout Nebraska. "If we have robust economic activity where we have opportunities for people in Nebraska and places for our students to have internships and for our graduates to work, we don't need it just in Omaha and Lincoln; we need it throughout the state of Nebraska," he said.

Milliken said that even though people are coming into Nebraska, there are too many people who leave the state after they attend a Nebraska college or university – the "brain drain." People leave, he said, for economic opportunity; in many cases, they can't find the kind of jobs they have prepared themselves to take.

"You need the human talent; you need an educated work force; you need businesses to grow out of that; and you need new business to come to Nebraska to offer opportunities to those students," Milliken explained. "Innovation Campus is a way. It's a catalyst as much as anything."

Nebraska Innovation Campus is projected to be comprised of two-thirds private sector businesses, Milliken said. There is a great attractiveness to locating in, around or on a college campus, he said, but the main attraction is the ready source of talented people ready to take the good jobs that will be available.

The Peter Kiewit Institute in Omaha is part of the University of Nebraska system. That institute gave rise to the Scott Technology Center, Milliken said. There are businesses that are now located in Nebraska that were not here before; there is a conference center; and now the University of Nebraska-Omaha is moving its business college there, he added. Milliken expects to see the same kind of catalyst effect with Nebraska Innovation Campus. ●

For more information visit www.unl.edu/sdn/opportunities
Innovation image provided by JJR



Any economic growth anywhere in the state of Nebraska helps everyone in the state of Nebraska.

- Harvey Perlman, Chancellor
University of Nebraska-Lincoln



Helping Kids Learn, Grow and Connect – Wherever They Live

By Mary Garbacz

Eighty-five percent of Nebraska's school districts are rural. That means that with the exception of Lincoln and Omaha, the majority of the remaining youngsters in Nebraska attend rural schools. Even though there are more students in Lincoln and Omaha than in the rest of the state, Nebraska is a perfect place to research the strengths and needs of both rural and urban education, according to Susan Sheridan, George Holmes University Professor and Willa Cather Emeritus Professor of Educational Psychology at UNL, Professor of School Psychology and Director of the nation's only National Center for Research on Rural Education (R²Ed). The center was established in 2009, the result of a nearly-\$10 million grant from the U.S. Department of Education's Institute of Education Sciences that will keep R²Ed on the UNL campus for five years.

Sheridan is also director of UNL's Nebraska Center for Research on Children, Youth, Family and Schools (CYFS) where R²Ed is located. "The nature of the work that we do here in our Center for Research on Children, Youth, Families and Schools and the research we will be doing through the National Center for Research on Rural Education are very hands-on. It's very applied...it's very much about the lives of Nebraskans," she said. Everyone, regardless of where they live, has concerns about children, she added.

"Our work is really about real life and the things that matter most to people: education, child-rearing and health... healthy environments for children that are supportive, that are nurturing, that promote their learning and optimal development," Sheridan said.

Support and Training for Teachers, Improved Education for Children

The National Center for Research on Rural Education will provide support and training to rural schools and their teachers. More than 500 Nebraska teachers will take advantage of this training and other services and will apply new research-based methods in their classrooms.

Two R²Ed goals are improving reading skills for students in kindergarten through third grade and improving middle school and high school students' skills in science, technology, engineering and mathematics – known as STEM. STEM education is a national priority, Sheridan said, and rural school districts often are severely understaffed in these areas.

R²Ed will also focus on supporting teachers and families as they work together to address concerns they share for their children. Sheridan and her R²Ed leadership team have worked in urban and suburban areas, bringing families and schools together to set goals and develop plans to help kids succeed, but they have never tested that approach in rural schools.

"We know a lot about the challenges that families face in rural areas and the real difficulties in creating these connections across families and schools when you're talking about a school maybe being 30 miles away from home," she said. There are also other issues that get in the way of being able to create these relationships and partnerships. Logistics is one issue; concerns such as behavior and achievement are another. She expects the work of R²Ed will begin to bridge the barriers in rural areas that already are being addressed in urban areas.



- Dr. Susan Sheridan
(Photo by University of Nebraska-Lincoln)



CYFS nebraska
center for
research
children youth families & schools

Urban-Rural Differences

“There are a lot of differences between urban schools and rural schools. One is resources,” Sheridan said. Urban schools tend to have more resources and more specialists to address both behavior and academic concerns, she said. “In rural schools, we’re talking about large geographical distances separating small groups of children – an area that might span 300 miles. All the students are together in a couple of buildings because they have consolidated the educational opportunities for these kids.”

Logistical challenges such as snowstorms and agricultural schedules can keep kids away from school in rural areas, she said. Some limiting factors are physical challenges, like the distance between home and school. Distance is not only a consideration for students, it can be a consideration when planning parent-teacher meetings and creating close home-school partnerships.

There are often teams of science teachers, math teachers and counselors in an urban school system, but in a rural area, there might be just one science teacher for the entire K-12 school system, or one math teacher for a middle school and high school curriculum. “So not only is it fewer resources, but it’s limited access, fewer specialists and logistical challenges of creating connections,” she said.

Attracting and keeping high-quality teachers in rural schools is a challenge, Sheridan said, and research in R²Ed will emphasize teacher support and professional development, as well as ways to build resources for teachers in rural areas. For example, teachers and specialists in larger schools have the chance to share ideas and lesson plans with other members of say, the science team. That option isn’t available to teachers in some rural areas, so the R²Ed group is discussing ways technology can create virtual teacher lounges among some of the rural schools. “We’re hoping we can create these new

opportunities for camaraderie, connections, supports and communities of learning that teachers will want to ascribe to,” Sheridan said.

Besides Sheridan, the R²Ed core leadership team includes Todd Glover, Gina Kunz and Gwen Nugent, all UNL researchers with the Center for Research on Children, Youth, Families and Schools, and James Bovaird, a UNL educational psychology faculty member. However, there are partnerships with many other areas.

“The work that we’re doing and partnering with other science researchers around campus represents a very unique marriage of educational researchers that come from our center, with content people from the area of engineering or physics or other hard-science disciplines,” Sheridan said. “People come to the table with different strengths, different areas of expertise and we are creating something new and different that none of us would have been able to create had we worked independently.”

Sheridan’s passion is families, and that guides her work. She discovered early in her career that learning about a child’s family situation was essential to helping the child. “So I created a new model for consulting with teachers that connected families very squarely in the whole process and then created a whole research program around that,” she said.

“Children work and live and function and learn and grow in many different environments, and there are connections between them. The stronger the connections, the more support and safety nets there are for children,” she said.

“The learning opportunities for children extend well beyond a school building. If we’re really concerned with educating children, we have to think very broadly about where all those learning opportunities occur.” ●

For more information visit www.unl.edu/sdn/opportunities

Our work is really about real life and the things that matter most to people: education, child-rearing and health... healthy environments for children that are supportive, that are nurturing, that promote their learning and optimal development

- Susan Sheridan
Professor and Director of the National Center for Research on Rural Education

Choosing a Medicare Part D Plan: UNL Extension Offers Advice

By Sarah Van Dalsem

Medicare national health insurance has been available since 1965, but coverage for prescription drugs wasn't included until January 1, 2006. That's when Congress introduced Medicare Part D, which offers a variety of cost-saving prescription drug plans to Medicare beneficiaries.

What Medicare beneficiaries didn't get from Medicare Part D was an easy way to answer the question "which plan is best for me?" One way people can obtain help in answering that question is through University of Nebraska-Lincoln Extension, which offers one-on-one, personal assistance.

Mary Ann Holland, a University of Nebraska-Lincoln Extension educator, is one of four Nebraska educators who are specifically trained by the Senior Health Insurance Information Program (SHIIP) through the Nebraska Department of Insurance. Holland is the trained extension educator and is located in Weeping Water; Mary Loftis is in Tekamah; Jeanne Murray is in Alliance; and Carla Mahar is in Chappell and Oshkosh. These educators offer assistance year-round to Medicare beneficiaries, but additional extension educators statewide counsel beneficiaries during the open enrollment period in November and December. People who would like to take advantage of this assistance can call their local extension office any time and they'll be given the direct contact information for the nearest extension Medicare Part D advisor.

Holland said Medicare Part D consists of several drug plans, each offering insurance coverage for different prescription drugs. Holland's job is to help each beneficiary determine which plan covers the needed drugs and also works best with the beneficiary's budget. Plans change every year, so an annual advising session is usually necessary. Some people are paying a great deal of money every month for prescription drugs, she said, so carefully examining drug plans and choosing the right one may save some people hundreds of dollars every month.

However, extension educators will not tell a beneficiary which plan to choose. "Our job is to provide them the best educational information that we can, point out their options and help them see if there are any red flags in the drug plan that may cause them a problem," Holland said. "Affordability is one of the key things, as well as finding a drug plan that covers your drugs."

Medicare's website includes a drug plan finder, which helps beneficiaries determine which plans best suit individual needs. However, Holland said, many beneficiaries are much older than 65 and are not comfortable using computers. "So that's where someone to assist and educate is necessary," she said.

Holland asks each beneficiary to bring his or her Medicare card to the advising session. She enters into the computer the



Mary Ann Holland

person's Medicare information, the prescriptions they take (including dosages) and the beneficiary's zip code; then the screen displays the drug plans available for that individual. Prices of drugs continue to change, she said, so premiums change, as well.

Holland says it's a bonus whenever an adult child, caregiver or spouse comes along to an advising session because the information can be complex and hard to understand. "They help fill in the gaps and remember what was said," Holland said.

"While University of Nebraska Extension certainly did not invent Medicare, the partnership between the Nebraska SHIIP and extension is a good one," Holland said. One of Medicare's needs is to get out in a rural area and meet with individuals, and that's what Social Security is looking for too, she said. The Social Security Administration is trying to identify people who qualify for available low-income subsidies. "Extension is the outreach that benefits them most, and that's already built into the extension system," Holland said.

Most Medicare beneficiaries are 65 or older and often have limited resources, she said, and choosing the right prescription drug plan can make a big difference in their monthly budgets. "A lot of people in this age group are folks who lived through the Depression, so they are in their upper 80s," she said. "They are proud people. They don't want to be handed money...they don't feel that's right." However, there is an income bracket above Medicaid called a "low income subsidy" and Holland said there is a dollar benefit for them – all they have to do is apply. Extension educators can help these people with the application process.

The extension Medicare educators in Nebraska held more than 100 enrollment events between mid-November and late December in 2009, assisting more than 1,800 Medicare beneficiaries and their families or caregivers. Between the fall of 2008 and the summer of 2009, extension educators counseled 2,295 clients and 938 either changed prescription drug plans or were enrolled in a plan, saving a total of nearly \$646,000. "Those dollars, then, become available to be used in the beneficiary's local economy," Holland said. ●

For more information visit www.unl.edu/sdn/opportunities

Handling Rural Conflict Can Make or Break Small Communities

By Sarah Van Dalsem

Many rural Nebraska communities are focused on progress and growth, with residents concentrating on attracting and retaining young people, developing strong businesses and improving the community's infrastructure.

However, rural development doesn't happen overnight and just like in larger cities, it most likely doesn't happen without some conflict among people in the community, said Randy Cantrell, an extension professor with the Nebraska Rural Initiative at the University of Nebraska-Lincoln.

"It's common for conflict to exist anywhere," said Cantrell. "Conflict's how we solve problems. Conflict's how we set up the basis for negotiations to come to agreements."

Community disagreements are so common that it is an area of study for Cantrell and other rural researchers at UNL, as well as in institutions across the nation. Cantrell believes that to be successful, a community needs to make the decision to work together for the good of the community and commit to improving internal and external communication. One of the first steps is for the community to create a vision for its future that unites a large percentage of the residents – a vision that compels residents to invite change and invest in the community.

Even so, differences of opinion among residents can arise over many issues, including taxes, urban vs. rural ideas, schools – or just personalities, Cantrell said.

Moving Past Conflict

In small communities, conflicts can spill over into many facets of life, he said.

"If I let the fact that the guy that runs the hardware store is cheating on his or her spouse affect my ability to buy a hammer, or if some family issue that existed between my family and their family 20 years ago affect my willingness to do business...these things really become kind of problematic," said Cantrell.

Because rural conflict can become very personal to people, the need for unity and communication in a rural community is especially important. Resolving the differences among community members, Cantrell said, is the first step to reaching a common community vision.

"If you go about the business of trying to enhance the economic viability and enhance the quality of life in a setting, then you have to have some sort of agreement on what direction you're going," he said. "You have to be able to put things behind you and move forward."

In order to try and mend a division among the people, Cantrell suggests holding community gatherings or celebrations to help build a network of people who will work together in the future.

Communities that hold active celebrations not only help heal divisions, but engage new and longtime residents in a common activity.



Dr. Randy Cantrell

Open Communication Aids Understanding

"It's very common among newcomers in rural communities to say, 'I'm here, but it didn't provide me with the opportunity to participate in the community that I thought it would. My skills aren't recognized, and so I think what I'll do is go someplace else and try again,'" said Cantrell.

Cantrell said people who are a part of a multi-generational family are not likely to leave if they get upset, but newcomers will leave if they cannot integrate into the community. If a community hopes to grow its population, attracting new people to the community and giving them a reason to stay are important goals.

Engaging Newcomers

"If I get three people in a room to have a conversation that they haven't had before, I'm engaging in development, I'm making possible more opportunities," said Cantrell. "If folks allow themselves to become entrenched and angry, then those conversations don't occur and the possibility of some kind of compromise, some way to move forward, is limited."

Cantrell said residents should avoid sneaking up on others with information or actions and should also avoid giving people a reason to believe a decision was made without their input or consideration. "Backroom deals" aren't acceptable – the debate must be put on the table where people can participate, he added.

Media outlets in town also need to have a commitment to presenting all sides of an argument. Extension educators from UNL are also available in most counties to help people understand all sides of tough issues in the communities, Cantrell suggested. The role of extension educators is to provide information based on research, he added. ●

For more information visit www.unl.edu/sdn/opportunities

One Million New Scientists. One Million New Ideas.™

Nebraska 4-H Program is working to achieve the national goal of educating one million new scientists by 2013 in science, engineering and technology.

By Sarah Van Dalsem

That's the national 4-H goal – to educate one million new scientists in the U.S. by 2013. It's an ambitious goal, but one set by national 4-H administrators so more young people will consider careers in the sciences.

Elizabeth Birnstihl, Associate Dean and Associate Director of UNL Extension and Nebraska State 4-H Administrator, said she and several of her national counterparts met several years ago to share concerns that young people were not excited about science, engineering and math, and what that would mean to the next generation.

"We set a goal for ourselves and the goal was One Million New Scientists. One Million New Ideas™, which meant we wanted to engage a million young people," she said. That national initiative extends across all the land grant institutions in the United States and its territories.

The 4-H Science, Engineering and Technology program (SET) is designed to teach science to kids so it's fun and hands-on, she said. Thousands of Nebraska 4-H members apply SET skills through the Nebraska 4-H robotics program, in which kids design, build and program robots.

"They love, love, love science and engineering and technology, if you can make it fun!" Birnstihl said. "They have started robot clubs on campus and in counties. We have robot clubs at Boys and Girls Club sites, we have robot clubs in commercial businesses, we have robot clubs in schools, we have robot 4-H clubs," she said. "What does it teach them? It teaches them the applications of math and engineering and technology." Birnstihl said 4-H has other projects to engage kids in science-focused learning, including wind power and insects. "If they can get excited about this whole field, there are career opportunities. That's the goal. To create the next generation of scientists, engineers and technology specialists," she said.

In 2007, the National Academy of Sciences published a book titled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. That book – called the RAGS report – makes four recommendations:

"1) Increase America's talent pool by vastly improving K-12 mathematics and science education; 2) Sustain and strengthen the nation's commitment to long-term, basic research; 3) Develop, recruit and retain top students, scientists and engineers from both the U.S. and abroad; and 4) Ensure that the U.S. is the premier place in the world for innovation."

4-H in Nebraska

Nebraska's 4-H program engages 135,000 young people and 10,000 volunteers, giving Nebraska one of the highest per capita participation rates in the nation, Birnstihl said. "We provide applied, experiential learning experiences," she added. "It's our job in 4-H to take our science-based education here at the University of Nebraska and help extend that beyond the classroom."



Dr. Elizabeth Birnstihl holds a robot like the ones in the 4-H Robotics project

Nebraska 4-H members study science, entrepreneurship and careers beyond the classroom, using the resources of the university to extend the learning to out-of-school time, she said. Besides that, the 4-H program emphasizes higher education and currently, 96 percent of Nebraska 4-H members go on to post-secondary education.

Birnstihl attributes the success of the Nebraska 4-H program to three things – getting kids excited, having a good curriculum and having volunteers that nurture members' interests. Additionally, the University of Nebraska embraces 4-H and encourages visits to college campuses so young people know what it's like to be on a university campus, she said.

One of the 4-H slogans is "Step up to the responsibilities of the next generation," Birnstihl said. To achieve that goal, 4-H focuses on: careers; healthy lifestyles; science, engineering and technology; and citizenship, in addition to its longstanding animal science and nutrition projects. "We want to help young people learn to thrive and grow; they are our next leaders and we need to prepare them to lead," she said.

Birnstihl hopes the future will show these young people leading in multiple areas – finding cures for cancer and diabetes, going to Mars, leading the world in technology. "I think we can help young people dream, and I think we have to help them, encourage them to be successful. Helping young people be successful is our job." ●

For more information visit www.unl.edu/sdn/opportunities

Planning Your Meals to Save Your Life: Nutrigenomics

By Sarah Van Dalsem

Imagine the day when you'll find out the diseases you may get in your lifetime – and the foods you can eat to prevent them.

“Prevention of disease – that's what we're trying to do – as opposed to curing disease, which is much more expensive and, of course, comes with much more personal tragedy,” said Janos Zempleni, Professor of Nutrition and Health Sciences at the University of Nebraska-Lincoln. Zempleni heads a UNL team called Nebraska Gateway for Nutrigenomics – one of just a few groups in the world focusing on such research.

“We really identify which genetic makeup predisposes you to increased disease risk and we identify dietary interventions that can be used to minimize the disease risk,” he explained. Even though the study of nutrigenomics is relatively young, Zempleni and his team are beginning to solve mysteries such as why some people live long lives in spite of what they eat, while others aren't so lucky.

Members of the nutrigenomics team have individual specialties and study the interactions between nutrients and an individual's genes – how nutrients regulate gene expression, Zempleni said. As their work continues to unfold, people will learn whether they are at risk for a variety of diseases, as well as whether their children may be born with specific birth defects. Zempleni said the team includes about 30 faculty members from 12 different departments, both at UNL and at the University of Nebraska Medical Center. Team members specialize in plant science, animal science, food and nutritional science, biological sciences and biochemistry, among other specialties, as well as what Zempleni calls “hard core, bench-top scientists” working in genetics, ethnogenetics and gene regulation.

Most of the independent nutrigenomics researchers are funded by grants from three major organizations – the National Institute of Health, the National Science Foundation and the United States Department of Agriculture.

Understanding the Science

Zempleni said human genetic makeup is 99.9 percent identical, but that remaining one-tenth of one percent is what makes everyone different. That one-tenth of one percent can have major implications for nutrients, vitamins and disease risk.

For example, one specific gene in that one-tenth of one percent plays an important role in the metabolism of the vitamin folate, which is a B vitamin. If an individual carries a minor change – called a polymorphism – in this specific gene, it makes the protein produced by this gene much less stable, he explained, dramatically enhancing that individual's requirement for folate. Although most people consume adequate folate in the foods they eat, specific genetic testing will indicate who needs more folate.

“This change in the gene comes with increased risk of



Dr. Janos Zempleni

cardiovascular disease and also comes with increased risk of giving birth to children with birth defects such as spina bifida,” Zempleni said, but “this little change in the gene can be easily characterized in the lab. The beauty about this is you can eliminate this enhanced disease risk by supplementing your diet with folate, so it's really kind of a change that is intriguing to know about and easy to address nutritionally.”

At some point, it may be possible to have large-scale genetic testing for disease, Zempleni said, but not all disease risk will be related to nutrition. Additionally, some people will be predisposed to diseases that pose ethical dilemmas. For example, screening for psychiatric disorders or for cancer might limit an individual's eligibility for employability or insurance. For that reason, Zempleni said, “we really want to limit this to polymorphisms that are limited to nutrition simply because they can address this very easily by dietary intervention.”

Zempleni and the people who work in his lab have pioneered an area of research demonstrating that biotin – a B vitamin – binds to certain proteins to articulate gene expression and DNA repair, he said. “The DNA aspects of this relates my research specifically to cancer and DNA repair,” he said.

“I think UNL and Nebraska is uniquely positioned in that this is where most of the foods in the U.S. are produced. We have this critical mass of plant and animal breeders, we have the legislature behind us, we have agricultural business behind us. Of course, now with the advent of the Nebraska Innovation Campus, that really adds another layer of opportunity to our group,” Zempleni said.

Increasingly, Zempleni expects that UNL Extension educators will be able to explain nutrigenomics to people who need the information, along with the role of a well-balanced diet in overall health. ●

For more information visit www.unl.edu/sdn/opportunities

“Impacting the World Three Times a Day” and “Food from Thought”

Phrases show relevance of UNL food science, food processing research

By Mary Garbacz

Rolando Flores dreams big. As department head of the University of Nebraska-Lincoln Department of Food Science and Technology, he dreams that the work of the department's faculty will make every person a healthier individual. As director of the UNL Food Processing Center, his dream is to make Lincoln the food capital of the world.

Under Flores' leadership, top UNL scientists are conducting the kinds of complex research that beg to be explained, but the impact of their work means better food safety, healthier individuals and food businesses that are more successful. It also means undergraduate and graduate programs for students not only in food science and technology for humans, but for companion animals as well.

“Impacting the World Three Times a Day” is the motto of the Department of Food Science and Technology; “Food from Thought” is associated with The Food Processing Center. Both are located in The Food Processing Complex on the UNL east campus, where locals know you go to buy student-made cheese and ice cream.

Food Science and Technology – Focusing on a Healthier You

“In terms of research, we have been moving from a very traditional food science and technology department to more of an avant garde department,” Flores said, focusing on how an individual person is affected when certain foods are consumed.

“We have moved traditionally from the ‘farm to table’ to ‘farm to gut,’” Flores said. “Gut” is intestinal biology and is one of the most exciting things happening right now.” Flores explained that the intestinal tract contains more microorganisms than cells in the body and it has been learned that many diseases, as well as nutrient absorption, take place in the intestinal tract. “We are focusing on food for the individual – how one type of nutrient is absorbed by the individual,” he said.

Recent studies associate diabetes, as well as other diseases and conditions, with what a person eats and how that individual's system processes the nutrients. Flores has hired faculty members who specialize in targeted areas, including a specialist in probiotics and prebiotics, who is researching what microorganisms work in a beneficial way for an individual; a specialist in intestinal microbiology, who is researching the microorganisms in the gut, but also providing that information to the food industry; a specialist in mucosal immunology, who performs research on the effects of microorganisms in a germ-free lab setting; and a grains specialist, who focuses on

starches and carbohydrates. These are fundamental areas of work that focus on the individual, Flores said, and also connect the food science and technology with other NU departments, colleges and campuses. Flores has a Ph.D. in grain science from Kansas State University and worked as a research agricultural engineer with the U.S. Department of Agriculture before coming to UNL in 2006.

Food safety is not only an area of microbiology research in the food science and technology department, it's also an area of outreach, or extension. “We have a faculty member who works with food companies and assists them, along with faculty members in animal science, in setting up programs to keep their facilities clean for processing food and preventing what could be a terrible contamination,” Flores said. A Food Safety and Security Pilot Plant in the department is where testing is done to determine whether the processes in place in production facilities are effective in killing pathogens that could cause illness, Flores said.

Nutraceuticals, Flores said, is another departmental specialization. Nutraceuticals are elements of foods that have been proven to be useful in preventing or treating disease. Examples of nutraceuticals are Omega 3 fatty acids, such as fish oil, and antioxidants in dry beans, both of which have been researched extensively at UNL. “It's creating a very fertile area...identifying nutraceuticals that could be added to foods to create functional foods,” he said.

The department's food allergy program works closely with industry and governmental organizations in developing methods to test for the presence of allergens such as nuts and seafood. “We have a very unique program here in the department that identifies (food) allergens,” Flores said. It is a unique lab, he added, that is known worldwide.

Food Processing Center – Adding Value to Ag Products, Supporting Entrepreneurs

When Nebraska's state senators voted to establish the UNL Food Processing Center in the early 1980s, the goal was to create value for Nebraska's agricultural products, Flores said. For example, corn processed into cornflakes sells for more money than the unprocessed corn. “That's the issue of value-added. By doing processing, you increase the value.”

The basic mission of The Food Processing Center is economic development. “We provide support to individuals in terms of technology transfer, financial management, strategic planning, feasibility analysis and in writing proposals,” he said. “Last year, we had a success rate of 100 percent...their proposals have been funded.” The Food

Processing Center offers four phases of training to entrepreneurs; laboratory testing to food-related businesses; and research and development services to companies.

“We pride ourselves in having state-of-the-art pilot plants,” Flores said, and new, sophisticated equipment such as extruders, a reverse-osmosis ultrafiltration system, a vibratory fluidized bed dryer and a high-pressure processing unit. The high-pressure processing unit, for example, allows pasteurization with pressure instead of heat. That technology is used in packaged guacamole, for instance, which is displayed at room temperature, is safe and retains the product’s flavor and color.

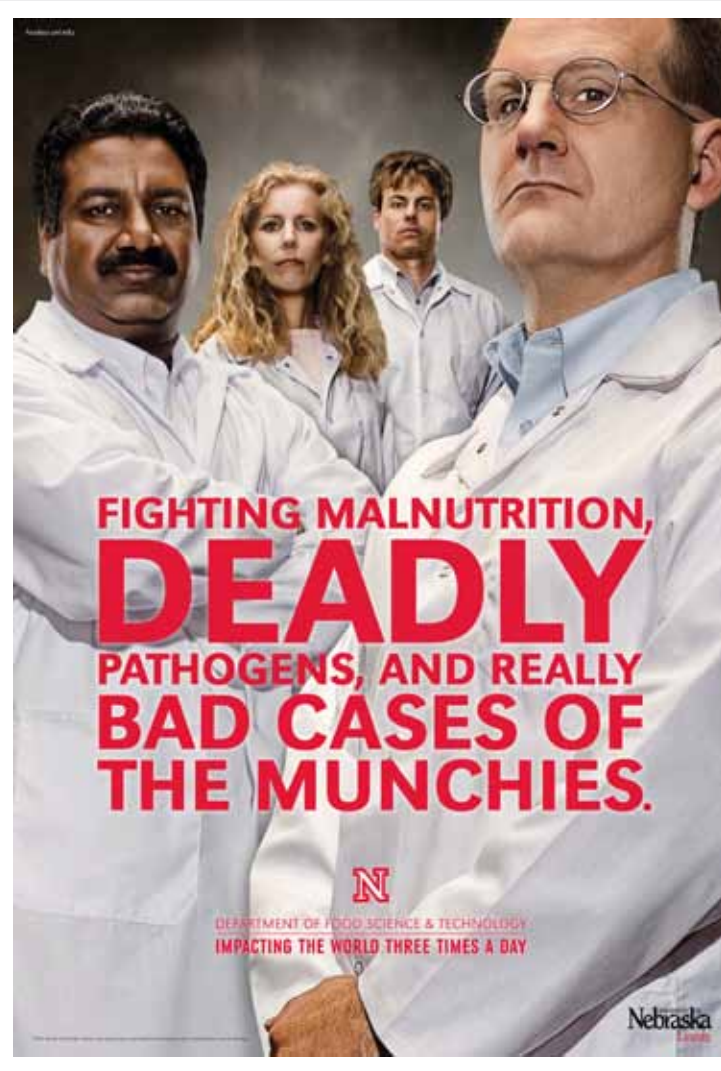
The Food Processing Center trains and supports entrepreneurs who are starting or improving food-related businesses and tests the items the businesses produce. The center manages and charges rent for customers who wish to use the center’s facilities, Flores said, and those funds help maintain and support that sophisticated equipment.

The dairy plant, in which university students manufacture cheese and ice cream, also rents space to entrepreneurs. “There are several cases of cheese makers in Nebraska that learned their trade here,” Flores said. “They first started working in some of the pilot plants, then took their products to the farmer’s market a couple of weeks later. This is a very direct connection in value-added and promoting economic development.”

The Food Processing Center offers training to entrepreneurs in Nebraska, but also to global entities through videoconferencing, featuring simultaneous language translation. Participants pay a fee for the training, he said.

The training, Flores said, consists of four levels of workshops that draw participants nationwide. In the first level, entrepreneurs determine whether they are committed to putting a product on the market. In the second level, the entrepreneur works with the center’s consultants to fine-tune the product. The third level is a national conference hosted in Lincoln and Omaha, presenting specific issues such as brokerage and transportation of products. The fourth level, he said, will provide training for established entrepreneurs who want to expand their businesses into an international market, as an example. ●

For more information visit www.unl.edu/sdn/opportunities



Above: Dr. Rolando Flores

Below: a UNL Department of Food Science & Technology poster

Feeding Millions of People Motivates UNL Grains Breeder

By Mary Garbacz

The work of P. Stephen Baenziger feeds three million people every year that otherwise might not be fed. That's what got him into agriculture and that's what has motivated him every day of the last 24 years at the University of Nebraska-Lincoln.

Baenziger, who is the Eugene W. Price Distinguished Professor of Small Grains Breeding and Genetics, mainly develops new varieties and cultivars of wheat, but also breeds triticale and barley. There is one public small grain breeder for the state of Nebraska; that person is hired by the University of Nebraska-Lincoln.

"Nebraska, to me, is the greatest wheat-breeding position in the country," he said, noting that historically, the greatest breeders of the previous generation were at Nebraska. "It's a great place to breed, it's a great tradition, great germplasm, wonderful environments, wonderful people to work with," he said. He accepted the job at Nebraska because it involved two things he loves: breeding crops to feed the world, and teaching.

Nebraska is in the top 10 of wheat-producing states in the country and wheat ranks as the fourth-largest crop produced in the state. "In 2008, we produced about a 73.5 million-bushel crop," he said. "Then, you figure that the average person eats somewhere around 150 pounds of wheat a year, so that 73.5 million-bushel crop, which is roughly 4.5 billion pounds of wheat, means we could feed roughly 29 to 30 million people from the Nebraska wheat crop. So, that's a lot of satisfaction when you're working on a crop that could feed one-tenth of America," Baenziger said.

It isn't all about quantity, though; it's also about quality, and that includes the growing market for organic products. The wheat team at UNL includes specialists in breeding, plant pathology, entomology, irrigation, dryland, pesticides and herbicides, and quality. "You want to produce what you can sell, not just sell whatever you produce," Baenziger said. "You want to make a quality loaf of bread."

Improved Science Takes Time, But Reaps Financial Benefits

"My guess is that the State of Nebraska probably spends \$1.5 to \$2 million dollars on the wheat project, but they're getting a \$30 million return at the farm gate from what we've done. So, I think if you can get a 15 to 1 return on your investment, most people would say that's probably okay," Baenziger said.

It takes 12 years to develop a new wheat variety, Baenziger said, but it pays off. Genetic improvements in Nebraska wheat have improved bushels per acre by more than 20 percent since 1966, he said. The 73.5-million-bushel wheat crop that was produced in Nebraska in 2008 had a dollar

value of nearly \$300 million, he said, which means that 20 percent of its worth is due to genetics. That means that \$60 million is because of wheat breeders like Baenziger. About half of that \$60 million directly benefits the farmers who produce the crop. The other 50 percent benefits the value chain, such as the processors who produce flour, then the bread or other products that contain wheat.

"The good news is we're getting a little better," Baenziger said. Statistics prove that since 2008, genetic improvements have increased the value of the wheat crop by about 23 percent instead of 20 percent. "Our new varieties are very well accepted and our yields have gone up. So the \$30 million a year is a very low estimate, and that's just in Nebraska. A lot of our varieties are grown in South Dakota, Wyoming, parts of Kansas and part of Colorado, so in the region, our impact is much larger," he added.

Whenever you produce a plant, it has its own genetics and its own environment, Baenziger said. Environment is where the plant is grown and includes such things as weather, whether the crop was fertilized, whether the crop was sprayed for weeds and whether insects and diseases were controlled. Environment also includes such things as conservation tillage – whether the soil was tilled or whether the no-till method was used to prevent soil erosion.

Triticale, Barley and...Rice?

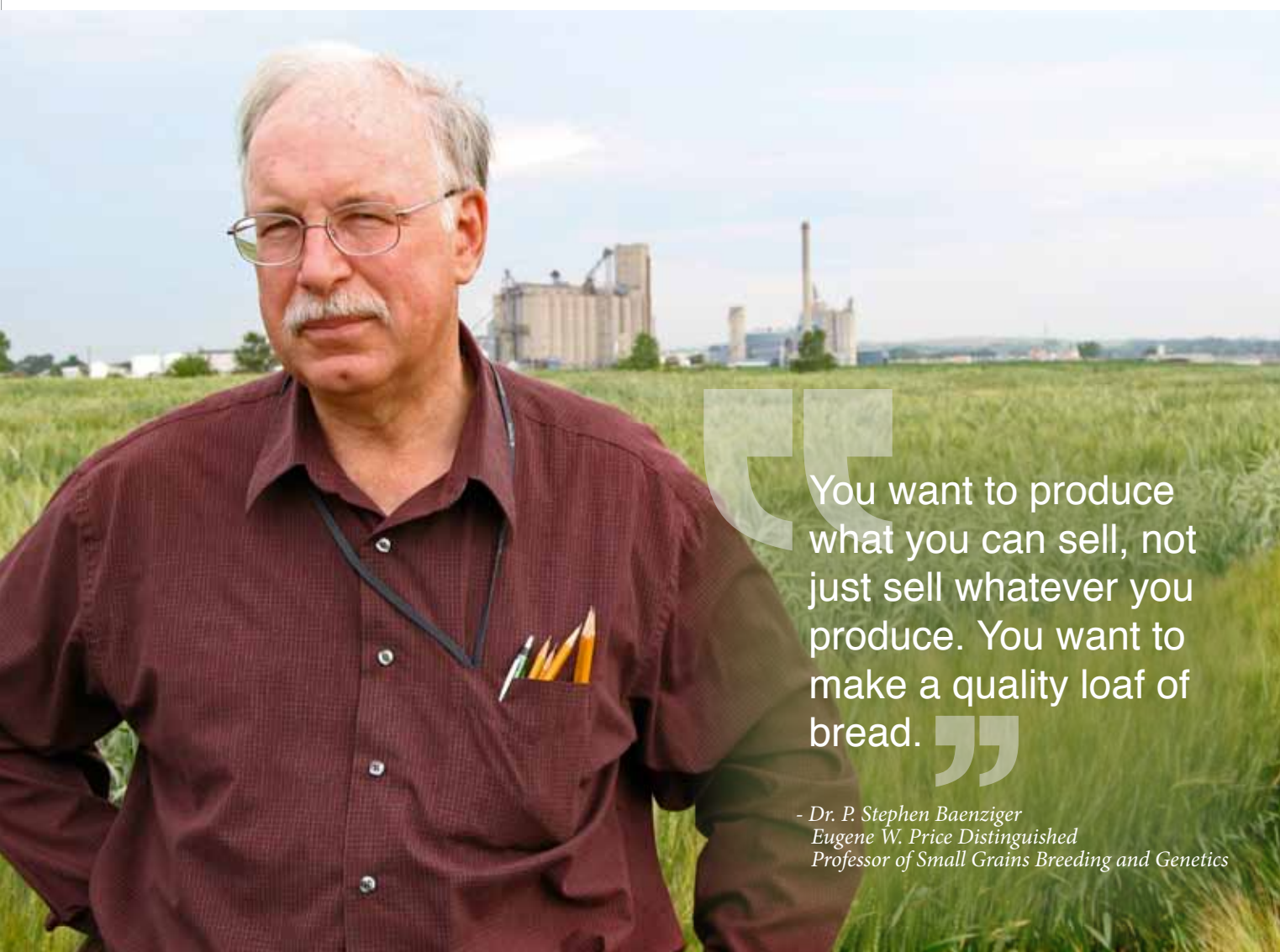
Baenziger also works to improve other small grains, including triticale, barley and rice.

Triticale can be grown in much tougher conditions than wheat, Baenziger said, and is a natural for animal feed in areas where it's too cold to grow corn. Triticale is also a good crop for biomass, which uses organic plant and animal material as renewable fuel sources.

Barley, he said, is used mainly for animal feed, but also for forage. It doesn't have the winter hardiness of triticale, so is grown in the slightly milder climates in Kansas and Oklahoma. "We're the last barley breeder in the Great Plains, so we do it because we think the growers need choices. As a tenured professor at a university, you can do that. That's why we do the other two crops," he said.

But rice?

Baenziger is a trustee for the International Rice Research Institute (IRRI), which is located in the Philippines. "I am a wheat breeder and the breeding techniques I use in wheat are very similar to the techniques they use in rice," he said, adding that he is the only breeder on the IRRI Board of Trustees and also the only American. "That's because the U.S. has made a commitment to foreign aid and their interests need to be represented, demographically, on the board," he said.



You want to produce what you can sell, not just sell whatever you produce. You want to make a quality loaf of bread.”

- Dr. P. Stephen Baenziger
Eugene W. Price Distinguished
Professor of Small Grains Breeding and Genetics

*Photo of P. Stephen Baenziger in a Nebraska wheat field.
Photo by Aaron Franco.*

Cereal crops are the majority crop for feeding the world, Baenziger said, and each crop is represented by an international organization. In addition to IRRI in the Philippines, the International Center for Maize and Wheat Improvement is located in Mexico and sorghum, which is the other major global crop and also important in Nebraska, is represented by an international organization based in India.

Funding Sources

Breeding new varieties can be costly; salaries are paid by the University of Nebraska-Lincoln. Additional funding comes from the Nebraska Wheat Board, which has provided funding since 1986 through the wheat checkoff program. The Nebraska Wheat Board also used checkoff funds to pay for a quality laboratory. “We can never thank the Wheat Board enough,” he said. “The growers have always been a huge mainstay.” However, Baenziger said millions of dollars in federal grants provide funding for basic research, because “we never want the growers to pay

for research that doesn’t directly impact them short-term; we don’t think that’s a good use of their money.” Additional funds come from other associations and from corporations. “We are inclusive; we think that corporate America is part of ‘our people’ too,” he said.

Baenziger grew up in the 1960s and was influenced by the government’s efforts to eradicate hunger in the United States. “I went to college to be a human nutritionist, but it became obvious to me that if I were going to work in human nutrition, I would be defining a problem without providing the mechanisms to solve it,” he said.

“I got into agriculture because I wanted to work in feeding people, and what I’ve learned is that 80 million to a billion people go to bed hungry every night,” he said. “And so, my goal is to continue to provide the world the global wherewithal to be able to feed ourselves whenever we choose to feed ourselves. I hope I will live that long to be able to see that day.” ●

For more information visit www.unl.edu/sdn/opportunities

Understanding Nebraska: Pride, Geography and Self-Deprecation

By Becky Gailey

What makes Nebraskans proud? What makes them stay, generation after generation, in what some call “flyover country”? What makes them stay through long, cold winters and long, hot summers, often hearing someone say, “It could be worse”?

Conquering geography

“A Nebraskan...is attached to a place that many other people might not be attached to because of its wide horizons, what is perceived as a lack of detail in landscape by many people,” said David Wishart, a University of Nebraska-Lincoln geography professor and editor of the Encyclopedia of the Great Plains.

Many of Nebraska’s settlers found the wide horizons lonely and difficult to cultivate. So many of them left that Wishart called 19th century Nebraska a place of “chronic impermanence.”

But some people stayed. They stayed through the Great Depression, the Dust Bowl and the farming crisis of the 1980s. They stayed and helped cultivate the Great Plains, a region Wishart described as “the most successful agricultural region in the world over the last 100 years.”

“The self-deprecating boast”

Despite the dependence of America and other countries on Great Plains agriculture, many people view Nebraska as one of those flat states somewhere in the middle of America.

Wishart said that in the Great Plains “there is a sense of perhaps inferiority, a sense of feeling rural and maybe out of the stream of life that’s going on in New York and San Francisco and the bigger metropolitan [areas].”

Wishart believes, however, that this feeling of inferiority also creates a sense of pride in Nebraskans, which is one of their major characteristics. They are proud to live in this land that was too harsh for others, and out of this pride comes an interesting reaction — the “self-deprecating boast” — a way of showing pride in the concept of being unpopular, of being proud of traits others would not find attractive.

Instead of struggling to “fit in” with the rest of America, Wishart said Great Plains people react to America’s view of their geography with a sense of humor. Wishart found an example of a self-deprecating boast when he visited a bar in Yates Center, Kansas. The pub, Earl’s Tavern, was one of the most ramshackle looking places Wishart had ever seen, and hanging on the side was a sign saying, “We only look expensive.”

Wishart, who was born and raised in northeast England, has visited several restaurants in rural Nebraska. Rural Nebraska still has insular characteristics, despite the fact that new communication technology is bringing the world to rural communities, Wishart said. When he enters one of these restaurants, conversation often stops because he is

someone different.

“People are not unfriendly; people are almost shy,” Wishart said. “Whereas it might be difficult to get a conversation going there, if I were to get in my car and break down a mile down the road, any one of those people would stop and fix it... so I see it as a generous place.”



Dr. David Wishart

A sense of place

Nebraskans’ humorous response to being thought of as “rural” is partly due to their strong attachment to the land. According to Wishart, it is much easier for people to develop a strong sense of place in a rural area where chain restaurants and gas stations have not taken over Main Street, where family businesses still thrive.

“It’s difficult to have a sense of place where houses all look the same, the lawns look the same and it’s all so modern. Sense of place, I think, takes time, generations perhaps, on the land,” Wishart said.

But studies show that the newest generation of Nebraskans is leaving the land behind. A 2009 study by UNL sociology professor Randy Cantrell for the University of Nebraska Rural Initiative reported that 73 of Nebraska’s 93 counties experienced population loss between 2000 and 2007. Douglas, Sarpy (the Omaha metropolitan area) and Lancaster county (including Lincoln) all experienced growth during this time period, so rural population loss can perhaps be explained by immigration to urban areas.

More young people may be leaving rural Nebraska, but Wishart said they still retain their attachment to the land. In Lincoln and Omaha, unlike many other American cities, numerous residents are only one or two generations removed from rural communities. Nebraskans still return to their rural roots to visit family for holidays, and their sense of place, their attachment to the land, still exists.

Loss of the Reproductive Population

Nebraska’s rural youth leave home for a variety of reasons, but they leave behind the same two things: peers who have fewer options for life partners and an elderly population that does not want to leave.

“The social amenities of small towns are not great, but young people are full of ambition and enterprise. So I think

that young population's going to continue to leave, which means the reproductive population, the population capable and likely to have children, is gone. Therefore, you get a population structure which is top heavy," Wishart said.

In the United States, there are two areas with concentrated populations of people who are 75 and older: Florida, because people move there, and the Great Plains, because people want to stay there. While this attachment to the land is a core characteristic of a Plains person, it can have economic consequences when combined with a leaving reproductive population because a dwindling work force must struggle to support an aging population.

The Past

Nebraskans' deep attachment to rural areas seems even deeper when considering the number of people who have left the land. European immigrants established towns along the newly-built railroads, but the Sand Hills discouraged western expansion. Early farmers did not have the technology to survive in the more than 19,000 square miles of semi-arid land that stretches down from the South Dakota border, and many of them returned to the more fertile land of the East when their crops failed.

Today there are still remnants of the divide that formed between settlers who stayed in western Nebraska and those who left. Geography helped separate different cultures as people chose to settle parts of the state based on how they thought they could use the land. This divide evolved as western ranchers and urban businessmen developed different lifestyles.

It is always easiest to identify differences among the various geographical regions of Nebraska, but Wishart said that Nebraskans share more similarities than differences. For the most part, all Nebraskans eat the same food, watch the same TV shows, and, most importantly, define themselves as Nebraskans.

"There are a lot of similarities around the state, not least of which, probably the preeminent regionalism, is identification with the state and iconic things like the football team," Wishart said.

The Future

Although people left Nebraska in the past, the population of the state is now growing, and Wishart predicted that Nebraska's population will become increasingly urban in the future.

"Two-thirds of the population lives in the standard-statistical metropolitan areas of Omaha and Lincoln," Wishart said. "At a certain point you hit rock bottom. You do have to have farmers on the land still, but I can't see any option... What are young people going to do?"

Young people may be leaving their agricultural roots, but this does not mean some rural centers cannot flourish in the future. Towns with attractive locations, enterprising citizens and effective advertising will always be able to attract new residents. Despite the increased social and job opportunities in urban areas, rural Nebraska has many attractive traits: parents walk their children to school instead of commuting; friendly neighbors watch over children playing outside when mom has to run down the street to the grocery store; and the vast beauty of the Great Plains always lies nearby. ●

For more information visit www.unl.edu/sdn/opportunities



McCook, Nebraska

There's No Place Like Nebraska – for Weather

By Mary Garbacz

Nebraska's extreme weather must have been a surprise to the state's first settlers, especially when they tried to grow crops.

"It must have been awful!" said Ken Dewey, professor of climatology in the University of Nebraska-Lincoln School of Natural Resources. "I can't imagine being a farmer without today's technology of hybrid seeds and irrigation...going through the 22-year drought cycle when we turned into the Dust Bowl in the 1930s. What was it like for those people?"

Did those early settlers pass down their hardiness, their stubbornness to today's Nebraskans? "I think there's resilience in the DNA of people who live in Nebraska that they just hunker down and say 'we can do it,'" Dewey said. "So I think that's made the Nebraska population extremely resilient and very creative and innovative, and it's part of a culture that I didn't understand," he said.

Dewey grew up in the Chicago area and began a career there as a city planner – specializing in the design of on-and-off ramps. "I thought I was the happiest person in the world!" he said, especially when he learned that he might be promoted to designing guardrails and medians. But Illinois Planning Commission co-workers noticed he often stayed after work to watch sunsets and lake-effect weather from his 42nd floor office. One co-worker suggested his hobby might become his career, and that's when he returned to school to earn advanced degrees in climatology and environmental studies. He accepted an offer to teach and conduct research at the University of Nebraska-Lincoln, moving to a state where the wide horizons allowed him to see tornadoes, watch approaching weather systems and study the weather extremes the settlers battled in the 1800s.

"Nebraska began to grow on me in a way I never expected. I can't imagine being anywhere else," Dewey said. "What pulled me to Nebraska was the weather, and what has kept me here are the people."

Geography, Irrigation and Technology

Cozad, Nebraska marks the 100th meridian, representing 100 degrees of longitude west of Greenwich, England. The 100th meridian separates the United States into east and west, but in the last century, has been known as land that can be farmed without irrigation from land that requires irrigation. East of the 100th meridian, annual precipitation is at or above 20 inches. West of there, it's less than 20 inches...too dry to farm without irrigation. "So for farmers, I don't recommend Nebraska," Dewey said. "I think Illinois would be a better place. But if you're going to farm in Nebraska, the land's cheaper and it's probably a nicer place to be, but you need technology."

Even though the western part of the state is supposedly too dry to farm, the massive Ogallala Aquifer lies underneath much of Nebraska and supplies water for irrigation. Without irrigation, it would be tough to survive in farming, especially

west of that 100th meridian. A combination of creativity, technology and water resources has made survival possible, Dewey said. Late spring freezes require short-season hybrid seed developed if replanting is to be successful. Pests that plagued early farmers can be controlled, as can weeds. Hail? Early fall freezes? Not so much.

Does Nebraska Have a Climate?

Nebraska doesn't "own" a climate, and that's one reason it's exciting to live here, Dewey said. "We're not the snowbelt, we're not the sunbelt, we're not a tropical climate, we're not Florida, we're not Hawaii, we're not a coastal climate. We have to share whatever somebody's going to send us...we're in the middle of a flat continent open entirely to the Arctic...so the cold air can come down," he explained. "We're open to the Gulf, and all that heat and humidity can come up here. And the mountains off to the west can mess with our weather." This is the only place that can have 70-degree weather in January, then plunge to 20 below zero within hours, he said.

Nebraska may not be predictable and it may not be an easy place to farm, but it's perfect for the study of the weather and climate. Dewey said his students don't want to be in forested areas or areas with mountains or tall buildings – they want to be here, where there are few trees and the wide plains and open sky allow them to study storms and weather. Students not only chase tornadoes, they chase snow storms and ice storms, determining where the snow will be deepest and the winds strongest – and they wait in inexpensive motels for the storm to arrive so they can have a firsthand experience, he said.

Climate Change: Adapting to the Future

"When you ask 'is there climate change?' we have to be careful how we define it," Dewey said; "there is climate variation that's profound, and we can relate it to Nebraska. Weather is huge differences from minute to minute, hour to hour, day to day...climate is a slow, gradual change – kind of like aging. But like aging, climate changes slowly. Our worry is that climate is changing faster than we've seen in climate history," he said. So whether you believe it's climate change, which could be permanent, or variation, which means it's just changing in this direction, it is having a profound effect in Nebraska, he said.

The variability in Nebraska weather makes it more difficult to see climate change here, Dewey said. "When we have a Nebraska climate that can have 30 inches of snow in North Platte in the month of October...and one week after it was near 90 degrees...people don't see climate change because they're too busy jumping back and forth and reacting to all the information that's coming at them," he said.

"Think about the climate as a patient. It's aging – like a patient – and there are some things that don't seem right," he said. "There's no natural thing we can do to stop climate

“So, this is the future. Climate changes can’t be stopped, but you can adapt and use that as an opportunity to jump forward into additional technology and challenges, especially here in Nebraska.”

- Dr. Ken Dewey

Professor of Climatology in the University of Nebraska-Lincoln School of Natural Resources



*Left: Dr. Ken Dewey (Photo by University of Nebraska-Lincoln)
Above: A storm front moves through the Great Plains
(Photo by Dr. Ken Dewey)*

warming. There’s no natural thing you can do to stop aging, but you can slow it down by living a good lifestyle,” he said. Scientists don’t know if the climate is going to continue to get warmer, so “all we can do is slowly change what we’re doing.” As an example, Dewey said some countries are already operating vehicles experimentally that have rooftop solar panels that collect more energy than the car needs. That excess energy can be downloaded to the grid for other uses. Other new technologies are already in use, such as hydrogen power for vehicles, forming what may be the clean future of transportation.

The key is for people to adapt to changing conditions. “If it gets colder and you’ve found a way to get energy cheaper in Nebraska...and you’ve investigated different types of seeds for warmer conditions and at the same time found some seeds for colder...and you’ve insulated your home... you win,” he said. “It’s as simple as that. It’s called adapting.”

Dewey has traveled to other countries, as well as all 50 U.S. states, studying the effects of climate change. In 2009, he drove to Alaska and the Yukon on a 10,000 mile journey to study climate change with other scientists and found real and documented change. “I didn’t have trouble finding

climate change in the Arctic,” he said. Some glaciers had retreated more than nine miles in 20 years; permafrost had melted out, causing roads and buildings to collapse; wildlife had moved out of areas so indigenous cultures can no longer hunt for their food.

“That made me come back to Nebraska and say ‘what can I see here?’ And it’s so obvious,” he said.

Longtime Nebraska farmers acknowledge that there have been changes over the years, he said. Pests are wintering over; there is rust on the winter wheat because it’s damp longer in the fall and earlier in the spring. Generally, snow now covers the ground for a shorter period of time in the winter. There is more evaporation; some habitats are changing. Toxic weeds are moving up out of the south – weeds that we haven’t had to deal with in the past that are coming into Nebraska because the climate is changing, he said.

“So, this is the future. Climate changes can’t be stopped, but you can adapt and use that as an opportunity to jump forward into additional technology and challenges, especially here in Nebraska.” ●

For more information visit www.unl.edu/sdn/opportunities

UNL Water Center Addresses Quality, Quantity, Sustainability Issues

By Mary Garbacz

“Nebraska is unusual because we’re number one in the nation in the amount of irrigation that comes from groundwater sources,” said Bruce Dvorak, interim director of the University of Nebraska-Lincoln Water Center. Yet, when Nebraskans talk about water, residents of the central and western part of the state often look at the whole spectrum of water issues, while many residents of the eastern part of the state mainly consider water used at home. “I think a lot of people in the eastern part of the state take water for granted,” Dvorak said. In Nebraska, only about three percent of water is used by public water supplies and domestic wells; the rest is used in irrigation and by industry.

A UNL professor of civil engineering, Dvorak has a special interest in drinking water and sustainability issues and in the research and extension efforts related to those issues.

“Obviously, water is very important throughout the country. We all need to drink water, but it’s also very important for the economy here in Nebraska,” Dvorak said. Nebraska relies on irrigation to produce agricultural crops and for urban horticulture; industry relies on water as a cooling source; and water is used to generate hydroelectric power. Additionally, water is necessary in streams for fish, birds and other wildlife, he said.

“There are a lot of reasons water is important and a lot of reasons water research is important to help support those various uses and help improve both quantity and quality,” Dvorak said.

The Water Center serves a broad mission and addresses the science and engineering of the quantity and quality of water, as well as the management and laws and policies related to water. The Water Center is one of 54 centers established by federal mandate more than 45 years ago. Dvorak said the centers were established in each U.S. state

and territory for three main purposes: 1) to provide a place for competent research to expand the understanding of water and to address water problems; 2) to aid the entry of new water scientists, engineers and managers into the field of water study; and to communicate results of the research to water managers and to the public.

Nebraska’s Water Situation

Nebraska is unique because of the large groundwater supply provided by the Ogallala Aquifer, Dvorak said. “And that groundwater is of really high quality, so we’re fortunate. A very large amount of our water is from groundwater sources; in Nebraska, over 80 percent of our citizenry gets their drinking water from groundwater.” Also unusual, he said, is that almost half of Nebraskans are drinking groundwater supplies that have little or no treatment because the quality is so high. Dvorak said the aquifer provides some extra treatment and means many of the issues of national concern – such as various contaminants – are less of a problem in Nebraska’s public water and domestic water supplies.

Limited Water, New Laws

However, the amount of available water is limited. If we’re not careful, Dvorak said, we’ll start seeing more rivers and wells going dry, so that vision of the future has led to competition and concern. From a law standpoint, regulations are being developed to address competing interests, he said, balancing agricultural water use with other uses. “Many of our laws are based on outdated science. Many laws were developed 60 to 90 years ago when we did not understand the hydrology and the water cycle the way we understand today,” he said. “Now, we understand an awful lot more about the science, and we’re experiencing some climate variability,” he added. Better knowledge of science has



Almost half of Nebraskans are drinking groundwater supplies that have little or no treatment because the quality is so high.

- Dr. Bruce Dvorak (left)
Interim Director of the UNL Water Center
Photo by University of Nebraska-Lincoln

changed the way land is used and that has changed water usage. Conservation techniques such as no-till agriculture and efforts to protect the soil by reducing nonpoint source pollution have resulted in reduced river flow in some areas of the state, affecting contractual obligations to provide water to other states.

Sustainability, Pollution, Climate Variability...and Us

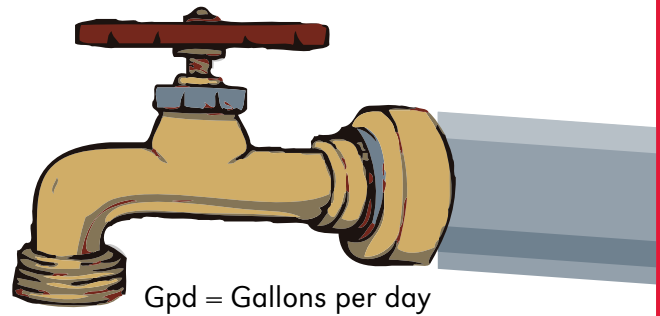
Above all, Dvorak believes a definition for “sustainable” will help to determine the future of water policy and law as scientists obtain a better understanding of science related to climate variability, drought and potentially, climate change. He expects there will be more discussion about both rural and urban nonpoint source nutrient pollution that will be particularly focused on the eastern third of Nebraska. He also expects more discussion related to micro-contaminants, including more scientific information on potential risks, adding that as a society, we are becoming more concerned about smaller and smaller risks. “I anticipate there’ll probably be discussion related to that, both research and policy and public discussion about what level of risk we’re willing to accept,” he said.

The future will emphasize working with the state’s economic systems to try to reduce water use without affecting production, he said, citing a recent UNL research project that has been shown to save two inches of water in each field to produce the same number of bushels per acre.

But Dvorak believes one of the biggest challenges in the next decade will be convincing people to put the science into use. “We have all this good science, we have great technologies, but the next challenge is what I call the human dimension,” he said, including having public policy and economic incentives in place as well as understanding the sociology of the way people use water.

“Nationally, internationally it is well understood that although there’s a need for more science and technology research, there’s also a real need to understand the human interactions with that science and technology so we can actually have it applied,” he said. ●

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Gpd = Gallons per day



Self Supplied Industrial
11,300,000 Gpd (99% private wells)



Self Supplied Domestic
52,070,000 Gpd



Livestock
108,310,000 Gpd



Public Supply
330,170,000 Gpd



Surface Water Irrigation
1,152,400,000 Gpd



Ground Water Irrigation
7,308,030,000 Gpd

Estimated Water Use in Nebraska in 2005

Source: U.S. Geological Survey
(www.usgs.gov)

Image provided by the
UNL School of Natural Resources





A GLOBAL INSTITUTE AT THE UNIVERSITY OF NEBRASKA

By being the place in the world that is leading the discussion on the use of water for food, water for agriculture, there will be benefits for Nebraska.

- James B. Milliken
President of the University of Nebraska

Global Water for Food Institute Races to Find Sustainable Solutions

Founding gift focuses on water, agriculture and doubling world food production with the same amount of water and land

By Mary Garbacz

Nebraska's strengths in agriculture, water and training scientists in all things that grow have come together to establish the global Water for Food Institute at the University of Nebraska. Experts from NU and around the world will collaborate, racing the clock to address the world's challenge of growing twice as much food by 2050 using the same amount of land and water.

"Right now, water for agriculture is about 75 to 80 percent of the consumptive use of fresh water worldwide. Not only do we need to produce much more food with a finite resource, we need water for other purposes," said James B. Milliken, President of the University of Nebraska. Developing countries also need improved availability and quality of water for drinking and for sanitation, he added.

A \$50 million gift to found the institute was provided in early 2010 by the Robert B. Daugherty Charitable Foundation. Daugherty founded Omaha-based Valmont Industries, one of the world's leading manufacturers of center pivot irrigation systems. Milliken said Daugherty is committed to the sustainable use of water for agriculture and also believes that soon, people around the world will know that this institute has solutions to challenges related to water for agriculture.

The university will build on the founding gift through funding partnerships with government, university and additional private sources, Milliken said. The key elements of the institute will be established rather quickly, including hiring an institute director and directors for research and policy analysis, then recruiting talented graduate students to take classes and conduct research. The basics of the institute have been in place for two years; the Daugherty Foundation sponsored the first annual University of Nebraska International Water for Food Conference in May of 2009, and with the Bill and Melinda Gates Foundation, sponsored the second conference in May, 2010.

Nebraska's Strengths in Water Research

Nebraska's economy is largely dependent on agriculture and the state already has a significant role in feeding the world, Milliken said, so locating the Water for Food Institute in Nebraska was a natural choice. The most heavily-irrigated state in the country, Nebraska sits above the largest freshwater natural resource in North America – the Ogallala Aquifer – so water quality, quantity, regulation, use and sustainability has long been a research focus in the state. Milliken said the Water for Food Institute will build on the success of the University of Nebraska-Lincoln

Water Center, which has been in existence for nearly 60 years and draws its nearly 100 faculty members from many parts of the university. The range of disciplines includes hydrology, engineering, plant science, drought mitigation, political science and law – addressing all aspects of the water challenges in the state. The Water for Food Institute will be located on the University of Nebraska-Lincoln campus, but also will draw on expertise from faculty from all four NU campuses. The institute will eventually be located on Nebraska Innovation Campus.

Facing the Challenge

"We need to be more efficient about the way we use water today; we need to produce crops that will survive and thrive with less water; we need to increase yields," Milliken said. Reaching those goals will be a challenge in Nebraska; it will also be a challenge around the world. Good policies must be put in place and good governmental decisions made about how this very important resource is used, he said. Regardless of the water challenges in Nebraska, "it's even more acute in other places around the world, so we need the best science to inform our decision-making and we think that's something we can contribute to," Milliken said.

Benefits for Nebraska and the World

"We have, we think, a great deal to offer the world. We also think by being the place in the world that is leading the discussion on the use of water for food, water for agriculture, there will be benefits for Nebraska," Milliken said. Degree programs will be created for undergraduate and graduate students that will create the most important place in the world for people who want to study and work in the area of sustainable use of resources for production of food. "We will become a center for scholarly activity for the best research in a range of disciplines," he added. Besides generating solutions from the Lincoln-based institute, the state will learn from the experts around the world who come to Nebraska and contribute to global solutions, he said.

"We'll become a place for practical solutions for water in Nebraska and elsewhere, but because Nebraska will be the center for this activity in the world, it will pay enormous dividends," Milliken said. "We will be a talent magnet for faculty and for students who are interested in making a difference in the use of water resources for agriculture." ●

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