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Strategic Discussions for Nebraska: Growing Opportunities Through Public-Private Partnerships

Mary Garbacz

University of Nebraska-Lincoln, mgarbacz2@unl.edu

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UNIVERSITY OF NEBRASKA-LINCOLN

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GROWING OPPORTUNITIES

★ ★ ★ *through* ★ ★ ★

PUBLIC-PRIVATE PARTNERSHIPS

N









MUTUALLY BENEFICIAL PARTNERSHIPS ARE THE FUTURE

RONNIE GREEN, CHANCELLOR,
UNIVERSITY OF NEBRASKA-LINCOLN

My first official day as the 20th chancellor of this great land-grant institution was May 25, 2016, after six years as Harlan Vice Chancellor of the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources. I am grateful to Harvey Perlman, who was chancellor for 16 years and led this university into a new era of academics, athletics and student life.

I step into my first year as chancellor with excitement, knowing we must continue our university's growth in new ways to contribute even more significantly to solving the world's challenges. Many of those challenges are in this university's areas of strength: food, energy, water, landscapes and people. Continuing that growth will require collaborations to achieve those goals.

This 2016 Strategic Discussions for Nebraska publication, "Growing Opportunities through Public-Private Partnerships" introduces many of the mutually beneficial partnerships that are the future of research, teaching and extension. Through these partnerships, we are finding solutions, sharing those solutions with others and developing the pipeline of talented students ready to join the workforce in complex fields of study, such as science, technology, engineering and mathematics. I believe partnerships are essential for our shared future, not only for the University of Nebraska-Lincoln, but for others who join us in solving the world's problems.

Nebraska Innovation Campus is an excellent example of attracting businesses to partner with the university. Food manufacturers partner with the UNL Department of Food Science and Technology, which moved to Nebraska Innovation Campus in the summer of 2015 to some of the best facilities in the world. Those facilities are a magnet for businesses around the world searching for better and safer ways to produce food. Technology startups are improving animal, human and environmental health while creating new jobs for our graduates. Crop science partnerships have helped build facilities in which UNL scientists can replicate growing conditions all over the world. Nebraska Innovation Studio, a maker space on Nebraska Innovation Campus, is open to anyone who wants to learn, experiment and invent. The best institutions in the world have such spaces, where imagination has no limits.

Funding our future requires us to think in new ways. What can our students learn from working alongside businesses? What can the businesses gain from working alongside the university's faculty, in outstanding research facilities? How can we nurture entrepreneurship in the university's areas of strength? How can we become a university with even more strengths?

The State of Nebraska has been generous in funding the work of this university. We are grateful to Nebraska's taxpayers for understanding the importance of our teaching, research and extension. You also have expressed your confidence in us by sending your children to the University of Nebraska.

The University of Nebraska-Lincoln is an internationally distinguished land-grant university and I look forward to every collaboration that will ensure its continued growth. I invite you to partner with us for our future. The public good depends on our efforts.



Representative from Vermont, 35th Congress

THE MORRILL ACT OF 1862

On July 2, 1862, President Abraham Lincoln signed into law a bill that donated land to each state for the establishment of colleges to provide a liberal and practical education to the “industrial class,” or the common person. These colleges would provide instruction in agriculture, military tactics, the mechanic arts and classical studies. Because of the land granted to each state and territory, the Morrill Act of 1862 became known as the land-grant act.

Sponsored by U.S. Congressman Justin Smith Morrill of Vermont, the bill allotted 30,000 acres of public land for each sitting senator and representative in Congress to establish these colleges. Morrill could not have known the future impact this law would have in providing equal opportunity to education to people in the United States and its territories.

Today, there are more than 100 land-grant institutions in the United States and its territories, each focusing on teaching, research and outreach — taking new knowledge to the people.

The University of Nebraska was founded on February 15, 1869, and designated a land-grant institution under the 1862 Morrill Act.

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

IMPACT ON NEBRASKA

The University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR) is all about people and the food, energy, water and natural resources that sustain them. IANR innovation in research, teaching and Extension education places Nebraska on the leading edge of food production, environmental stewardship, human nutrition, business development and youth engagement.

The Institute of Agriculture and Natural Resources comprises the College of Agricultural Sciences and Natural Resources (CASNR); the Agricultural Research Division (ARD); Nebraska Extension; and the ARD and Extension components of three departments in the College of Education and Human Sciences.

The Institute of Agriculture and Natural Resources is committed to growing the future of Nebraska’s people, businesses and communities.

ABOUT STRATEGIC DISCUSSIONS FOR NEBRASKA

2016

Strategic Discussions for Nebraska is a program in the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR). Its mission is to teach students to communicate university research so it can be easily understood, then disseminate that information in a professional format. An SDN publication has been produced annually since 2008, each focusing on a different topic.

This year’s publication has been produced by a team of students at UNL who are majoring in Agricultural and Environmental Sciences Communication in the Department of Agricultural Leadership, Education and Communication. The students enrolled in the capstone course in the spring semester of 2016. The course brings together their prior coursework and skills and provides a learning experience similar to those they may encounter in the workplace. The course also emphasizes the factual, complete and accurate communication of complex, science-based issues to public audiences with clarity and objectivity.

During the course, the students learn about scientific research being conducted at UNL and the diverse funding sources required to support it. They interviewed scientists, entrepreneurs, mentors, business partners and university leaders. They wrote stories based on those interviews; the stories

were reviewed by the sources and approved for publication.

Media specialists from IANR Media provided videography and video editing expertise, which may be accessed online at sdn.unl.edu. University Communications provided photography and website services. Jon Humiston, an independent contractor, provided creative and graphic design expertise. IANR provided funding, business and liaison services for the production of this publication.

As coordinator of Strategic Discussions for Nebraska, I express sincere appreciation for the original vision and financial support of the Robert and Ardis James Family Foundation, which founded Strategic Discussions for Nebraska in 2007.

Strategic Discussions for Nebraska now receives the majority of its funding from, and is housed in the UNL Institute of Agriculture and Natural Resources’ College of Agricultural Sciences and Natural Resources and the Department of Agricultural Leadership, Education and Communication.

Please visit our website, sdn.unl.edu, where you will find the complete publication and a video montage of scientists explaining their research.

Thank you for your interest in our publication!

MARY GARBACZ, SDN Coordinator

EMAIL: mgarbacz2@unl.edu

PHONE: 402.472.7119

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[unl.edu/chancellor]

RON YODER, Interim Harlan Vice
Chancellor, University of Nebraska–
Lincoln Institute of Agriculture and
Natural Resources (IANR). [ianrhome.unl.edu]

MARK BALSCHWEID, Interim
Associate Vice Chancellor, University of
Nebraska–Lincoln Institute of Agriculture
and Natural Resources (www.ianrhome.unl.edu) and head, Department of
Agricultural Leadership, Education and
Communication. [alec.unl.edu]

STEVEN WALLER, Dean, University
of Nebraska–Lincoln College of
Agricultural Sciences and Natural
Resources (CASNR). [casnr.unl.edu]

JILL BROWN, Assistant to the Vice
Chancellor, Institute of Agriculture and
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**UNIVERSITY OF NEBRASKA–
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faculty and staff. We are fortunate to work
with these innovators who are making the
world a better place.

NEBRASKA EXTENSION, led by
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beyond. [extension.unl.edu]

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Becky Aiken, Interactive Design Specialist
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101 AGRICULTURAL COMMUNICATIONS BUILDING
UNIVERSITY OF NEBRASKA–LINCOLN
LINCOLN, NEBRASKA 68583-0924

TEL: 402.472.7119 | FAX: 402.472.5863
EMAIL: MGARBACZ2@UNL.EDU
WEBSITE: SDN.UNL.EDU

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SDN PUBLICATIONS STAFF

2016 STUDENT WRITERS



PAIGE DIETRICH



JENNY KEYES



DANIEL FRANCK



RACHEL NOE



SARAH SCHELLPEPER



SAMANTHA SCHNEIDER



ELIZABETH UEHLING



MARY GARBACZ,
SDN Coordinator



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PARTNERING FOR THE GREATER GOOD

by RACHEL NOE

The competition for state and government funding for research purposes has become a battleground. There are fewer available dollars and stronger competition between the entities applying for those dollars.

To address this issue, universities are using collaborative and creative opportunities with private companies to continue conducting research that benefits the general public and better educates students. Ronnie Green, Chancellor of the University of Nebraska–Lincoln and former Harlan Vice Chancellor of the UNL Institute of Agriculture and Natural Resources, believes partnerships are a positive way forward.

“Public-private partnerships are important because they allow us to better educate students in areas we might not have support for in other ways. They’re important for the research work the students produce for the greater good. They’re important for society as a whole,” Green said.

The University of Nebraska–Lincoln has recently partnered with Bayer CropScience, Cargill, DuPont, Farm Credit Services and many other companies to allow university students and faculty to develop innovative research, Green said. This research is then used by businesses to create a commercialized end product that benefits the general public. Green pointed out that while these partnerships are investments of resources, they aren’t just strictly financial; they also often include sharing people resources.

SCIENCE FOR THE GREATER GOOD

Research conducted at the university helps develop new products that benefit the general public, as well as advance the field of science, Green explained. Many faculty members

work at the university because they want to conduct unbiased research, he said. When working in partnerships, the University of Nebraska takes care to remain a neutral third party by conducting unbiased and objective research.

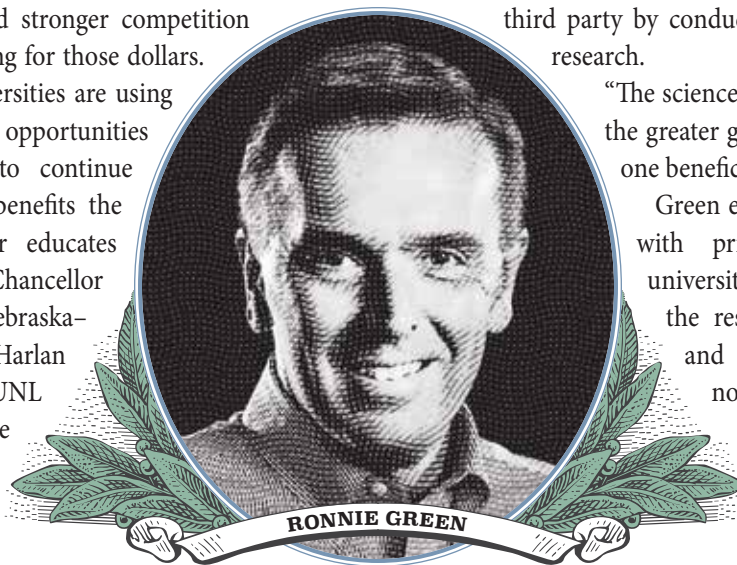
“The science we’re doing is the science for the greater good,” Green said. “It’s not for one beneficiary or for one agenda.”

Green explained that in partnerships with private sector entities, the university maintains ownership of the research done by its students and faculty. The research is not exclusive to the private partner; it is still available for access and use by the greater population. Green said the University

of Nebraska’s rich history in plant breeding holds many examples of partnerships, such as one with Bayer CropScience. In this partnership, Bayer CropScience helped fund research on developing new crosses with the wheat germplasm developed at UNL and endowed the Nebraska Wheat Growers Presidential Chair, now held by UNL Professor P. Stephen Baenziger (read about Professor Baenziger in this publication).

“Bayer CropScience doesn’t just work with our wheat germplasm and exclude everybody else. They work with it, further develop it, and so can everybody else,” Green explained.

Nebraska Innovation Campus at the University of Nebraska–Lincoln holds numerous examples of partnerships that benefit the greater field of science locally, nationally and internationally. The Food Processing Center in the Department of Food Science and Technology offers a space for food companies and entrepreneurs to test their products before going to market. The Food Processing Center immediately benefits local entrepreneurs and benefits the public in the long term through the food science industry.



Green highlighted the Food Allergy Research and Resource Program, or FARRP, as an example of an international partnership at Nebraska Innovation Campus. FARRP is a part of the UNL Department of Food Science and Technology. Scientists in FARRP work with 88 member companies that are all interested in the area of food allergens, he explained. These member companies pay a membership fee to have access to FARRP scientists. These scientists then test the companies' manufacturing facilities and products for allergens. This research and testing has an international effect on the world of food science and allergens, Green said.

These partnerships are all between companies that would normally be competing against each other to market their products to the public, Green said. Nebraska Innovation Campus is a way to bridge the gap between private industry and public research conducted at the university. The close facilities and partnerships with private sector businesses "allow you to work closely together while still separating the academy from private industry to move that technology out faster," Green explained.

CLOSING THE GAP

"One of the things that's a real hurdle for seeing the benefits of research is getting it out into the public faster," Green said. By partnering with private sector businesses, universities can decrease the "time to market" and close the gap between research and public benefit through a commercialized end product, Green explained. The University of Nebraska has many examples of partnerships that have mutually benefited the public, the university and its partners. Green pointed to the university's research into Dicamba resistance in crop production as one such example.

"Technology that's been developed for Dicamba resistance, for the next generation of herbicide resistance for crop production primarily in corn and soybeans, that's a technology that was developed here that's now being partnered with Monsanto," Green said. "We're doing research here that Monsanto can then pick up and put into production through all the right channels of commercialization of technology." The public benefits from this partnership by having the research and end product commercialized into crop production, which could ultimately benefit the producer's bottom line.

"We've developed a number of products here in our biotech program that are slowly making their way into the public. They would make their way into the public faster, if we worked jointly with the private sector in developing those products," Green said.

IMPACTING GENERATIONS TO COME

Partnerships are beneficial not only to the public and the partners involved, but also to the students at UNL. Both graduate and undergraduate students benefit in various ways from these partnerships. Green explained that partnerships help support graduate student assistantships and hands-on research opportunities, while also providing funding for the students to pursue advanced degrees. Graduate students also benefit from these partnerships because it gives them the opportunity to conduct innovative research and work with various professionals in their field of study, he said.

"Undergraduate students also benefit in real ways as well from these public-private partnerships," Green added. "Faculty members take their experiences in research and help impart that knowledge to their undergraduate students. Graduate students also serve as teaching assistants in undergraduate classrooms and are able to pass on their firsthand knowledge and experiences to fellow students."

Green highlighted the creation of a commodity trading room in the University of Nebraska-Lincoln's Department of Agricultural Economics as a recent example of a partnership forged specifically for undergraduate students. Numerous and varied private sector groups partnered with the university to collaboratively fund the project. Agribusiness and agricultural economics students now use the room to develop a better understanding of the commodity markets. Green explained that private sector businesses and interest groups helped fund and develop the trading room because they knew students would gain a "strong, fundamental understanding of the commodities and the futures markets as part of their undergraduate experience." The private partners benefit in knowing that graduates from these programs are more experienced and capable of working in the private sector companies post-graduation, he said.

"The University of Nebraska has been a leader in many ways in developing public-private partnerships for the benefit of the public at large," Green concluded. "We're living in 2016, but we need to be thinking about 2050. If we want to meet the food, fuel and water needs of the future, agriculture needs to innovate — now. Nebraska is a living laboratory and the University of Nebraska, as its public university, is a global leader in growing a healthy future for our state and the world. Public-private partnerships will help us do just that." [unl.edu] ★

Diversifying Funds for **WORLD-CHANGING RESEARCH**

by SARAH SCHELLPEPER

Improving the vitality of food, energy, water, animals, land, and people requires sophisticated equipment coupled with researchers who are educated and passionate about improving the human condition.

More than 9 billion people will coexist on Earth before 2050 — an increase of more than 2 billion from today. Thus the research into bettering the “human condition” is needed today in preparation for the future. “Nebraska has an important role in creating and sustaining a healthy source of food for a global population,” according to Archie Clutter, dean of the University of Nebraska–Lincoln Agricultural Research Division. “As a state, we need to be leaders.”

Yet research takes time and money — and increased competition for traditional funding now requires diversified approaches to acquire funding. Partnering across disciplines and with business, industry and individual producers is important, not only to acquire funding, but to provide faster application of research, train the upcoming workforce, and integrate business development training. Partnerships are built to benefit both partners, Clutter said. When both partners’ goals and expertise come together, “it is a win-win,” he added.

“From basic discovery to application, often there is opportunity for a partnership with the private sector to accelerate research into impacts,” he said. That captures the importance of any kind of partnership and delivering the value from research and research investments.

NEBRASKA INNOVATION CAMPUS

Partnerships bring the private sector together with faculty in a place where innovation can occur, Clutter said. Nebraska Innovation Campus — the university’s developing research campus — is the place at the University of Nebraska–Lincoln designed to make those innovations occur.

Nebraska Innovation Campus is itself a public-private partnership where private investment is paired with university commitment to continue the development of facilities and opportunities that exist there, he said. Nebraska Innovation Campus is all about creating, fostering and mentoring partnerships too, ranging from large,

multinational corporations to small startups headed by entrepreneurs. Occasionally, individual donors partner with the university on a project that aligns with a university priority and the individual’s personal interest.

Clutter said examples of university partnerships include those with UNL and the commodity boards, such as corn, wheat, soybean and sorghum. Increasingly, there are new forms of partnerships with producer or producer groups in precision agriculture; water and irrigation; animal genetics; and food science and technology. Each partner provides support in different ways, as well as providing a connection to producer priorities, he explained.

UNL has a longstanding on-farm research program through the Agricultural Research Division and Nebraska Extension, which shares these on-farm research outcomes with Nebraska’s agricultural producers, Clutter said. Research that takes place



in a university greenhouse, for instance, yields plant varieties that are then grown on small plots on university farms, and then taken to farmers' fields for a field-scale evaluation. "That partnership with producers is really valuable," he said.

Public-private partnerships often align with the current interests and research of a faculty member, Clutter said. If the interests and research fit with available resources, there could be a match. Bayer CropScience partnered with the university by endowing the Nebraska Wheat Growers Presidential Chair. The funding aligns with the research of longtime UNL wheat breeder P. Stephen Baenziger. The funds are self-perpetuating, supporting both wheat research and students — who are in the upcoming workforce pipeline. These students are learning to breed new wheat varieties.

DEVELOPING THE 'PIPELINE'

There are great workforce needs in the science, technology, engineering and mathematics fields, Clutter said. Developing capacity in the workforce is a priority for UNL.

The workforce pipeline necessary for food security will be enhanced by providing opportunities for students to participate in research, he said. The university side of a partnership often includes a significant commitment to graduate students and post-doctoral graduates, in addition to funding for leading researchers. There are collaborations today in food science and manufacturing, based on partnerships, he said. In July 2015 the UNL Department of Food Science and Technology became the first department to move to Nebraska Innovation Campus; the department occupies the Food Innovation Center. The department includes The Food Processing Center and the Food Allergy Research and Resource Program — both longtime examples of UNL public-private partnerships.

"Graduate and undergraduate students, and interns — today have opportunities to work in the Food Innovation Center on projects that are really a collaboration of our faculty, mentors and company personnel," Clutter said.

Many companies include both business goals and professional development goals in their organizational structures. Clutter said both student and faculty participants in university partnerships with companies can benefit not only from research and application outcomes, but also by gaining professional development related to team performance, project management, and how to commercialize research.

"It's not just about achieving direct research goals, but about

building capacity for the workforce," he said. Students who might not even consider working for a company when they enter graduate school may work in university partnerships and learn there are growing opportunities in that subdivision of the private sector, he said.

"We need to be known as the place where a student can come and experience collaborative research with the private sector," Clutter said.

FUNDING TO FEED THE FUTURE

Partnerships are critical — "a very important part of the support that we have is from private sector partners," Clutter said. "Again, we are focused on impacts needed to provide and sustain healthy food for a quickly growing global population." What Nebraska can do to contribute to that food security has to be driven by partnerships with the private sector. "If we are really going to achieve what we need to achieve over the next 20 years, it has to be in partnership with the private sector," he said.

The university receives support not only from partnerships, but from federal grants, state dollars and private gifts.

"Nebraska tax dollars are really important to everything we do," Clutter said. "We are very fortunate in the state of Nebraska that we have significant funding from the state."

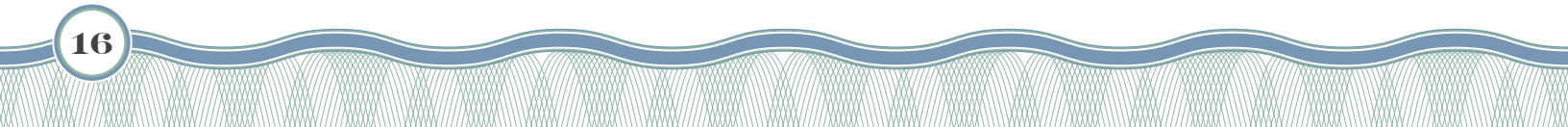
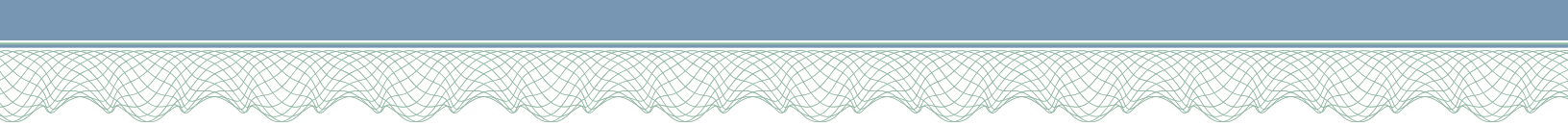
Those tax dollars help the university to sustain programs, fund work that is specific to Nebraska, and address needs in Nebraska as they emerge. "We can leverage from that strong base to seek federal funding or other sources of funding," he explained.

Public-private partnerships currently are the fastest-growing sector of university funding, Clutter said. While there is increasing competition for fewer dollars from traditional external funding sources, such as grants from the federal government, "partnerships provide new opportunities to support research programs in a way that accelerates impact," he explained.

Partnerships often result in new companies and more jobs. Clutter pointed out that partnerships contribute to and accelerate economic development through faster commercial applications of agricultural and environmental research. [ard.unl.edu] ★



PARTNERSHIPS



A very Personal Partnership:

HENRY J. STUMPF INTERNATIONAL WHEAT CENTER

A TRIBUTE TO HARD WORK, FAMILY

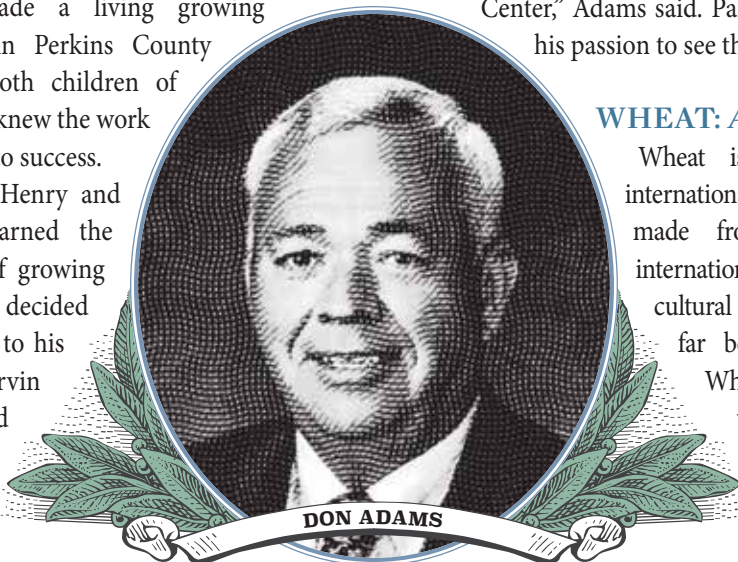
by MARY GARBACZ

Henry J. and Darlene Stumpf were hardworking farmers, born in the 1920s and made a living growing wheat in Perkins County in southwest Nebraska. Both children of Germans from Russia, they knew the work of their hands was the path to success.

Marvin Stumpf, one of Henry and Darlene's six children, learned the work ethic and the skill of growing wheat from his parents. He decided to pay tribute to them and to his late wife, Pearl. In 2013, Marvin donated \$1 million and 640 acres of land east of Grant, Nebraska, to the University of Nebraska Foundation to establish the Henry J. Stumpf International Wheat Center. The Pearl C. Pogue Peterson Stumpf Educational Center was constructed on that land as a part of that gift. The Perkins County Extension Office relocated to the Pearl C. Pogue Peterson Stumpf Educational Center. The research component of the wheat center began in 2015.

This gift is an example of a public-private partnership involving an individual benefactor partnering with the University of Nebraska-Lincoln to "do something that would benefit not only the people in the Grant area or in southwest Nebraska, but around the world," according to Don Adams, director of Research and Extension at the UNL Agricultural Research and Development Center near Mead and former director of the UNL West Central Research and Extension Center in North Platte. Grant is in the West Central district.

"Marvin Stumpf has also made some other gifts to help furnish the Pearl C. Pogue Peterson Stumpf Educational Center," Adams said. Part of his contribution will be his passion to see that good comes from his gift.



WHEAT: An international crop

Wheat is a crop that is grown internationally, Adams said, and products made from wheat are consumed internationally. Growing wheat involves cultural practices with implications far beyond Nebraska, he added.

Wheat is an important crop where there is limited precipitation and where water must be conserved, such as in southwest Nebraska. "How do we conserve water, build

soil and produce crops? How do we help people to be successful with limited resources, particularly water?" Adams asked.

"Conserving the world's water supply has worldwide implications," Adams said, and global partnerships with other countries and businesses are encouraged.

The UNL Agricultural Research Division has reached out to several companies to extend partnership opportunities, Adams said, and Bayer CropScience and Monsanto accepted invitations to partner. Bayer CropScience conducts variety testing; Monsanto conducts variety testing and also cultural practice work. Research into water, fertilizer and other inputs is establishing management strategies for successfully growing particular wheat varieties.

P. Stephen Baenziger, UNL professor of agronomy and horticulture, is a geneticist and Nebraska's small grains

breeder. He holds the Nebraska Wheat Growers Presidential Chair, which was endowed by Bayer CropScience in 2010. The Henry J. Stumpf International Wheat Center gives Baenziger a presence right in the heart of the wheat-growing area for research, field trials, working with international wheat companies and for educating graduate students in genetics and in growing wheat in water-restricted conditions, Adams said.

IMPLEMENTING THE DREAM

Adams said Robert Klein, UNL emeritus professor and Extension cropping systems specialist, has been critical in implementing the dream of Marvin Stumpf. Klein has helped transition from the farm to research and demonstrations at the wheat center. He has worked to be certain everyone knows who is responsible for each part of the center's synergy. "It works," Adams said.

Many opportunities have resulted from Marvin Stumpf's gift, including partnerships with the USDA Natural Resources Conservation Services, Nebraska's Natural Resources Districts, the Nebraska Water Balance Alliance, Nebraska Extension and the University of Nebraska-Lincoln, as well as with Bayer CropScience and Monsanto. The University of Nebraska-Lincoln recently hired a cropping systems specialist at the West Central Research and Extension Center, who will take on additional responsibility at the wheat center.

Additionally, UNL specialists from the West Central Research and Extension Center in North Platte are conducting research at the Henry J. Stumpf International Wheat Center facilities, all using a systems approach and collaborating with others to find answers to production questions. For example, a UNL entomologist is collaborating with a UNL plant pathologist on bacterial control of insect pests. Soil fertility and irrigation specialists are teaming up on water efficiency and crop rotation questions. Two Extension educators — one 4-H Youth Development and one Cropping and Water Systems — and an office assistant round out the permanent Perkins County Extension Office. A technician has been added to the farm team, Adams said, a UNL employee paid in part by UNL and in part by the partnership with Monsanto. Other scientists conduct research at the wheat center; everyone works together in this "true public-private partnership," he said. "We're sharing the resources and each person working there is contributing to see that the work is done."

GRANT

The Henry J. Stumpf International Wheat Center has been well-received by the town of Grant, Adams said. The population of Grant is just more than 1,100, so housing is at a premium.

"When you go into a rural community, they don't have a lot of those resources, but the community of Grant has bent over backwards to try and help," he said.

One essential already has been integrated: high-speed internet. "We have really good service," Adams said. "High-speed internet is really important for the graduate students to be able to come from Lincoln and for the scientists in Lincoln to be able to communicate with their students at the wheat center."

HANDS-ON LEARNING

The Pearl C. Pogue Peterson Stumpf Educational Center, as an Extension Office, has space to accommodate about 200 visitors, Adams said. There are plans to reach out to schools in the larger area so youth can have a learning experience like few others in the world.

"We built a small teaching kitchen in the new building," Adams said. "In the future, our Extension staff can take students out and show them what wheat looks like in the field, then bring them back to the kitchen, give them some wheat, grind it into flour and then make a pastry they can eat," he said. "It's that kind of experience, from producing the food to eating it that will help youth know where their food comes from. We want to teach from this farm, every day."

THE PUBLIC GOOD

Public-private partnerships help to fund university research, teaching and outreach that go beyond taxpayer support, he said. If someone is passionate and wants to help further opportunities for food production, for conserving natural resources, for educating students, for the whole gamut of what the university is about, Adams said there are huge opportunities available.

"There is significant opportunity to help attract some of the best faculty in the world, to support the best research and teaching in the whole world," Adams said. "It goes way beyond the equipment and the farm; it really goes to student training, engagement and virtually everything. This is the public good at a high level." [extension.unl.edu] ☆

PARTNERSHIP PRODUCES HARVEST OF REWARDS:

Nebraska Wheat Growers Presidential Chair a partnership that buys time, results

by MARY GARBACZ

The desire to feed people is the main reason P. Stephen Baenziger decided to go into wheat breeding. He earned a bachelor's degree in biochemical sciences from Harvard University, then master's and doctoral degrees in plant breeding and genetics from Purdue University. He just knew he could make a difference in the world by breeding stronger, more drought- and disease-tolerant wheat varieties. If he could do that, he knew more people could eat every day.

He knew that the world depended on science to improve and increase the world's food supply. He also knew that scientific research takes money from many sources.

Baenziger is distinguished professor of agronomy and horticulture at the University of Nebraska–Lincoln, specializing in small grains breeding and genetics. He also holds the Nebraska Wheat Growers Presidential Chair, endowed in 2011 by Bayer CropScience with a \$2 million gift to the university. The position will exist in perpetuity, Baenziger said, and will transfer to his successors.

THE FUTURE OF FOOD

It is widely publicized that by 2050, the world's population is likely to exceed 9 billion, compared with just more than 7 billion in 2016. But, Baenziger said, those 9 billion people won't eat like 9 billion people today; they will eat like the equivalent of 12 billion people today.

Why?

"We hope those 9 billion people are more prosperous than they are today," Baenziger said. "As you become more prosperous, more wheat is consumed. Bread is a convenience food, as opposed to crops like rice, which has to be boiled, or corn, which has to be milled and edible products made from it." People also like animal products, such as meat, eggs and milk, so more feed grains will go into animal production, he explained.

If people are going to be fed the way they would like to be fed and the way they deserve to be fed, Baenziger said, "agriculture will have to be much more efficient, much more productive than we've

ever been in the past to feed the future."

Yes, it is possible, but it is going to be difficult, he said. "Winston Churchill said 'never have so many asked so much of so few,' and I think that's where agriculture is right now." In times of surplus, people tend to take food for granted, he said, but the future won't allow for that luxury. Instead, there may need to be changes in both behavior and consumption. "We will accommodate the future, but we would rather have the future we would like than just what we can settle for," he said.

WHEAT

Wheat as a crop has advantages for agricultural producers, Baenziger said. It grows with less water than many other crops; it is an appropriate crop for a cooler climate in a higher elevation; it is a good rotational crop as a winter annual. A winter wheat crop breaks up the life cycle of weeds producers are fighting in their corn and soybean fields. In addition,



a wheat planting after a summer annual gets a producer 12 months of production instead of just four or five with a summer annual, he explained.

“Wheat as a human-consumed food is considered a premium grain because people always will pay more for what they feed themselves than for what they will feed to an animal,” he said. Globally, about 20 percent of the world’s calories and 20 percent of the world’s protein comes from wheat.

PARTNERING: ESSENTIAL

The university’s partnerships with Bayer CropScience and with other local and international companies are making it possible to fund essential agricultural research. There is increased competition for fewer dollars from traditional funding sources, such as federal grants. Diversifying funding sources makes it possible to conduct the scientific research that affects the world’s future food supply.

Not only that — the public-private partnerships make it possible for scientists to choose the projects they study. For example, interest from the Nebraska Wheat Growers Presidential Chair endowment allows Baenziger and his team to pursue exploratory projects with greater potential for payoff, he said. The funding also will pay the salaries of graduate students and allow the team to select the students’ projects, which sometimes is not possible with specific grant-funded projects.

Bayer CropScience, Baenziger said, has specific strengths in cereal grains, including wheat; the company also is a leader in cotton, canola and hybrid rice. However, the company wanted to expand its portfolio to include wheat breeding, Baenziger said, and since Nebraska has 80 years of wheat breeding

experience, the company chose to partner with Nebraska, providing the research funds for the future of wheat.

It benefits both UNL scientists and Bayer CropScience, Baenziger said. Since universities conduct research for the public good, the Presidential Chair agreement outlined a sharing of wheat germplasm. The university retains ownership of the germplasm, but Bayer CropScience has the right to use it and create new products from it.

The substantial gift meant time saved for the company.

“Plant breeding is a slow, methodical process,” Baenziger said, so this partnership bought the time necessary to conduct the research without having to start from scratch. “It generally takes 12 years before a variety is released and even with some really advanced techniques, it’s seven years,” he said. “Bayer CropScience was willing to come to us and we were willing to share on a non-exclusive basis our germplasm. It allowed them to get into the wheat-breeding business early with advanced generation lines and that saved them time. We could have done this with any company,” Baenziger said.

Royce Schaneman, executive director of the Nebraska Wheat Board, is pleased with the agreement and with the name of the Nebraska Wheat Growers Presidential Chair. “We are so pleased that Bayer recognized the 40-plus years of commitment to the wheat growers of Nebraska by investing in our future,” he said.

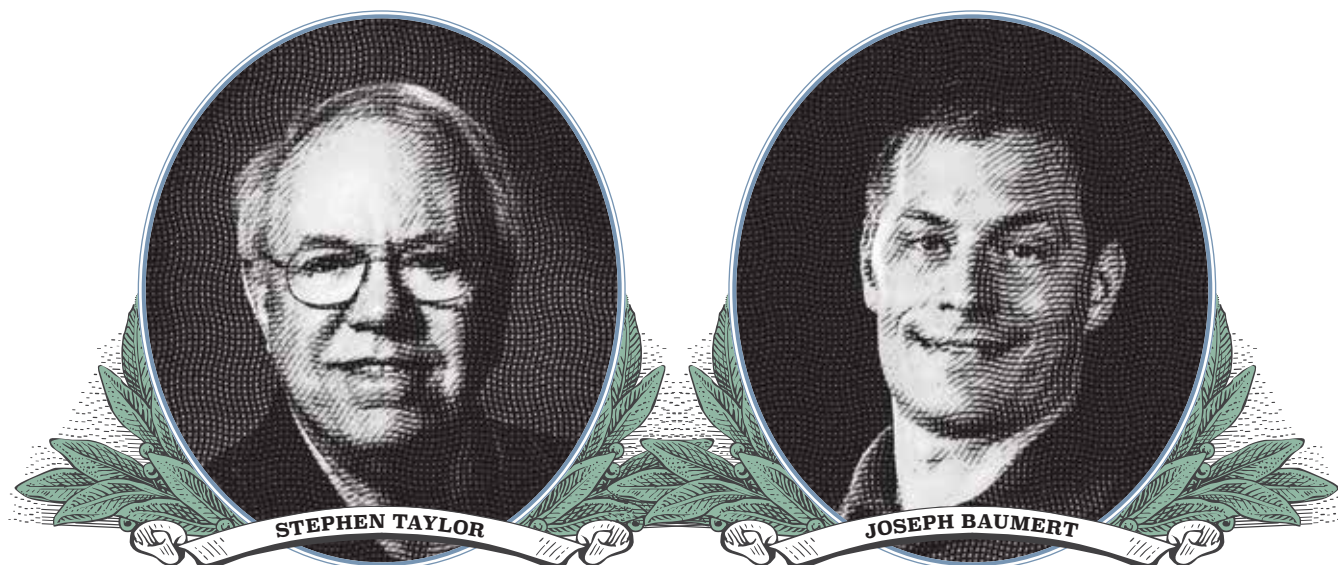
“We can tell this relationship really goes two ways. There are relationships between public and private partners, but this is one of the best I’ve seen,” Schaneman said. “Nebraska signed a fair and honest deal, and it’s only going to get better.”

For more information, go to [agronomy.unl.edu/baenziger] and to [nebraskawheat.com]. ★

UNL FOOD ALLERGY GROUP

Makes Eating Safer for Allergic Consumers

by PAIGE DIETRICH



Eight major allergenic foods are often referred to as the Big 8: milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat and soybean. These foods account for about 90 percent of all food allergies and must be declared on the label of any processed food, according to the food allergen-labeling act enforced by the U.S. Food and Drug Administration.

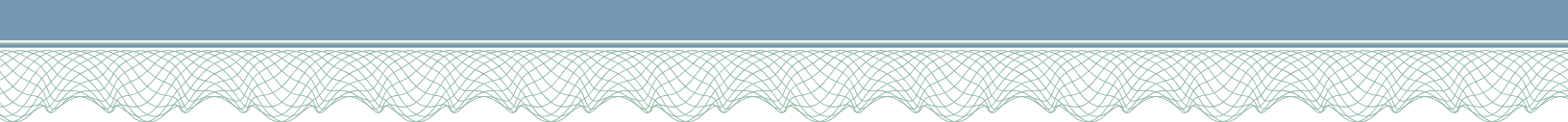
Stephen Taylor founded the Food Allergy Research and Resource Program (FARRP) in 1995 in the University of Nebraska–Lincoln Department of Food Science and Technology, now located in the Food Innovation Center on Nebraska Innovation Campus. Taylor, a professor in the department, has a background in food science, biochemistry and toxicology. Taylor conducted research into food allergens for many years prior to founding FARRP and said the industry had a lot of common questions and didn't have very many of the answers. "Clearly, there was an opportunity to build a program that would help get those answers," Taylor said.

Taylor founded FARRP in a public-private consortium model, in which companies pay a fee to become a member. Membership means a company will benefit from the scientific research and testing that is conducted. "I knew no one

company was going to fund all the research needed to answer all of those questions," Taylor said. Seven companies signed on in 1995; currently 88 companies are in the consortium. By pooling their resources, all member companies can benefit from research results. Any company can submit samples for testing, but FARRP members pay less, Taylor said.

The core mission of FARRP is to take basic science about food allergies and translate it for the food industry directly, according to Joe Baumert, associate professor in the department. Baumert, with Taylor, now co-directs FARRP. "We look primarily at how we can help the food industry to make products for food-allergic individuals," Baumert added. Food processors often manufacture many products in the same facility, and it is important that a product that contains peanut, for example, not cross-contaminate with another product that does not contain peanut.

FARRP scientists also serve the public and the research community by maintaining a database, www.allergenonline.org, that provides access to a peer-reviewed allergen list, intended to identify proteins that may present an allergy risk. The website was designed to help assess the safety of proteins that may be introduced into foods through processing methods or through genetics.



FARRP meets with its board of directors twice a year to establish the research priorities that have a common benefit. Most processing facilities have multiple products made in the same facility, so keeping allergens out of the products is important to FARRP, the member companies and more importantly, to consumers. Since its founding, FARRP scientists have developed analytical methods to detect residues of allergens in food. In 1997, FARRP scientists developed the first assay for peanut residues, which was licensed to Neogen Corporation; Neogen then released the first commercial peanut kit in 1999. “I can kind of say that led to the creation of the whole allergen detection industry,” Taylor said.

OUTREACH AND RESEARCH

The outreach component for FARRP is just as important as the research component. “We provide training opportunities and really empower the food industry with knowledge it can use,” Baumert said.

The move to the Food Innovation Center on Nebraska Innovation Campus in the summer of 2015 enlarged the laboratory space for the 25 staff members.

“It’s a large and unique lab that provides a food safety service for the industry,” Baumert said. Food companies may contact FARRP for analytical testing of processing facility samples, which FARRP scientists analyze. In 2015, for example, FARRP scientists tested 51,000 samples. Scientists not only conduct

the testing but also provide the interpretation of the results. “If you don’t find any residues, anybody can interpret that. If you find a whole lot of allergens, you know you’ve made a big mistake and that’s easy to interpret. But if you find just a little bit, what does that mean, and is it hazardous? How can we fix it? All of those things are what we help our member companies with,” Taylor said.

FARRP scientists have partnered with clinicians in Canada, the European Union and Australia. They also work with risk assessors, regulatory agencies and other academic units around the world to gain a broad insight into food allergy for the food industry.

According to Baumert, having direct interaction with the food industry is the biggest benefit for FARRP.

“This collaboration allows us to approach an area that may not have as much federal funding for the applied type of research that the food industry may need,” Baumert said.

With the addition of two new faculty members who have diverse scientific backgrounds, Taylor and Baumert hope to drive the program’s research even further when it comes to better identifying allergens, characterizing allergens and detecting allergens. “I think we have a very dynamic group and we are building upon that. So the future definitely looks bright for us,” Baumert said.

For more information about the UNL Food Allergy Research and Resource Program, go to [farrp.unl.edu]. ★

NU RURAL FUTURES INSTITUTE:

a world-class center for building capacity and confidence, broadband, health care, education and jobs

by SAMANTHA SCHNEIDER

Defining the future of rural areas and rural people is essential, not only for Nebraska, but for humanity itself.

And the mission is urgent.

Chuck Schroeder is the founding executive director of the Rural Futures Institute at the University of Nebraska. “Building broadband access for rural people in Nebraska, across the country and around the world may be the achievement that defines this era of humanity,” he said. Broadband — high-speed internet service — is commonplace in cities, but not in rural areas. Broadband means jobs, education, health care and connectivity to the global marketplace. “Opportunities today for someone in a rural setting to have contact with folks in dozens of other countries on a daily basis is a genuine reality,” Schroeder said.

“Today, the person with the big idea who is creative and who tries to understand the marketplace and use the tools available, can launch businesses with global reach,” he explained. “But it’s not just a marketplace for goods and services; it’s for educational offerings. It’s for sharing of ideas.”

In his three years heading the Rural Futures Institute, Schroeder and his team have traveled and connected, held an annual Rural Futures Conference — and created a vision for rural areas.

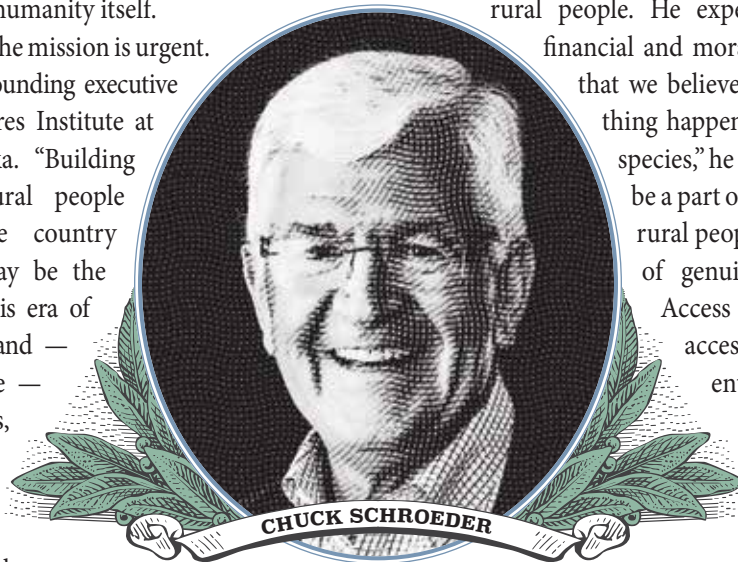
STRATEGY OF HOPE

“My overarching goal is to create a world-class center for exploring and impacting all things rural,” Schroeder said. His

strategy, first, is to assemble a team of people committed to being a part of an internationally recognized center for helping rural people. He expects to “attract and sustain

financial and moral support for this enterprise that we believe may be the most important thing happening on the globe to save our species,” he said. Finally, he said, “I want to be a part of changing the narrative about rural people from one of despair to one of genuine hope and opportunity.”

Access to broadband creates global access that is unprecedented for entrepreneurs, businesses and young families to become involved in communities where they can make a difference.



CAPACITY, CONFIDENCE, LEADERSHIP

The Rural Futures Institute vision is to be internationally recognized for building capacity of people living in rural communities while also building the confidence they need to address challenges in a unique world, he said, building more resilient and sustainable futures for rural communities. A collaborative, innovative approach is being used to encourage people from all sectors, public and private, to come together to make a difference. “We hope we will be successful in building genuine hope in rural people for the kind of future they would like to have for their communities,” he said.

Much of building confidence and capacity in rural communities involves leadership. Local leaders can build communities that are “legitimate best choices” for young families. Communities can be strong economically, socially, culturally and environmentally, and strong leaders can

accomplish that, Schroeder said. The Rural Futures Institute is working with its partners to create that environment. “Their vision, their notion of where they would like to be with their community is absolutely achievable,” he said.

GOALS, ACTIONS, PARTNERS

Public-private partnerships are at the core of the Rural Futures Institute; Schroeder noted the Rural Futures Institute already has developed projects and partnerships throughout Nebraska:

- *Competitive Awards Program* encourages the faculty from the four campuses of the University of Nebraska and the Nebraska College of Technical Agriculture at Curtis, as well as partner institutions across sectors, to partner on projects that address specific issues and opportunities in innovative ways.
- *Rural Serviceship Program* is a partnership with the Rural Futures Institute, the UNL Engler Agribusiness Entrepreneurship Program, UNL’s Nebraska Human Resources Institute, the UNL Office of Civic Engagement and the Heartland Center for Leadership Development. High-capacity university students are recruited to go into communities for 10 weeks during the summer to solve real-world community problems.
- *Rural Opportunities Fair* is a partnership between the Rural Futures Institute, UNL Career Services, and chambers of commerce, economic development entities and other community organizations throughout Nebraska. They come together in one location so students can investigate career opportunities outside metropolitan areas.
- *Rural Futures Fellows Program* will bring together national experts — faculty, emeriti faculty, undergraduate and graduate students from around the world, plus nonprofit and rural community leaders. The fellows will consult and engage in research and education initiatives designed to make a difference in rural areas everywhere.
- *Connecting Young Nebraskans* is a network of nearly 600 young professionals outside of Lincoln and Omaha drawn together to share ideas and issues and to partner on projects. The Rural Futures Institute provides the group with professional development opportunities to help them build skills to be successful in today’s economic, social and cultural environment.

RFI: REFLECTION OF STRENGTH, INFINITY

Schroeder wears a pin wherever he goes that signifies the Rural Futures Institute. It’s a diagonal ribbon of green, intersecting with a swirl of gold. It is symbolic of infinity, but also of the environment in which rural communities are located, Schroeder said.

“From our perspective, if we want to be green as a planet, as a society, as a culture — if we want to sustain the resources that sustain human life on this planet, we’d better be worrying about strong communities in the midst of those resources,” he said. “People who are making decisions about those resources, who care about those resources, who understand those resources in their very DNA,” he added.

“That pin, that symbol is a daily reminder that we are involved in the cycle of life while we talk about entrepreneurship and building businesses. We are also in the business of trying to see that humanity can be around for many more generations and in order to do that, it takes a whole mix of things. Yes, communities have to be strong economically, but they also have to be places where people want to live, where they believe that who they are as human beings has an opportunity to grow and blossom, to be nurtured in the education system, that their health care is going to be taken care of, that they have access to the humanities. They are seeing one another in that community for the power of their differences and the things that they bring to the table.” [ruralfutures.nebraska.edu] ☆

Rural Nebraska:

THE TREASURE OF THE MIDWEST

RFI serves Nebraska, but impacts the world

by DANIELLE FRANCK

If you've never canoed down the Niobrara River on a beautiful day with a bright blue sky and white puffy clouds with an eagle soaring by, it's an amazing experience and I think the value it can offer people is absolutely incredible," said Connie Reimers-Hild, associate executive director and "chief futurist" at the University of Nebraska Rural Futures Institute (RFI). "It's about this global community of rural and all the value it adds to people's lives. Also, our food, fiber, water and fuel come from rural places."

The RFI works to bring leaders together in new and innovative ways to evolve the narrative and story of their towns, but also to aid them in getting things done in their communities and sharing the stories of what people are already doing, she said. People aim to create a full life for themselves and their families; Reimers-Hild believes that rural communities are part of the answer to that fulfillment. "Each community has its own culture and its own attitude. The RFI supports a culture of discovery and innovation from a lens of possibility and positivity. We want to help foster a great future for rural people and places."

RURAL TREASURES

Reimers-Hild said living in a rural community provides camaraderie, tranquility and peacefulness for her family and that her children's education is high quality and adds to the benefits of living in a rural community.

"Sometimes there is a negative stigma or misperception of rural areas. Our role is partly to change that conversation to

one of positivity, opportunity and building a bright future," she said.

EXPERIENCING RURAL COMMUNITIES

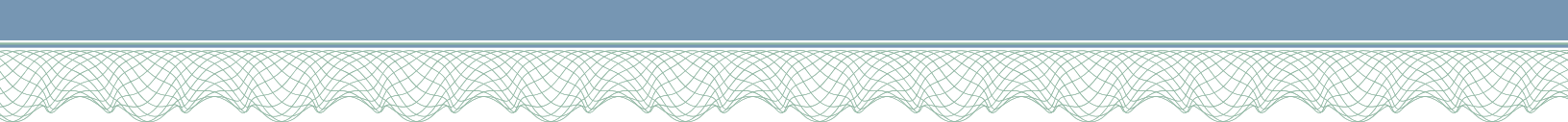
Items people wear, eat and consume in everyday life often originate in rural areas. Where they come from is important and can help rural areas connect with consumers.

"When we drink our coffee in the morning, we don't think about the fact that it comes from a rural place; maybe not here in Nebraska, but globally. We don't always think about the importance of rural when we are sitting in

a wooden chair or at a wooden dining room table enjoying our meal; everything from that experience comes from a rural place. We don't always think about the value of rural communities when we slip into our cozy cotton pajamas at night. Cotton is grown in rural communities. We really need to reconnect people with rural communities. Our conversation doesn't just include rural, it's a combination of rural and urban because we know all of these communities rely on one another, especially in a global economy," Reimers-Hild said.

Reimers-Hild's work has demonstrated that people look for a sense of personal fulfillment and purpose. She believes that rural areas can provide a sense of fulfillment, connection and satisfaction if people choose to seek unique experiences. "If you go out to western Nebraska, you can take a drive through the Sandhills, you can go watch wildlife in the many wildlife refuges throughout Nebraska and around the nation, which you can't do in an urban setting. Rural areas afford people





unique, fulfilling and fun opportunities to get out there and explore their life from a different lens,” she said. “I think for people to really understand rural, it’s important for them to actually go there and have their own unique experience.”

Most of the RFI team is centrally located on the East Campus of UNL; however, team members also are located at the University of Nebraska at Kearney, the University of Nebraska at Omaha, and in Scottsbluff. The Rural Futures Institute has a strong presence throughout Nebraska and partners with other organizations to strengthen its reach, Reimers-Hild said. One partner is Nebraska Extension. “The Nebraska Extension faculty members help connect programs to the communities. They live there, they’re connected there, they’re the eyes and ears of the university in our communities,” she said. The partnership between Extension and the RFI has resulted in a number of successful programs, such as Marketing Hometown America. The program is a multistate effort that focuses on the positives of rural communities and the treasures they hold through a lens of opportunity, hope and change. (For more information, visit: communityvitality.unl.edu/marketing-hometown-america-0]

LOOKING TO THE FUTURE

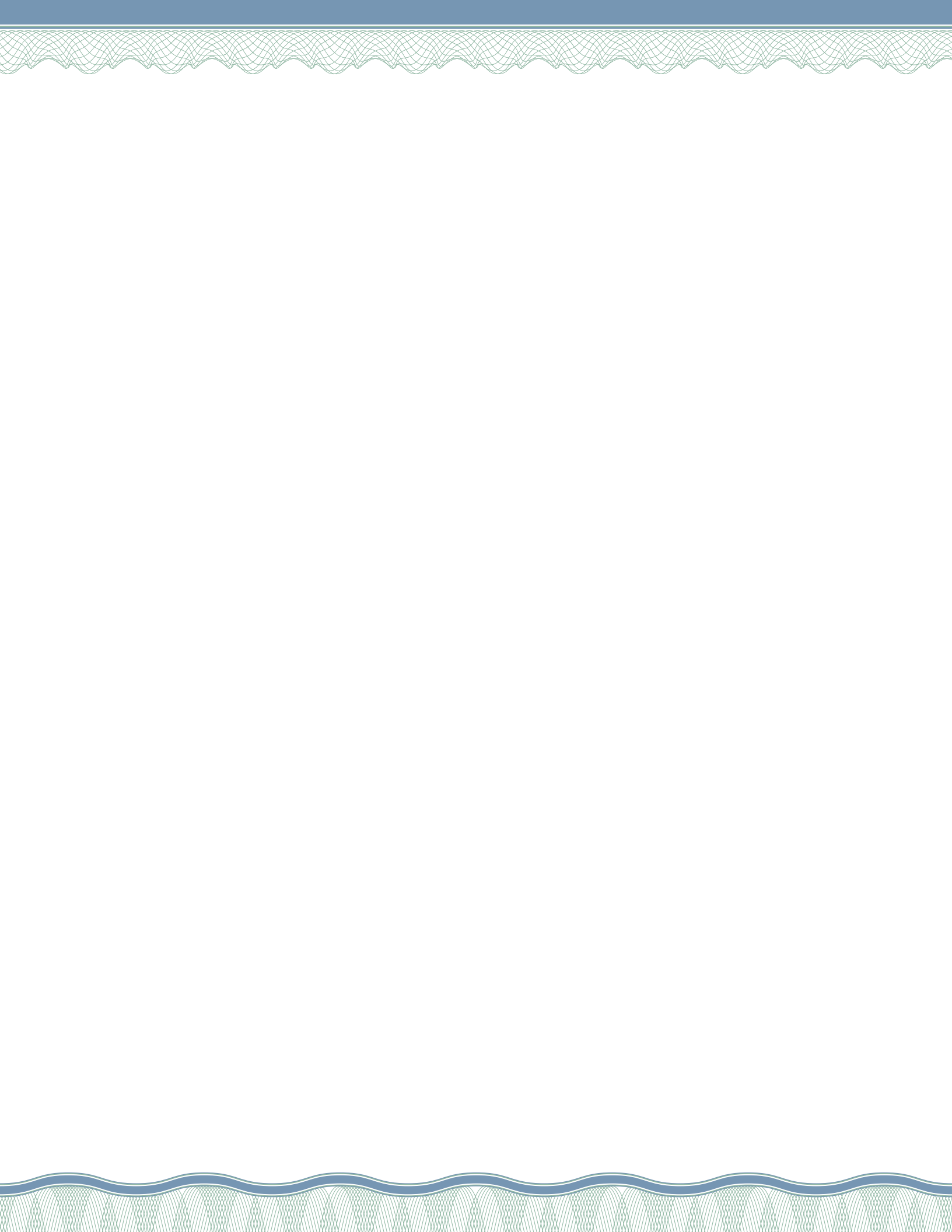
The Rural Futures Institute is working hard to serve Nebraska while growing its national and international presence through partnerships and technology. Reimers-Hild looks to the future on how to work with rural communities. “I’d love to see us connect more virtually. How do we engage the global audience of people that may never have worked in rural communities? Getting those minds together is really important so we look at niche areas, physical communities and also communities of purpose. The RFI is committed to engaging online stakeholders and partners in both physical and virtual communities. We want to find opportunities and solutions in this globally connected world by bringing new partners to the table.”

Connecting with people from all different backgrounds is important, she said, because great ideas can come from those not connected to rural communities. “Diversity comes from a wide range of things. It’s not just skin color, it’s gender, it’s experience, it’s age, it’s physical ability, it’s mental abilities. It is critical for us as we think about how we help move rural people and places forward in a way that they want to move, that all those groups are engaged and that people from those diverse backgrounds are engaged. The best innovation can happen from people outside the industry. It also happens when those diverse minds, those people from diverse backgrounds and cultures come together.”

[ruralfutures.nebraska.edu] ☆



NEBRASKA INNOVATION CAMPUS



Vision 2015

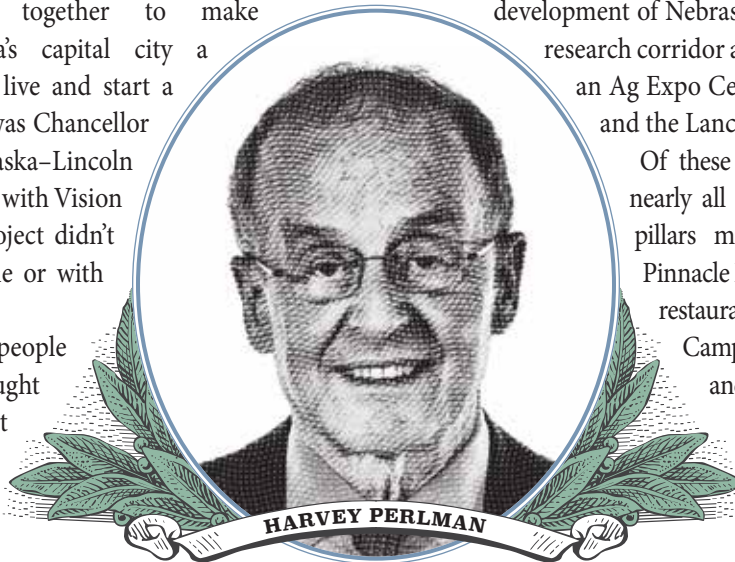
REVITALIZING A CAPITAL CITY

A CITY. MOTIVATED RESIDENTS. A VISION.

by RACHEL NOE

Over the course of a decade, a group of inspired residents and business leaders worked together to make Nebraska's capital city a vibrant, energetic place to live and start a business. Harvey Perlman was Chancellor of the University of Nebraska–Lincoln from 2000–2016. He worked with Vision 2015 and explained the project didn't start out with a fancy name or with fancy planning.

"It was just a group of people that got together and thought about how they could best be helpful and make a difference in Lincoln," Perlman reflected.



COMPLETING A REVITALIZING VISION

In the early 2000s, a group of business leaders in Lincoln looked at the significant philanthropic and business leadership support in Omaha's development and believed they had the influence and ability to develop Lincoln in much the same way, Perlman said.

"Prior to the organization of Vision 2015 and the engagement of that membership, Lincoln was a comfortable, quiet city that was not particularly attractive to young people and did not seem to have high ambitions about its future," Perlman said.

After numerous early conversations, the scope of the vision was narrowed to 10 project areas, or "pillars," outlined by members of Vision 2015, he explained. These pillars included a sports and events arena in the West Haymarket; a downtown convention center and hotel; a retail corridor on P and Q streets; a Sheldon Museum annex; an expansion of Haymarket

Park to include a triangle of sports complexes stretching north from the Haymarket to Cornhusker Highway; the development of Nebraska Innovation Campus and a research corridor along the Antelope Valley; and an Ag Expo Center combining the State Fair and the Lancaster Event Center.

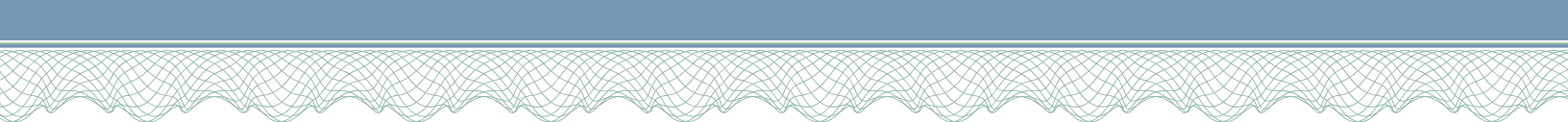
Of these 10 pillars, Perlman reflected, nearly all of them were completed. The pillars materialized in the forms of: Pinnacle Bank Arena; a West Haymarket restaurant area; Nebraska Innovation Campus; the redevelopment of P and Q streets for restaurants and shops; Breslow Ice Hockey Center; three new downtown hotels; and a completed flood-control project and public green

space in Antelope Valley. The State Fairgrounds was moved to Grand Island and the original plans for a convention center downtown were cancelled due to low demand and the construction of the Lancaster Event Center.

IT TAKES A VILLAGE

In terms of getting projects completed, the Vision 2015 group realized that real progress in a city does not come about if you leave it entirely up to the political bureaucracy, Perlman explained.

"It constantly needs to be motivated and pushed and helped because development is something private sector companies do," Perlman said. "Cities don't do development work. They incent and regulate it." The original steering committee of Vision 2015 was made up of a small group of business leaders. When the Haymarket arena came into focus, it was determined that funding would be decided by a public vote, Perlman



said. From there, the Vision 2015 steering committee funded initial conceptual drawings and the campaign to advocate for a positive vote. They also organized a website where people could sign up and become a part of what would develop into the larger Vision 2015 organization.

Perlman pointed out that while private business leaders and residents played a role in Vision 2015, partnerships with the city government weren't formal agreements of "you can do this and I'll do that." Rather, they were a constant set of interactions and assistance brought to the city government to complete desired projects, he explained.

While the pillars of Vision 2015 are almost all complete, the 2015 steering committee is watchful for future projects, Perlman said. The group itself isn't as active as it was during Vision 2015, but the individuals continue to contribute to city progress, he added.

"You see developments around the city that are being provoked or financed or started by members of the 2015 group that are going to make a huge impact on the city," Perlman said. "The original 2015 group gave Lincoln the confidence to have high ambitions."

A BENEFICIAL REALITY

Perlman believed that a revitalized capital city helps the whole state of Nebraska. Nebraska Innovation Campus and the vibrant atmosphere of the Haymarket are both recruiting advantages for potential University of Nebraska students, as well as new startup companies and incubators, he explained.

"Lincoln is a changed city from what it was prior to Vision 2015. It has more of a confidence and more of a vibe and it's clearly good," Perlman said. "You now feel that you're a part of a city again."

According to Perlman, Nebraska Innovation Campus was designed to create economic activity and jobs for students as internships or in careers post-graduation. He pointed out that students also benefit from the Haymarket atmosphere, P Street and new housing developments. Plans for Vision 2015 were set out to make Lincoln a city that was attractive to innovators to start businesses and to also make the city a place where those same innovators could start families and frequent restaurants, concerts and events.

"I think you see now from the projects that started and the projects that Vision 2015 pushed, along with assistance of the city and others, Lincoln is now regarded as a vibrant, energetic, exciting place to live," Perlman said. "I don't think without Vision 2015, this city would be anywhere close to where it is today, and right now, it's a pretty exciting place." ☆

INNOVATION FOR THE WORLD

Nebraska Innovation Campus – *from idea to reality*

by JENNY KEYES

The Nebraska State Fair called Lincoln its home for more than 100 years — 254 acres of prime real estate located between the City Campus and East

Campus of the University of Nebraska–Lincoln.

The university needed space to expand, but more importantly, it wanted to build a research campus similar to others attached to universities throughout the United States.

Then-University of Nebraska President J.B. Milliken and then-UNL Chancellor Harvey Perlman, along with representatives from Lincoln’s business community, considered options. If a research park could be built, Nebraska could become a leader in its areas of strength — food, energy and water. It also could attract private businesses, world-renowned scientists and students who would study and work with those scientists, creating a pipeline of qualified graduates prepared to enter the workplace ready to make a difference.

TIMELINE

In late 2006, a recommendation was made to move the Nebraska State Fair. Grand Island submitted a bid to become home of the fair. To accomplish this move, the State Fair Board would require funds to construct new buildings in Grand Island. Nebraska Legislative appropriations allocated \$5 million; the University of Nebraska allocated \$21.5 million; the State Fair Board committed to providing \$7 million; and Grand Island, \$8.5 million.

The research campus idea gained interest and momentum; it was to be designed as a Live-Work-Play model to attract talent and create a place where talent wants to locate. Based on studies of other research parks around the United States,

research parks contribute to regional innovation and are key to driving regional economic development, according to a 2007 Battelle study, commissioned by the Association of University Research Parks.

Legislation was introduced during the 2007 session of the Nebraska legislature and a formal process began, including public conversations, a report by a consultant and a legislative study of the feasibility of transferring State Fair Park to the university to build a research park.

On April 16, 2008, the full legislature approved Legislative Bill 1116, authorizing the fair’s move to Grand Island, and setting up the transfer of the property to the NU Board of Regents by January 1, 2010, making way for the development of Nebraska Innovation Campus. Then-Governor Dave Heineman signed the bill into law, saying the legislation created “the opportunity of a lifetime for two important institutions in our state — the Nebraska State Fair and the University of Nebraska.”



25-YEAR BUILDING PLAN

Nebraska Innovation Campus is being built to facilitate the expanding research enterprise of the university and contributing to economic development, focusing on partnerships between the university and private businesses. Of the 254 acres, 122 acres are in a floodplain, leaving 132 acres available for building construction, according to Dan Duncan, executive director of Nebraska Innovation Campus. At full build-out, Nebraska Innovation Campus will be a 2.5-million-square-foot campus, located between the University of Nebraska–Lincoln City Campus and East Campus.

Completion of the research campus is on a 25-year plan, Duncan said. At full build-out, Duncan said Nebraska

Innovation Campus will meet the needs of various kinds of research being conducted. Multiple types of spaces will include wet labs, greenhouse, pilot plants, high-bay prototyping, offices and studios.

The 25-year building plan calls for construction of 80,000 square feet of space per year, requiring the Nebraska Innovation Campus team to raise approximately \$40 million in funds per year, he said.

“That is very aggressive, but we are putting systems in place to meet those goals,” he said. “Nothing significant comes without risk.”

FUNDING

The University of Nebraska paid \$21 million to acquire the land and change the use of the site, Duncan said. The university then sought out a private developer to construct and maintain the buildings. Tetrad Property Group was selected for that purpose. Tetrad Property Group owns the buildings, Duncan said; in return, the university pays rent to Tetrad Property Group to occupy the space and for maintenance of the buildings and the grounds. The university holds a 99-year lease from the NU Board of Regents for the sole purpose of developing Nebraska Innovation Campus into a public-private research campus.

In January 2015, an additional \$25 million was appropriated by the Nebraska legislature from the state’s cash reserve through Legislative Bill 560, creating the “Nebraska Innovation Campus Building Acceleration Fund.” The bill specified that the funds were to be used to design and construct “one or more buildings” on Nebraska Innovation Campus. This was approximately half of the estimated cost of initial building of the campus; the rest of the funds would come from other sources.

In July 2015, Nebraska Innovation Campus opened its doors, with 380,000 square feet of built-out space complete. Buildings included 80,000 square feet of wet lab space and 65,000 square feet of office space. Part of the former 4-H building was reconstructed into the Nebraska Innovation Campus Conference Center, which provides meeting and collaboration space for 400 participants.

AS OF SUMMER, 2016, NEBRASKA INNOVATION CAMPUS INCLUDED:

- *Food Innovation Center*, housing the UNL Department of Food Science and Technology and The Food Processing Center, including state-of-the-art laboratory space and pilot plants
- *Greenhouse Innovation Center*, featuring a LemnaTec system for plant phenotyping
- *Innovation Commons*, a state-of-the-art office building
- *Nebraska Innovation Campus Conference Center*
- *Nebraska Innovation Studio*, a “maker space” in the conference center, where students, faculty, business partners and community members can build, invent and innovate

It takes two years from design to completion of a building, Duncan said, and he always wants to see building cranes on the Nebraska Innovation Campus landscape. Although it would be nice to have all 2.5 million square feet built out right away, Duncan explained that the capital would not be available, nor would the occupants. Research facilities often are built specifically for the needs of the research and the partners, requiring that the partners participate in the design of the facilities. [innovate.nebraska.edu] ★

Nebraska Innovation Campus: GROWING THE UNIVERSITY AND ALL OF NEBRASKA

by SAMANTHA SCHNEIDER

They build ideas and capacity; they generate jobs; they benefit the economy.

They are innovators.

Nebraska Innovation Campus inspires innovation, facilitates research and forges new and in-depth partnerships with the University of Nebraska and the private sector. It is a space and culture that inspires, attracts and keeps talent in Nebraska, according to Dan Duncan, executive director of Nebraska Innovation Campus.

And it works.

“Nebraska Innovation Campus is in the beginning stages of a 25-year plan to build out 2.5 million square feet,” Duncan said.

The campus opened in July 2015 and as of July 1, 2016, has 380,000 square feet of built-out greenhouse, high bay, laboratory and office space, he said. At full build-out, Duncan expects to have 5,000 people working at Nebraska Innovation

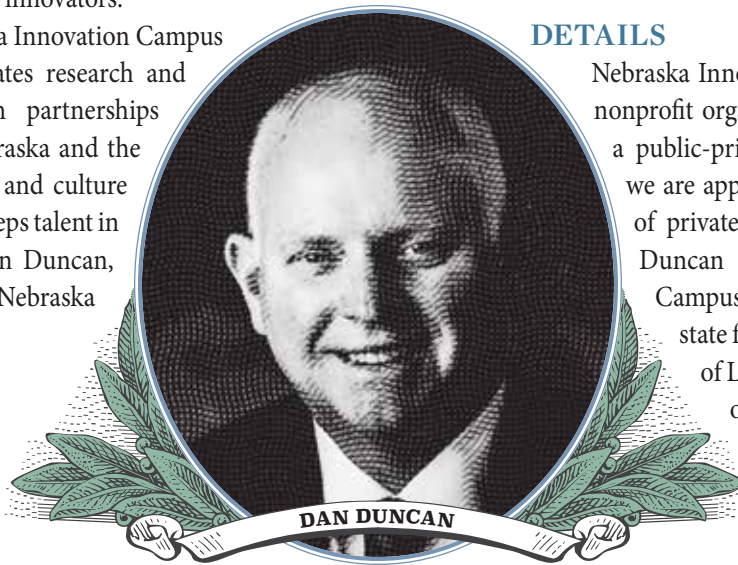
Campus: two-thirds from the private sector and one-third from the university.

DETAILS

Nebraska Innovation Campus, a 501(c) (3) nonprofit organization, is the definition of a public-private development. “To date, we are approaching \$100 million worth of private investment in the campus,” Duncan said. Nebraska Innovation Campus has received \$25 million in state funds, provided by the passage of LB 560 during the 2015 session of the Nebraska Unicameral.

Nebraska NOVA, a private development firm, owns all of the buildings at Nebraska Innovation

Campus, with the exception of the Conference Center. That building is owned by the university and leased to the Nebraska Alumni Association.



As of July 1, 2016, partners on Nebraska Innovation Campus include:

- ConAgra Foods
- Echo Canyon Services
- ENHANCE Health Network
- Food Dreams Made Real
- UNL Food Allergy Research and Resource Program
- Great Plains Safety and Health Organization
- Hastings HVAC
- IntelliFarm
- Metagenome Analytics, LLC
- Nebraska Safety Center
- NUtech Ventures
- NuTek Food Science
- Quantified Ag
- Robert B. Daugherty Water for Food Institute at the University of Nebraska
- Spreetail
- Tetrad Property Group
- The UNL Food Processing Center
- UNL Department of Food Science and Technology
- UNL Industry Relations
- Virtual Incision Corporation
- 3M

Private industry has invested dollars and human resources, and private developers take on the risk of building and owning the facilities. The public sector has resources invested and researchers committed to the work. “When those come together, we see dynamic research and economic development growth,” Duncan said.

CREATING GROWTH

“I think one of the misconceptions is that you can build a building and recruit people to it,” Duncan said. In fact, partnerships attract additional partners, forming a critical mass that diversifies the innovation and attracts amenities, such as restaurants, day care facilities and housing options. Critical mass shows prospective private industry partners the successes and helps them buy into the vision, giving them a reason to invest.

As an example, ConAgra Foods partnered with Nebraska Innovation Campus, “and the idea of moving the entire Department of Food Science and Technology to Nebraska Innovation Campus really gelled with ConAgra Foods,” Duncan said. This partnership is bringing students, faculty and companies together in the research campus environment for transdisciplinary research and innovation. The Department of Food Science and Technology includes The Food Processing Center and its pilot plants, which are used by faculty, staff, students, food entrepreneurs and established food processors.

“It’s really important to create critical mass, so companies will actually understand that things are going to work,” Duncan said. “The campus is going to move forward, there is a commitment, and they want to be a part of it.”

Duncan said the goal is to have constant construction of new buildings until the research campus is complete. Nebraska Innovation Campus began construction on an 80,000-square-foot building in the summer of 2016; he said it takes two years from the time a building is conceived to when someone can move in, which requires partnerships and planning.

FOCUS ON STRENGTHS

“We recruit businesses that have or want a significant relationship with the university,” Duncan said. Nebraska Innovation Campus has targeted most of its marketing toward companies that specialize in food, fuel and water, which are strengths of Nebraska and of the University of Nebraska and will help move Nebraska’s economy forward.

The UNL Department of Food Science and Technology was the first UNL department to move to Nebraska Innovation Campus. It moved to the Food Innovation Center on Nebraska Innovation Campus in July 2015. The Food Processing Center, which is part of the Department of Food Science and Technology, is helping companies with research and development of new ideas and products.

For example, the department’s Gut Function Initiative uses the research campus facilities to study the metabolic function of the human gut, with the goal of improved health. Nebraska Innovation Campus’s first international partner — Food Dreams Made Real, Suji’s Cuisine USA, is a food product development and restaurant group that makes and commercializes Korean-influenced foods.

The fuel theme on Nebraska Innovation Campus is centered on biofuels, Duncan said. The water theme is reflected through the Nebraska Innovation Campus partnership with the University of Nebraska’s Robert B. Daugherty Water for Food Institute. This institute is working to address the global challenge of using less water resources to achieve food security.

EDUCATING THROUGH ACTION

Nebraska Innovation Campus not only empowers sustainability research; it is modeling sustainable practices. Those practices are integrated into the culture of the campus.

“If you go to Nebraska Innovation Campus, you don’t see two trash cans, you see three,” Duncan said. There is a bin for waste, one for recycling, and one for organic material, such as food waste. Prairieland Dairy in Firth, a campus partner, collects the organic recycling and composts it with manure from the dairy’s 1,400 cows. The dairy sells the locally sourced compost.

Nebraska Innovation Campus heats and cools its buildings through a partnership with the city of Lincoln and the city’s Theresa Street Wastewater Treatment Facility, which has a solid digestion system. The solid digestion system collects waste and pumps it into large tanks called anaerobic digesters, which break down the solids. One of the byproducts from the digestion process is 15,000 gallons per minute of 60-degree water.

“We have borrowed that water and we run it over into our Central Renewable Energy System (CRES) building through a series of heat exchangers,” Duncan said. This system heats and cools the buildings with a 50 percent reduction in greenhouse gas emissions. [innovate.nebraska.edu] ★

ATTRACTING COMPANIES, KEEPING TALENT, GROWING NEBRASKA

by DANIELLE FRANCK

Ann Willet knows her way around innovation and around industry. As director of Strategic Alliances for Food, Fuel and Water at Nebraska Innovation Campus, Willet recruits companies to join the synergy and excitement at the University of Nebraska–Lincoln research campus. Those public-private partnerships facilitate innovation and create opportunities, jobs and economic development.

“We need a research campus so we can keep and attract talent to Nebraska. We need to have a place that is appealing to young talent, a place that is welcoming and where they want to be and work — a place that meets their goals,” Willet said.

Willet earned a Doctor of Pharmacy degree from the University of Nebraska Medical Center and a Master of Business Administration from UNL. After years of experience in clinical development and medical affairs for a pharmaceutical company, she joined the Nebraska Innovation Campus team to attract partners whose interests align with the food, fuel and water strengths of the university.

BUILDING ON NEBRASKA’S STRENGTHS

“Food, fuel and water are important to our state. It’s what we’re good at in our state; it’s a strength of the university and it’s a natural leverage of our natural talents and skills here,” Willet said.

The entire Department of Food Science and Technology moved to Nebraska Innovation Campus in the summer of 2015, to a specially designed building called the Food Innovation Center. The state-of-the-art facilities result in research and teaching opportunities that are attracting

students, faculty and private business partners, Willet said.

“The work being done, for example, in the Food Innovation Center has an immediate impact,” she said, citing the Department of Food Science and Technology’s Food Allergy Research and Resource Program, which works around the world in areas of food allergies; extensive research in food safety; the Gut Function Initiative, which focuses on gut microbes and how they affect health; The Food Processing Center, which consists of more than 20,000 square feet of pilot plant space where companies and entrepreneurs can test their products and obtain advice from food scientists on product commercialization.

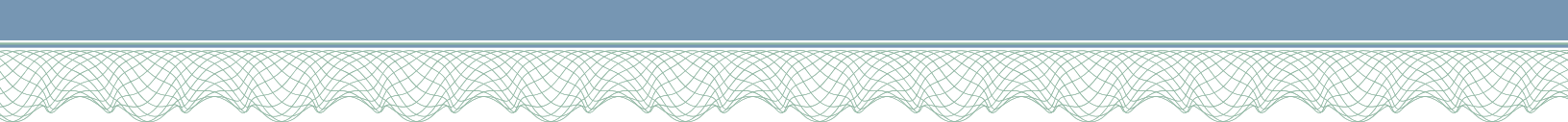
Additionally, the Food Innovation Center houses a consortium of private partners called the Alliance for Advanced Food Sanitation, bringing in eight major companies to research improved methods regarding food sanitation, such as new surface materials that will improve sanitation and food safety in production facilities.

THE TALENT PIPELINE

The university is one public entity in a partnership that includes faculty, students and residents of Nebraska. The university brings in unique skills, training and research ideas that private businesses want and can benefit all involved.

Many private partners express initial interest in a university facility or faculty expertise, but typically the second request is “how do we access students?” Willet said. “It’s the natural pipeline for them; they want to have the right talent coming in to their corporation, and this is a very good way for them to build that pipeline.” There is increased competition among companies for highly trained employees, especially





in the sciences. Willet said UNL students are intelligent and hard-working, and private partners hire them as interns or researchers and often, they transition into full-time employment after graduation.

“Our goal is to be a place where talent wants to be and wants to stay,” Willet said. “That’s how we build Nebraska Innovation Campus — by providing the space and culture that will build economic development and opportunities for our students, faculty and the state.”

Willet said the process of recruiting new partners may involve academic advisors, faculty or the research park’s private development partner, Tetrad Property Group. It might also include existing partners already located on Nebraska Innovation Campus. Getting all of these parties involved in the process verifies that all of the partners at Nebraska Innovation Campus fit the mission of the research campus. “First, we identify if the potential partner is a good fit,” she said. “If it is, we work to solidify the relationship and the appropriate opportunity for that relationship.”

Willet said it is important to have international and domestic partners, startups and established companies — and everything in between. “We believe they each bring their own traits. We also believe that diversity wins, and innovation will come out of that mix,” she said. The companies on Nebraska Innovation Campus also have a variety of focus areas, including food safety, agricultural technology and electronic commerce.

“We hope the outcome will be a benefit to our state and people around the world,” she said. “We think the research will impact every corner of the state and its people. We also think it is an economic opportunity for our state,” she said. “As we grow and develop that culture of innovation in a place where talent wants to grow and to be, it will only help our state grow and flourish,” she added.

The physical plan for Nebraska Innovation Campus includes 2.2 million square feet of built-out space in the 25-year plan. As of the summer of 2016, the campus had finished its third year of development, with 380,000 square feet of built-out laboratory, office and conference space. The conference center is owned by UNL and operated by the Nebraska Alumni Association, while the other buildings are owned by Tetrad Property Group. “We are very proud of the success we have had thus far, and we look forward to the next phases of our growth at Nebraska Innovation Campus,” Willet said. “We ask everyone to be a champion of Nebraska Innovation Campus.” [\[innovate.unl.edu\]](http://innovate.unl.edu) ★

NUTECH VENTURES HELPS UNL INVENTORS PROTECT, COMMERCIALIZE DISCOVERIES

Technology commercialization arm of the university offers complete services for innovation

by MARY GARBACZ

Guiding research and new knowledge at the University of Nebraska–Lincoln can be described as an innovation machine — one that results

in new jobs for UNL graduates and value to its stakeholders, partners and the community.

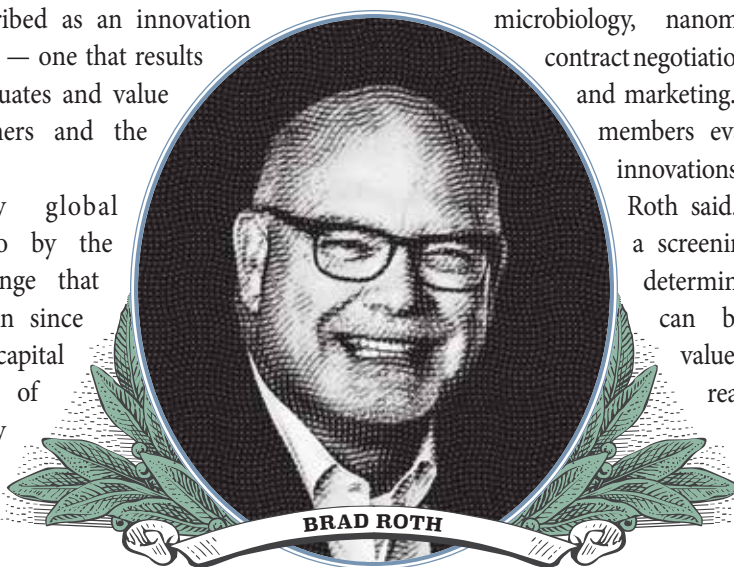
It's all fueled by global competitiveness, but also by the attitude and culture change that has taken place in Lincoln since 2005, moving Nebraska's capital city to a growing center of innovation. The university has been a large part of growing the infrastructure that educates students, provides a place and support for invention to occur and incubate, helps with funding and marketing — and building up the city and state of Nebraska to support innovation.

Brad Roth is the executive director of NUtech Ventures, the technology commercialization arm of UNL. Roth holds a doctorate in crop genetics and heads a team of technology licensing professionals who work with UNL faculty, staff and students on their latest inventions. The goal is to protect new knowledge, discoveries and inventions — the intellectual property — and commercialize them for the public good. NUtech Ventures also connects innovators with the mentors and resources they need to start companies, develop products and create jobs, Roth said, "so UNL technologies can change the world."

NUtech Ventures serves all of the University of Nebraska–Lincoln, including City Campus, East Campus and all of the UNL offices and research facilities throughout Nebraska.

"There is never a dull moment," Roth said.

The NUtech Ventures team of scientists and legal professionals specializes in many fields of expertise, including biochemistry, microbiology, nanomaterials, commercialization, contract negotiations and compliance, accounting and marketing. The NUtech Ventures' team members evaluate each of the 100-plus innovations submitted to them each year, Roth said. Each innovation undergoes a screening evaluation, and the team determines whether the technology can be patented, the potential value in the marketplace and the readiness of the technology to be commercialized.



PROCESSING INNOVATION

Innovations may be new "widgets," as Roth calls them; they may be processes; they may be systems that bring many things together that haven't been brought together in the past. Or, Roth said, they may be unique biological materials, like plant varieties, cell lines, antibodies or vaccines. Plant varieties, including but not limited to wheat and other small grains, dry beans, soybeans and grasses, can be protected via Plant Variety Protection as set up by the United States government.

"We'll expend resources to file patents, then market the technology to companies that may be interested in it," Roth said. NUtech Ventures completes the license agreements to enable companies to use those technologies for their new products. The NUtech team looks at the market and determines the innovation's value for commercialization. Sometimes it takes several years to license an innovation because a market hasn't been fully realized, he said; other times, a technology is so much of a breakthrough with a strong market pull that it is licensed immediately.

Through the evaluation process, the team challenges itself to determine where an innovation fits in the marketplace, and at times, the potential applications and uses may extend to additional markets not initially envisioned, Roth said. Sometimes, NUtech's conversations with a company will lead to the opportunity for a company to sponsor research on campus in a specific interest area. "That kind of partnership not only helps with innovation; it helps with further developing innovations on behalf of the University of Nebraska–Lincoln," he explained. In other instances, NUtech's conversations with companies may also result in an opportunity for a company to become interested in other UNL innovations and inventors.

"In a nutshell, that is our mission: to serve the campus. We want to be a leading technology transfer organization among universities," he added.

UNL AS AN INVENTION GENERATOR

University of Nebraska–Lincoln faculty, staff and students are engaged in research with the intent to create new knowledge and invent new and better products and processes. The world benefits from these discoveries, whether it's a better, more reliable food supply or a vaccine that protects a human or animal from disease.

Roth said the intellectual property policy of the university is set out by the Board of Regents. In general, the policy states that for innovations created with substantial university resources, on behalf of the university or in line with employee job responsibilities, the innovations are owned by the university, and there is an obligation to assign those intellectual property rights to the university, he explained.

When a discovery is commercialized and income is generated, there is a royalty-sharing policy that distributes percentages to the inventor and to other parts of the university, including the inventor's college. NUtech Ventures also receives a percentage for its assistance with evaluation, protection, commercialization and marketing of the innovation.

NEBRASKA INNOVATION CAMPUS

Nurturing innovation is so essential to the public good, the economy and job creation that UNL built Nebraska Innovation Campus to provide a place where innovative "collisions" can occur, where entrepreneurs can build their companies, where

assistance can be found with protecting and commercializing innovations and where university experts, students and businesses can work together.

"I really applaud then-UNL Chancellor Harvey Perlman and the late Vice Chancellor for Research and Economic Development Prem Paul for the vision for Nebraska Innovation Campus," Roth said.

Part of Nebraska Innovation Campus is a multiuse space called Nebraska Innovation Studio where, Roth said, inventors can build prototypes of their innovations. NUtech Ventures is located on Nebraska Innovation Campus, in the same office suite as the research campus administrative offices.

Nebraska Innovation Campus offers innovation advancement suites, offices and conference rooms and soon, biotechnology connector laboratories, located in the Food Innovation Center, which houses the UNL Department of Food Science and Technology, including The Food Processing Center.

NUtech Ventures' personnel also operate NMotion, the Lincoln-based public-private startup accelerator that accepts an annual class of up to seven startup companies for an intensive 100-day program. NMotion and its director, Brian Ardinger, help each entrepreneur validate the company's idea and customer base, help develop a minimal viable product and help the entrepreneur pitch the company to investors.

"They work really hard for 100 days," Roth said. "The idea is to have an annual program where the result is more value for the community and for investors. We also hope there is more job generation and more of a landing place for graduates of the university," he said. NMotion is a partnership that includes UNL, NUtech Ventures, local businesses and investors, Invest Nebraska and the Lincoln Chamber of Commerce that fits well within the Lincoln and Nebraska startup ecosystem, he added. "It really puts the university right in the middle of the startup ecosystem."

CHANGING THE WORLD

Roth said the university, the state and the federal government invest a great deal in research. As a result, "we feel a real responsibility to see that put to good use, so it can benefit society. There is great research going on here that could change the world. That's what we want to be about."

[nutechventures.org] ☆

DEVELOPING, MANAGING NEBRASKA INNOVATION CAMPUS

by PAIGE DIETRICH

Tetrad Property Group is the behind-the-scenes company that keeps Nebraska Innovation Campus running smoothly.

Tetrad Property Group is a commercial real estate development and management company that provides services from the beginning of an idea to managing the construction and then management of the finished property.

The University of Nebraska Board of Regents owns the land on which Nebraska Innovation Campus is located, but Tetrad Property Group owns the buildings.

“There are not a lot of research campuses where you find a developer that is willing to take the financial risk by owning all those buildings. That’s one of the reasons we think Nebraska Innovation Campus will be very successful as we move forward,” according to Jennifer Brinkman, the company’s director of communications.

“Our company is interested in building a better future for the clients and communities we serve; we are committed to making sure the project will make a difference in the places we are working. We are all Nebraskans,” Brinkman said.

ABOUT NEBRASKA INNOVATION CAMPUS

The Nebraska Innovation Campus has 149 developable acres, she said. Tetrad Property Group was responsible from the beginning, to implement the infrastructure. The land on which Nebraska Innovation Campus is located was the site of the Nebraska State Fair until 2010, when it moved to Grand Island to accommodate the construction of Nebraska Innovation Campus. The land did not have utilities that could support an entire state-of-the-art research campus, so Tetrad Property Group worked with the University of Nebraska-

Lincoln, The Nebraska Innovation Campus Development Corporation and the city of Lincoln to put together a plan for an innovative infrastructure.

The infrastructure includes a Central Renewable Energy System (CRES), meets Leadership in Energy and Environmental Design (LEED) Silver Design Standards and includes energy-smart buildings. Tetrad will continue to be the development partner for the campus as it continues to grow.

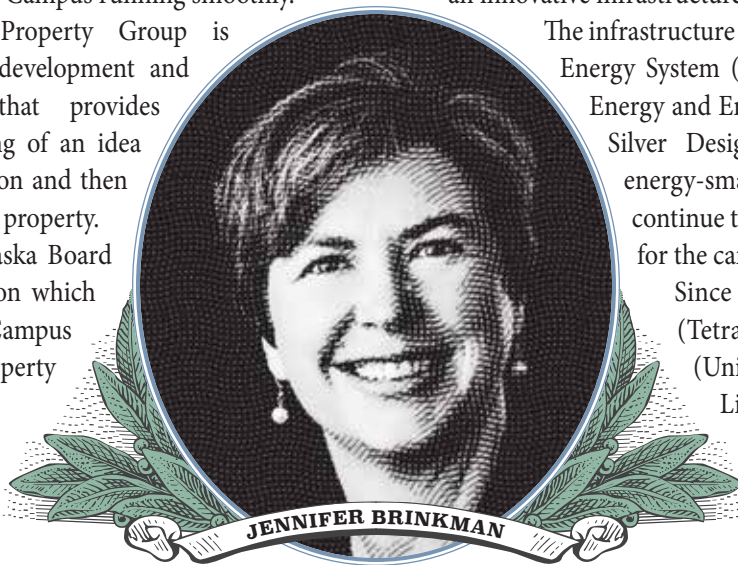
Since there is a private sector (Tetrad) and a public sector (University of Nebraska-Lincoln), Nebraska Innovation Campus has many stakeholders. “There is a responsibility I believe we have to be able to explain

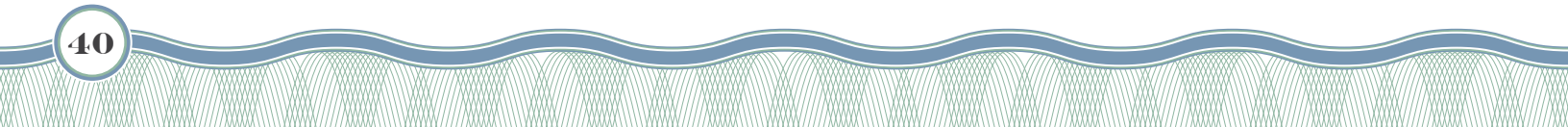
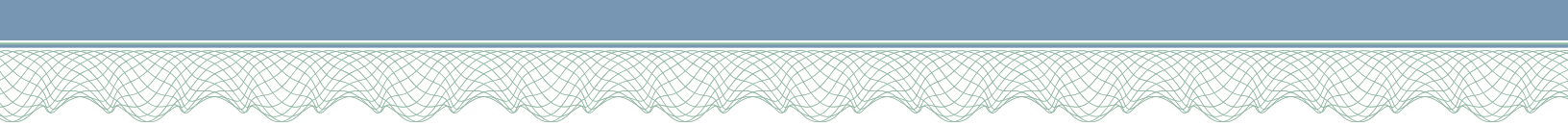
how we’re working with the public sector, because there are tax dollars that are invested in this project,” Brinkman said.

FUNDING, BUILDING

Tetrad has provided nearly \$94 million in financing and investment in these buildings, she said. There also has been money from the university’s funds, and then an investment of \$25 million from the state, Brinkman added. “We feel like those partnerships are really enabling the university to speed up the investment in the campus.”

Tetrad will be involved for the entire 25-year plan for development of Nebraska Innovation Campus. “We’re excited about the kind of difference that we’re able to make because we really do think that Nebraska Innovation Campus is real key to economic development, not only for UNL or Lincoln, but really for the state of Nebraska,” she said. “It is executing partnerships across the state, and that’s really exciting to be a part of.” ★





'The Best Facilities in the World'

TEACHING STUDENTS, ADDING VALUE, SERVING THE WORLD

*Department of Food Science and Technology
Moved to Nebraska Innovation Campus in 2015*

by SARAH SCHELLPEPER

The University of Nebraska–Lincoln Department of Food Science and Technology’s move from the UNL East Campus to the Food Innovation Center at Nebraska Innovation Campus involved relocating 27 laboratories, sensitive equipment of all sizes and purposes, decades of research and the offices of 67 faculty and staff. It required 18 months of planning, scheduling and teamwork and multiple days to accomplish the move.

It required consultation with and services from heavy equipment companies, specialized movers, household movers, clinical laboratory companies, hospitals and small moving companies. Manufacturers of specialized equipment advised the department’s specialists on how to take it apart, move it and reassemble it.

But now, after a year on Nebraska Innovation Campus?

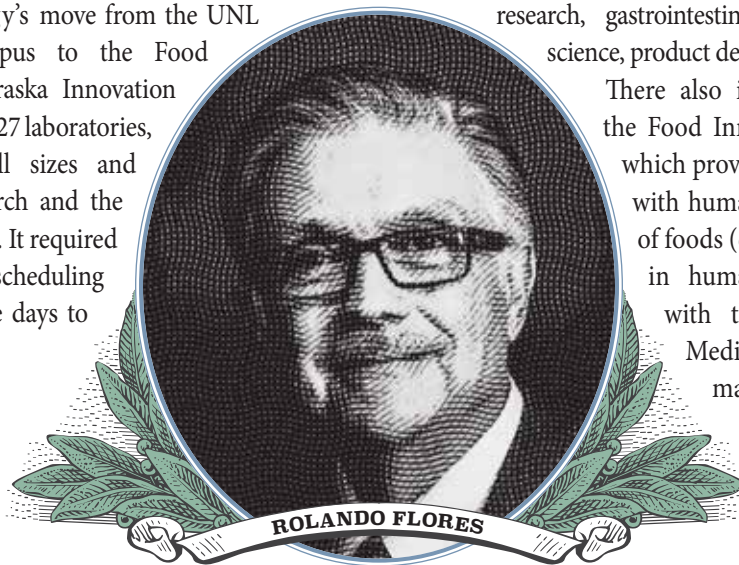
“We have the best facilities in the world. It’s as simple as that,” said Rolando Flores, who served as department head from 2010-2016.

“Teaching classrooms and laboratories are top of the line,” Flores said, “the best you can have.” Labs and classrooms flex for distance education — capable of nearly anything a learner could need, anywhere in the world.

The building itself is designed for easy communication and

innovative “collisions” between students, faculty and with the businesses that partner with the department in food allergy research, gastrointestinal biology, food processing science, product development and sensory testing.

There also is now a clinical facility in the Food Innovation Center, Flores said, which provides the capability of working with human subjects to see the impact of foods (developed in the department) in humans. “We are collaborating with the University of Nebraska Medical Center (UNMC) for the management of the clinical facilities,” Flores said. “These facilities also allow us to work in a more coordinated way with UNMC.”



CREATING VALUE FOR GROWER, MANUFACTURER

The Food Processing Center, which is aligned with the department, went from three pilot plants to seven, and from 8,000 square feet to more than 20,000 square feet when the department moved to Nebraska Innovation Campus. ConAgra Foods, Inc. donated a significant amount of equipment for use in The Food Processing Center, greatly expanding its capabilities. “ConAgra is a name associated with partnerships,” Flores said.

The mission of The Food Processing Center is to develop value-added products, bringing them from an idea to the marketplace. “We work in the creation of value-added that

assists the grower, but also assists the manufacturer who gets to transform that through applied research,” Flores said. Many new food products have been developed by faculty and students since The Food Processing Center was founded in 1983.

The pilot plants in The Food Processing Center are used in many ways, Flores said. Students can see experiments in the lab, but also see and work with the equipment that transforms raw materials at a scale used in the food industry. For example, Flores said, “we have one of the best food-grade extrusion facilities in the country.” Extrusion equipment turns cereal grains, such as corn, wheat, rye or millet, from the indigestible whole form into foods humans or animals can digest, such as flaked or puffed cereals and snack foods, or companion animal food.

Food processing companies can schedule projects in the pilot plants, and food scientists on staff will perform experiments for their needs, resulting in safer foods, improved flavors and textures, and better ways of processing, using less water and energy and retaining nutrients.

The Food Processing Center is expanding into new areas, such as developing a center for excellence in high-pressure processing in collaboration with a company based in Lincoln — Universal Cold Storage and Universal Pasteurization. “High-pressure processing allows the pasteurization without using high temperature, but using high pressure instead,” Flores said. “It allows for better retention of nutrients with less damage. As food scientists, we want to deliver those nutrients people want, and high-pressure processing allows for that,” he added.

“We not only want to feed more people; we want to give them food that is healthy, that is well-preserved and that is safe,” Flores said. He pointed out that companies from Nebraska, other states and other countries come to Lincoln to work with the department’s scientists and The Food Processing Center’s scientists. Nebraska Innovation Campus’ many private partners in the food industry rely on those scientists for assistance in all areas of food development and production.

The Alliance for Advanced Food Sanitation, a coalition of major food companies committed to improving food safety and sanitation, is one of those partners. Its location in the Food Innovation Center will facilitate research collaborations for better methods of processing; methods and products for cleaning equipment and the air; and research into surfaces that will not harbor bacteria.

TRANSFORMING RESEARCH, BENEFITING STUDENTS

Competency in food science requires that faculty members transfer applicable knowledge to students, Flores said. That “frontier of knowledge” must include a strong research program and funding to support it. In addition to traditional funding sources, such as grants and state aid, public-private partnerships are increasingly popular — and not only for funding. “We cannot see another way to fully develop applications of research and transfer them to students if we do not work with industry,” Flores said.

The move to Nebraska Innovation Campus has increased the students’ opportunities to work with industry. Businesses and coalitions founded on improving food, food processing and nutrition are located in the Food Innovation Center, where undergraduate and graduate students learn about business and food science at the same time, combined with applied research in The Food Processing Center, resulting in safer, more nutritious foods that address individual health needs. They carry that knowledge to positions in business and academia in the United States and all over the world.

“We are structuring ourselves to focus on what we know: the applied research,” he said. Applied research takes basic scientific research and finds ways it can benefit the public. The Department of Food Science and Technology faculty and staff are studying a variety of health-related areas, including food safety, allergens and gastrointestinal biology, and in the research and development of functional foods — also called nutraceuticals — that benefit human health. Examples of functional foods are probiotics and prebiotics, omega-3 products, soy foods and whole-grain products.

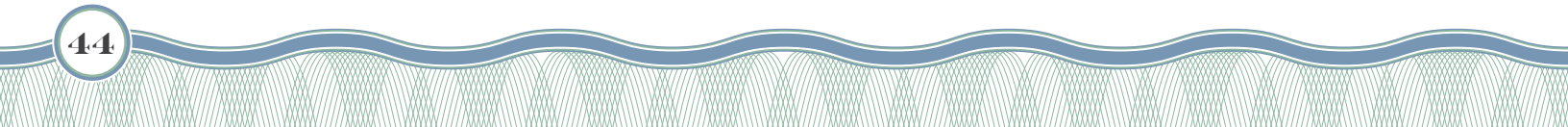
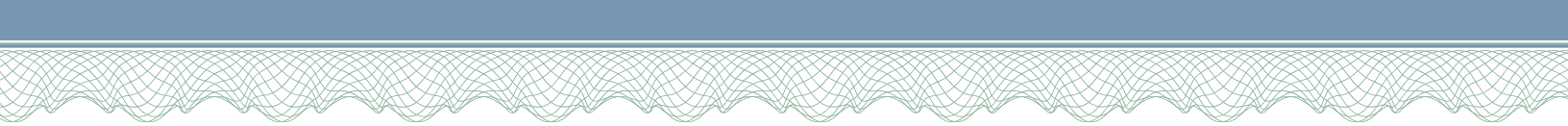
“We can solve problems faster, we can create products; at the same time, we can work with students,” he added.

Flores said that expanding research, involving industry and reaching out all are pieces of the puzzle that will bring Nebraska to a higher level in the science and technology of foods with a worldwide reach.

The department’s international focus has resulted in agreements with universities in other countries, such as a program with Northwest Agriculture and Forestry University in China. Under this agreement, NAFU students spend three years in China, then come to the UNL Department of Food Science and Technology for the last year of their undergraduate study. The first 50 NAFU students arrived on the UNL campus in the 2016-2017 academic year. [foodsci.unl.edu] ★



CAPITALIZING ON IDEAS



STARTUP ENTREPRENEURS BENEFIT FROM MENTORSHIP

by PAIGE DIETRICH

“**W**hen I get up in the morning I think ‘this is going to be the best day of my life and I’m going to help somebody out so they can have the best day of their life,’” said Vern Powers, who has not only served two terms as mayor of Hastings, Nebraska, but is also involved in mentoring scores of entrepreneurs — several of whom now reside in office space on Nebraska Innovation Campus at the University of Nebraska–Lincoln.

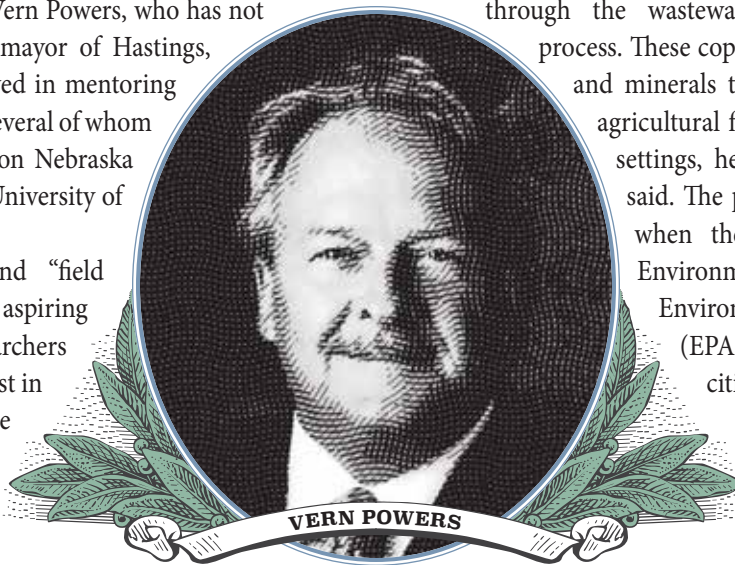
Nebraska is a newfound “field of opportunities” for aspiring entrepreneurs and researchers looking for someone to invest in them, their products and the future of their companies. Powers believes Nebraska’s economy can be improved by mentors investing their time in entrepreneurs and startup companies to make sure Nebraska benefits by innovation and the resulting jobs and revenue.

Not only has Powers served as a mayor; he has also been a business partner, mentor, founder or stockholder in 52 different businesses. Powers is owner and CEO of Hastings HVAC, which specializes in manufacturing the world’s largest heating, ventilating and air handling equipment. The company markets those products worldwide through a manufacturing rep network of 62 different companies. Powers also is owner and founder of Vestal W₂O, a biotechnology company in partnership with the University of Nebraska–Lincoln, using patented products and procedures to convert raw municipal sewage into products not only useful for a world consumer market, but also useful in alleviating and mitigating EPA registered pollutants from land and waterways. The ideas and innovation of these new products led Powers to team with the University of Nebraska–Lincoln. Paul Black, chair

of the UNL Department of Biochemistry, and his team of research professionals conduct advanced research on isolated molecules and biologic agents that not only clean contaminated municipal water, but also create marketable coproducts through the wastewater filtration and reaction process. These coproducts are biofuel, fertilizers and minerals that can be used in vehicles, agricultural fields, advanced technological settings, health care and more, Powers said. The project began eight years ago when the Nebraska Department of Environmental Quality and the U.S. Environmental Protection Agency (EPA) asked Hastings (and all cities) to be better stewards of our environment. This moved Powers to begin a search to solve the problem as opposed to another Band-Aid on a solution.

“All the sewage treatment plants in the world have EPA hazards,” Powers said. But Vestal W₂O, started by Powers to partner with Black and the University of Nebraska–Lincoln, will use biochemical processes to convert 20 percent of the valuable waste stream into oil. In addition, these molecules will also clean up heavy metals, nitrates, ammonia and carbon dioxide,” Powers said. Black had already begun conducting research on algae and biofuels; Powers encouraged him to meld that research into sewage treatment research. The University of Nebraska–Lincoln and Vestal W₂O will be in charge of the research and Vestal W₂O will own and be in charge of marketing the biofuel/oil and minerals produced by the processes. This research will be conducted in collaboration with Hastings HVAC, Echo Canyon, the city of Hastings and the University of Nebraska–Lincoln, Powers said.

This research is what has led Powers to lease office space at Nebraska Innovation Campus, the University of Nebraska–Lincoln research campus located between City Campus and



East Campus. Nebraska Innovation Campus was designed to encourage public-private partnerships between the University of Nebraska–Lincoln and private sector businesses. Nebraska Innovation Campus aspires to be the most sustainable research and technology campus in the United States, and Powers is helping make that happen by bringing his research and businesses there.

Powers believes public-private partnerships are important for many reasons. The University would not have the money to make the algae-to-oil project into a billion-dollar-a-year oil company, but its faculty can conduct the research and the private sector can contribute money. When it's all done, the University benefits by receiving royalties and the private company will control all of the sales and manufacturing. "It's a true hand-in-hand partnership," Powers said.

Another benefit Powers sees in private-public partnerships is technologies being invented and projects developed. Researchers need someone to take the invention to market, so that is where the private partner steps in.

MENTORSHIP

"We always hear 'we need to keep our kids in Nebraska,'" Powers said.

"As CEO of a number of Nebraska companies and also mayor of a town of 26,000, we can repeat that simplistic statement until the cows come home. Unless we actually go out and put our money where our mouths are and invest in our Nebraska students, they are going to go somewhere else if the opportunity looks attractive to them," he said. Powers is a proponent of economic growth, which leads to jobs created in Nebraska for young adults.

Mentorship is an important part of Powers' life, including mentorship of Lincoln-based Quantified Ag, which was a 2014 startup company in the NMotion Accelerator in Lincoln's Haymarket. Quantified Ag, in its third year and growing rapidly, is now based at Nebraska Innovation Campus. Vishal Singh, founder of Quantified Ag, had started Quantified Ag's

technology using drones to monitor cattle. Singh and Powers were introduced by Brian Ardinger (director of NMotion and owner of Econic in the Haymarket) with the idea of Powers helping Singh by being his mentor and investing in his technology and helping take it to market.

Powers believes that by mentoring "you can help people and help the state. The main thing a mentor does is protect and guide the person they are helping, and invest mentally in their concept and the person." That is what Powers has done for Singh and Quantified Ag. "Being there as a mentor on those scary days when confidence slips or money leaks or new challenges arise bolsters and encourages a new business owner not to give up." In the end, through Singh's hard work, follow-through and perfection of the technology, Quantified Ag's success has also meant hiring more people, creating more jobs in Nebraska.

As a mentor to many entrepreneurs and startup companies, Powers believes that a mentor should provide helpful and protective advice, but be careful about committing to funding. "Probably some of the best advice you are ever going to get from a mentor is free advice. Then if you get further into the mechanics of the product and knowledge of the market, and there is a clearly identifiable need for the product, funding makes perfect sense." Powers does request to be a board member for each company he mentors and/or funds, with a goal of making sure from start to finish that these companies make as few mistakes as possible. "With a great founder, a great team and the correct board DNA, decision-making has a very good chance of success," Powers said.

Powers mentors others because he has found success in business and politics since graduating from UNL in 1984 and would like to share his philosophy of success with entrepreneurs. "I try to educate myself every single day, to be successful this must never stop. I read voraciously, I try to find the right people in my life and I'm positive every day.

"Persistence is paramount, quitting is easy. Don't ever quit." ★

CLEANER WATER, IMPROVED HEALTH = GLOBAL IMPACT

by ELIZABETH UEHLING

Paul Black believes his research into lipid metabolism will provide key information that will lead to prevention of diseases, such as diabetes and obesity. But a new direction is proving Black's research also is improving the quality of communities' water supplies.

Black is the head of the Department of Biochemistry at the University of Nebraska–Lincoln (UNL). Much of his work addresses lipid (fat) metabolism in mammals using cell-based and animal model (mice) systems. His research into lipid metabolism began in the 1980s and has continued to lead him down different research paths in the years since.

Much like lipids occur in mammals, they also occur in algae, Black said. Algae also can metabolize the nitrates and phosphates found in fertilizers used on cropland.

"One of the challenges in modern agriculture is fertilizers high in nitrates and phosphates," Black said. Nitrates and phosphates are added to fertilizers to help crops grow, but end up in groundwater. Nitrates often run off the land and flow into natural water supplies like groundwater and rivers. Black said the Environmental Protection Agency (EPA) has asked the city administration of Hastings, Nebraska, to create a clean water filtration system to reduce the nitrates in the water.

That's where Black's research translates into not only human health, but the health of vital natural resources.

CLEANER WATER THROUGH SCIENCE

Hastings Mayor Vern Powers reached out to Black to advise and partner to meet the EPA's requirements. Black said talks began in 2010, and in 2015 Powers created a company called

Vestal W₂O (Waste to Oil). "It's a play on H₂O," Black said.

"Fundamentally, the question addressed to the mayor is 'what can we strategically do to make sure the water that comes into the Hastings water system and goes out of the Hasting water system is clean?' One of our thoughts was whether we can empower a biological system to be sustainable in wastewater remediation." The answer, Black says, is yes.

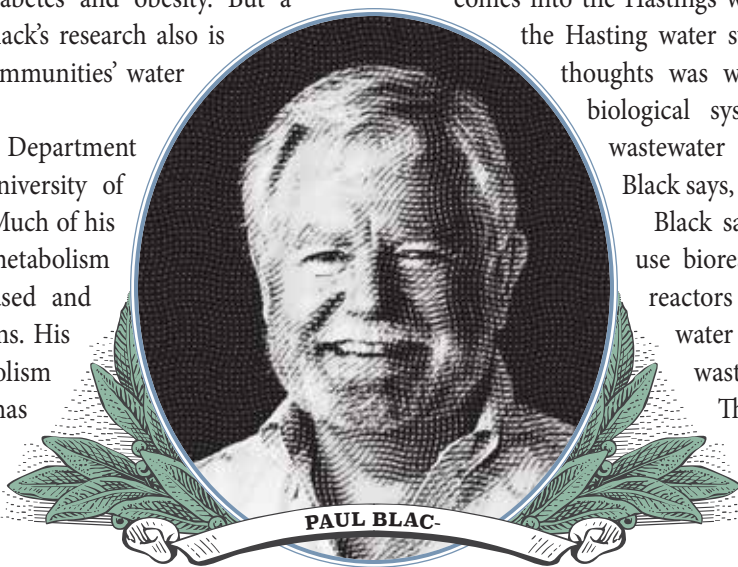
Black said the filtration system will use bioreactors to grow algae. These reactors will be linked up to Hastings' water system as part of the city's wastewater treatment system.

The wastewater will be used as a nutrient source to grow algae and in so doing will remove nitrates, phosphates and likely

other contaminants using the biological, metabolic process of the algae itself. "This process allows biology to do what biology does best," Black said.

An important consideration in these studies is that under stress, algae creates triglycerides — oil — that can be used to create a number of high-value products while simultaneously removing nitrates and phosphates from water. Black said these high value products range from biofuel to precursors for chemotherapeutic drug synthesis.

"We're looking at the biological strategies for production of oil, or another high-value product. In addition, we're looking to provide clean water that meets EPA standards of quality that goes downstream," Black said. "An important consideration is the algal biomass that's left over." Following the extraction of oil or other high-value products, the biomass can be dried and used as a nitrogen-rich fertilizer. "In essence, we are using biology to develop a system that is economically sustainable. There's high value in all the pieces," Black said.



IMPORTANCE OF PARTNERING

The work has been proven successful in laboratory-scale experiments, and Black believes they are ready to take the research to the next level through partnerships with engineers and the private sector.

“The public-private relationship is extremely important on this,” Black said. “We get grants from the government, but it’s really going to be what the private sector allows us to do to translate it into something bigger.”

The project has received funding from the Department of Energy, the Nebraska Center for Energy Sciences Research, Vestal W₂O and the Nebraska Department of Economic Development. NUtech Ventures (the technology-transfer unit of the University of Nebraska–Lincoln) is assisting with commercialization of the process.

“Partnerships are important because of the transitional nature of science. What we are doing is going to have a positive impact,” Black said.

IMPACTING SOCIETY

While there is no specific timeline set for a finished product, Black expects to deploy a small-scale system in 2017, as he knows the work is important not just for Hastings, but for the world.

“What we do as scientists is largely directed to improving the human condition,” Black said. “We’re trying to make the human condition better through science and technology development.”

While Vestal W₂O is being created locally, Black recognizes long-term global impact. “The foundation of everything we do is clean water,” he said. “We turn a faucet on and we’ve got clean water. If you think of parts of the world where they don’t have clean water, what is it associated with? It’s associated with disease and poverty.”

Black explained that clean water is central to human health. When clean water is available, the surrounding communities are healthier. Because these communities have access to clean water, infectious disease is less of a problem. Using a biological system to enhance wastewater remediation also will contribute to water conservation for crops and livestock.

“What you have is a mechanism that begins with clean water, which leads to a healthier society where children can go to school, and you end up with a more educated society,” Black said. What comes with a more educated society includes reduction of poverty, enhanced quality of life for small communities and an overall increase in opportunity.

“It all leads to a better and more sustainable structure because we’ve done the right thing at that foundational level of clean water. That’s a big deal.” [biochem.unl.edu] ☆

Guaranteed Tender Steak:

'A WONDERFUL MARRIAGE OF TECHNOLOGY AND NATURE'

by SAMANTHA SCHNEIDER

Who hasn't had a tough steak?" asked Chris Calkins, a professor and meat scientist in the Department of Animal Science at the University of Nebraska-Lincoln and co-founder of a company that uses technology to accurately predict a steak's tenderness.

"We all like to have a good eating experience," Calkins said, adding that meat scientists have been working on beef tenderness for hundreds of years. As a meat scientist, an interest in tenderness "is sort of a natural," he said. Several years ago, he was approached by Jayamkondan Subbiah, professor of biological systems engineering and food science technology, and Kenneth E. Morrison Distinguished Professor in Food Engineering. Subbiah had a technology idea that he thought might be able to predict beef tenderness during the grading process. During meat processing, carcasses are split, and then graded, Calkins explained. The ribeye steak area is presented to a U.S. Department of Agriculture (USDA) meat grader, who determines whether the beef is to receive the grade of Prime, Choice, or Select. The "guaranteed tender" technology could be a quick, additional step in the grading process to predict tenderness.

TENDERSPEC, LLC

"We call ourselves TenderSpec, as in specification for tender beef and also 'spec' as in spectral evaluation," Calkins said. Spectral evaluation uses a high-quality image to evaluate the ribeye muscle. TenderSpec technology looks like a very sophisticated camera in a stainless steel housing, he explained.

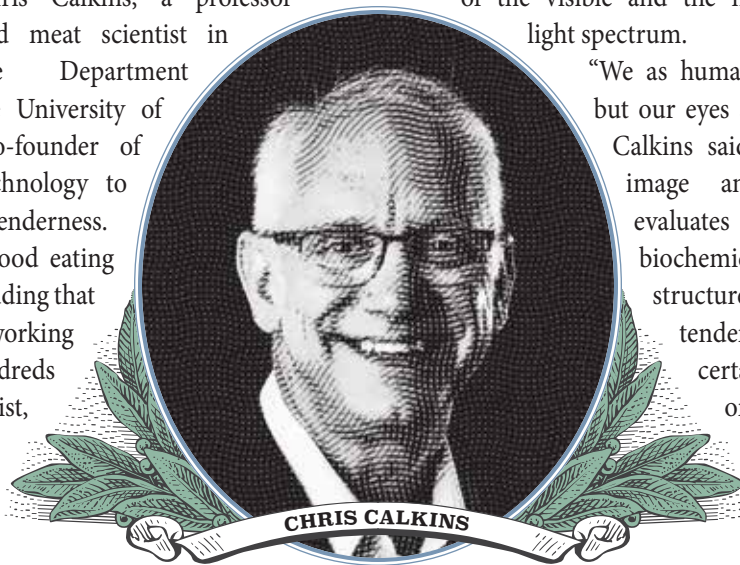
By placing the device on the ribeye, an image is taken of the visible and the near-infrared regions of the light spectrum.

"We as humans cannot see near-infrared but our eyes are sensitive to visible light," Calkins said. The camera captures the image and sophisticated software evaluates the characteristics of fat, biochemical composition, and meat structure. This quickly reports the tenderness of the meat. "Only certain parts of that carcass, the ones that are most tender, will carry the 'guaranteed tender' label," Calkins said. "Our hope is that in the next 6-12 months,

TenderSpec certified-tender beef will be available in the marketplace," Calkins said. Consumers will be able to identify TenderSpec certified-tender beef by a sticker on the packaging, he added.

BUILDING A TEAM

"Every good team has people who bring something special to it," Calkins said. Since every image that TenderSpec technology captures displays a great deal of data, the evaluation and tenderness predictions must be accurate, he explained. Subbiah and Calkins collaborated in the technology, "and so together we started on a process," Calkins said. Eventually, the team gained Ashok Samal, professor in the UNL Department of Computer Science and Engineering. Samal's role is to analyze the data. "We were able to hire a very bright engineer and former graduate student of Subbiah's, Govindarajan Konda Naganathan, who is now our vice president of research and development," Calkins said. The TenderSpec team also includes an attorney and an investor.



FUNDING THE DREAM

“Any new business enterprise requires financial support,” Calkins said. Calkins, Konda Naganathan, Subbiah, and Samal wrote grant proposals to possible funding entities. TenderSpec was fortunate to receive federal support and support from the Nebraska Department of Economic Development, but “it was clear we needed additional funding,” Calkins said. “We were very lucky to find Paul Engler, who appreciates good beef, understands the beef industry and was willing to risk his own personal capital for us,” he said. Engler is the founder of Cactus Feeders, one of the largest cattle feeding operations in the world. In 2010, the Paul F. and Virginia Engler Foundation established the Engler Agribusiness Entrepreneurship program at the University of Nebraska–Lincoln.

FROM RESEARCH TO CONSUMER

“Early on in the process we recognized that our ideas were unique, that the chance to apply the technology to forecast the tenderness of beef had never been done,” Calkins said. TenderSpec initially tested more than 100 steaks and was 100 percent successful in its predictions. “That’s when we knew we had something that’s going to add value to the industry and it’s actually going to work,” he added.

“It’s quite the challenge to take technology from the bench top and then actually make a working commercial unit,” Calkins said. TenderSpec technology is now patented by the United States Patent and Trademark Office, as well as Australia and Canada, he said. Calkins said getting a patent “does not happen overnight.” Currently, TenderSpec has two patents in the United States and one international patent with several more under review. “I would encourage anybody with an innovative or unique idea to reach out, get some support,

and then move forward to protect the idea through the patent system,” he said.

GENERATING VALUE

“Research shows that customers are willing to pay a premium if you can guarantee that the steaks they are going to eat tonight are going to be tender,” Calkins said. Consumers will pay 75 cents to \$2.50 premium for a guarantee of tender, he added. “There are four meatpacking companies that are responsible for about 75 to 80 percent of the fed cattle in the United States,” Calkins said. Since there are so few meatpacking companies to buy the technology, TenderSpec expects to share some of the value that is generated through licensing agreements.

NEBRASKA: THE ‘GOLDEN TRIANGLE’

“If you had the chance to create a state that was suited for beef production, you would make Nebraska,” Calkins said. Nebraska has millions of acres of pasture, making the state a good place to raise cattle. Nebraska is No. 1 in the United States in the production of red meat; it also is first in cattle on feed. The state is third nationally in corn for grain production, he said, making Nebraska well-suited to feed and raise beef animals. Also, Nebraska is a leader in the production of ethanol. Distillers grains, a coproduct from ethanol production, makes a great feed for cattle.

“When you’ve got cattle, corn and distillers grains, you have a golden triangle. Couple that with an industry associated with finishing cattle and beef packers located in the state, and you have the ideal place to produce high-quality, tender beef,” Calkins said. ★

NEBRASKA INVENTOR ENCOURAGES OTHERS TO INNOVATE

Nebraska Innovation Studio provides space, equipment to help others soar

by ELIZABETH UEHLING

What do Silicon Valley, California; Florence Italy; Athens, Greece and Vienna, Austria, have in common?

They are — or were — hotbeds of innovation.

University of Nebraska–Lincoln Professor Shane Farritor believes Lincoln, Nebraska, could become the next hotbed of innovation.

“I think this is a place where we can become world leaders. We can be a hot point of hardware-based innovation,” Farritor said. He’s talking about Nebraska Innovation Studio, a “maker space” on the UNL Nebraska Innovation Campus.

An inventor himself, Farritor grew up in Ravenna, Nebraska, planning on a medical career until a high school teacher suggested he consider engineering. It turned out to be a good fit, he said.

Farritor earned a bachelor’s degree in mechanical engineering from UNL, followed by a master’s degree and a doctoral degree in mechanical engineering from the Massachusetts Institute of Technology. He returned to UNL in 1998 as a professor of mechanical and materials engineering.

Farritor introduced the idea of Nebraska Innovation Studio, to include specialized spaces and equipment ranging from woodworking and weaving to computers for software development and 3-D printing. He generated the idea for the space through his past experiences with other maker spaces and the collaborative nature of their environments.

“I think it’s transformative. I think Nebraska Innovation Studio is a new way to educate students,” he said. “They’re

passionate about what they want to accomplish there, and that is an important ingredient in innovation and invention.

The fire has to come from within,” he added. The unstructured nature of a maker space allows an inventor to explore, tinker and think in a different way about the way things work.

“The best engineering schools have facilities where students can go build things. I think that’s not a coincidence,”

Farritor said. “There’s a ‘geography to genius’ concept that we need to try to facilitate, to make special places where we can create a lot of inventions,” he added.

Socrates, Plato and Aristotle knew each other in ancient Greece, as did

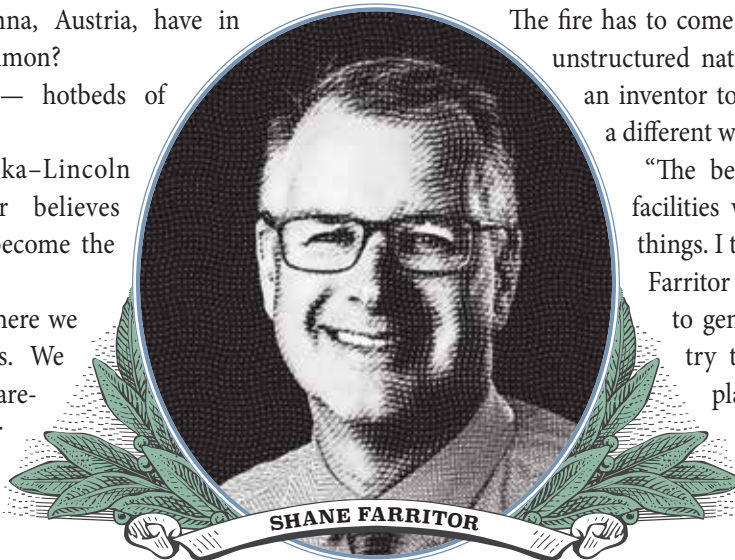
daVinci and Michelangelo in Florence,

Italy, in the 1550s. Mozart, Beethoven and Haydn all knew each other in Vienna, Austria, in the 1700s, too, Farritor said.

“I hope Nebraska Innovation Studio will be like that. I hope we’ll do a couple of startup companies a year with students or members with new, great ideas.”

People have problems in their personal lives and try to find solutions in maker spaces like this, he said. For example, a student recently invented a stirring robot so he wouldn’t have to constantly stir his spaghetti sauce, Farritor said. A UNL art student created a printer to print out her text messages, requiring her to work with electrical engineers. Another student, proclaiming himself the best foosball player of all time, got a camera to track the motion of the ball and then activated the goalie so a player could never score against the computer.

“It’s a numbers game,” Farritor said. “We’re going to get enough of these interesting projects going, and we’ll have new inventions that are valuable to people.”



MAKER SPACES — A GROWING TREND

Maker spaces are a growing trend in the United States and around the world, but Farritor believes Nebraska Innovation Studio has the potential to be unique. He said the focus of the space is to create an environment where diversity in people and interests thrive, while bringing in as many people to the space as possible — what Farritor calls “density.”

“You can look at the history of innovation and you will find you need certain characteristics. We want to build a culture and environment where we get artists talking to English majors talking to engineers about stuff they’re passionate about. We’re trying to make diversity and density critical elements of our goals, and I think that sets us apart,” Farritor said.

Cost for using the space ranges from a \$10 day pass to a \$660 yearlong community membership, Farritor said. Students pay the lowest rates, he added, to encourage participation.

While the space is available to everyone, safety courses are required for first-time users. “Table saws, drill presses and metal lathes are things you can hurt yourself with,” Farritor said. The safety courses teach participants to use the equipment properly and safely, he said.

Aside from orientation and safety courses, Farritor said there also are skills courses offered to those seeking a new interest or specialty.

Farritor said Nebraska Innovation Studio participants not only use the space but also offer their skills to others. There are members who are teaching courses in weaving, woodcarving and computer programming.

Collaborative projects have already taken place and Farritor is hopeful Nebraska Innovation Studio will continue to curate innovation.

“It’s early but there have already been some wonderful things that have come out of this space. We have a fashion and textiles major who made a dress she could reconfigure as the night went on,” Farritor said. “The dress had electronic elements, which allowed it to change shape so it would fit differently as the night went on.”

No matter what the project, Farritor believes these ideas are created because someone saw a problem and wanted to fix it, much like inventors from the past.

Farritor noted that 100 years ago, the richest man in the world didn’t have access to something as simple as air conditioning. “I think there are certain problems that can be fixed,” Farritor said. He is confident such inventions can be created through Nebraska Innovation Studio and is hopeful about what the space’s future holds.

FARRITOR’S PARTNERSHIP CONTRIBUTIONS

NASA Mars Rovers, surgical robotic arms and railroad tracks are just a few things Farritor has worked on over the years.

While Farritor has high hopes for such inventions to be produced through partnerships at Nebraska Innovation Studio, he is an inventor himself and one who is advancing the medical field. Read about Virtual Incision Corporation in **Virtual Incision Corporation: *partnering engineering with medicine*** in this publication. [innovationstudio.unl.edu] ☆

NEW ALLIANCE BENEFITS FOOD SAFETY

*Alliance for Advanced Food Sanitation developing processes
and products to improve food processing safety*

by JENNY KEYES

According to the Centers for Disease Control and Prevention, each year one in six Americans will become ill from a foodborne illness.

The Alliance for Advanced Food Sanitation (AAFS) is a new consortium on Nebraska Innovation Campus conducting research on every stage of food processing sanitation.

“Sanitation is critical and complex,” said Rolando Flores, who served as head of the University of Nebraska–Lincoln Department of Food Science and Technology from 2010 until 2016. Sanitation is expensive, he said, but without careful attention to sanitation, a company can go out of business.

The alliance, which involves research, extension and teaching, will develop improved sanitation practices and foster the development of new surface materials and procedures that can be implemented by the food processing and affiliated industries. The alliance’s office is in the Food Innovation Center where the Department of Food Science and Technology and The Food Processing Center are located.

Angela Anandappa was selected to be the founding director of the Alliance for Advanced Food Sanitation, beginning in June 2016. Anandappa earned a doctorate in Food Safety Systems from the University of Kentucky and most recently worked for KraftHeinz as a section manager in Supply Chain Safety Assurance.

SANITATION DEFINED

Sanitation includes the proper materials and methods used

in cleaning equipment in production facilities, Flores said. Not only are the surfaces and equipment important, but also the air in the facility.

The environment in which foods are processed is relatively high in humidity, which is ideal for the growth of certain microorganisms.

The AAFS’s goal is to assist in maintaining a clean food-processing environment, Flores explained.

“In order to have a food-safe product, we need to guarantee that the facility follows sanitation procedures properly and depending on the material that you are handling there, the type of products,” Flores said.

VISION, FUNDING

A senior faculty member in the Department of Food Science and Technology, Steve Taylor, generated the idea for the AAFS.

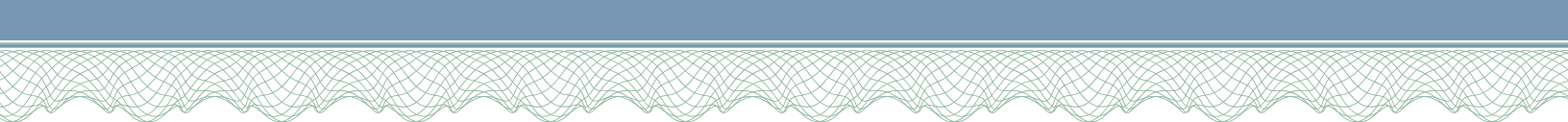
“It was brought up when we were having a retreat with industry members from ConAgra Foods,” Flores said. “In this meeting, this idea was brought up to create a consortium.”

The alliance is overseen by the director, who is responsible for all alliance activities and provides executive oversight for alliance programs.

The AAFS was funded by a group of nine major food companies and it is looking to increase the membership. Each company pays an annual fee, based on company size, to belong to the alliance. In exchange for this fee, the company can participate in deciding what areas of research are to be conducted.

As full members, they will have input in the alliance’s research agenda by recommending research proposals, acceptance, rejection and modification of proposals. Full





members will also have the opportunity to be involved in hands-on workshops to receive training in new approaches to cleaning and sanitation.

“The industry has been very positive,” Flores said.

The current companies are: Hershey, Kellogg’s, Nestle, ConAgra Foods, Cargill, Ecolab, Neogen, Commercial Food Sanitation and 3M.

GROWING IDEAS

Equipment in food processing facilities needs to be easy to clean. Traditionally, stainless steel surfaces have been used in food processing facilities. The research will look at developing bacteria-resistant surfaces and chemicals and techniques that may be more appropriate for the cleaning process.

A surface in a food processing facility is described as anything that gets in contact with food, intermediate products or raw materials, Flores said. To the eye, the surface may appear to be clean and smooth, but may look different when placed under a microscope.

“For example, if you put a piece of beef on a counter that is made out of high-density polyethylene, depending on the roughness of the surface, the food product is going to touch there and will leave some residual material there,” Flores said.

The group also will develop detection methods and solutions for issues related to equipment. For example, if a gasket in a pipe is not working well, it can allow for some accumulation

of food material, Flores explained. “Microorganisms at the microscopic level find an environment conducive to growth and then it contaminates everything.”

Steam and chlorinated chemicals currently are used to remove leftover food or organic matter from surfaces in food processing facilities. The research will look at new and more effective methods of cleaning equipment parts and ensuring optimal function.

The Alliance for Advanced Food Sanitation will work to reduce cost and increase efficiency in sanitation procedures in production facilities.

“The cost of the labor, the cost of chemicals and the cost of water result in high production costs. It is a high cost for the food industry,” Flores said. Further research will be conducted on using less water, chemicals and energy in food production facilities.

GOALS

Flores said finding a way to feed the world’s growing population is a constant reminder to the companies in the alliance.

“It is a matter of quantity of food produced, but also quality and safety,” he said.

“There are not only food scientists involved in this. There are chemists, physicists, engineers, biologists and microbiologists who are involved,” Flores said. “There is a lot of opportunity for the University of Nebraska to come out with very novel and timely research to benefit the consumer.” ★

QUANTIFIED AG COMPANY REMOVES GUESSWORK FROM ANIMAL HEALTH

by JENNY KEYES

A startup company in Lincoln, Nebraska is taking the guesswork out of animal health. Vishal Singh, CEO and founder of Quantified Ag, explained that the precision livestock data analytics company is developing a wearable health-tracking device for cattle.

The device is an ear tag loaded with sensors that can detect potential illness. Some indicators of illness include head movement, mobility and body temperature of the animal.

Quantified Ag's six-person team is located on Nebraska Innovation Campus, the research campus of the University of Nebraska-Lincoln. Team members are: Andrew Uden, chief operations officer and co-founder; Brian Schupbach, chief technology officer and co-founder; along with talented members helping to build the system.

"Being at Nebraska Innovation Campus, not only do you have the academic environment you are in, but you also have access to other business startups," Singh said. "It is nice to be able to talk through ideas with other people who may be facing the same type of issue you might be."

TECHNOLOGY

While Singh hasn't spent a career in the cattle industry, he discovered during his work with agricultural technology projects with the Institute of Agriculture and Natural Resources that one of the producers' main issues was animal health.

Singh originally looked at imaging cattle with the use of drones. After exploring the real problem for cattle producers, Singh decided the device needed to be user-friendly.

The battery-powered ear tag is currently being used on 1,200 head of cattle in Nebraska feed yards. The ear tag fits onto the cartilage of the animal's ear.

When cattle producers are looking for sick animals, they are looking for cattle with their heads down or that have a low range of mobility. The biometric sensors record temperature readings and behavioral patterns that are indicators of illness in the animal. For example, an animal that is standing in the corner of the lot by itself with its head lowered should be removed from the pen for a veterinarian to examine and treat.

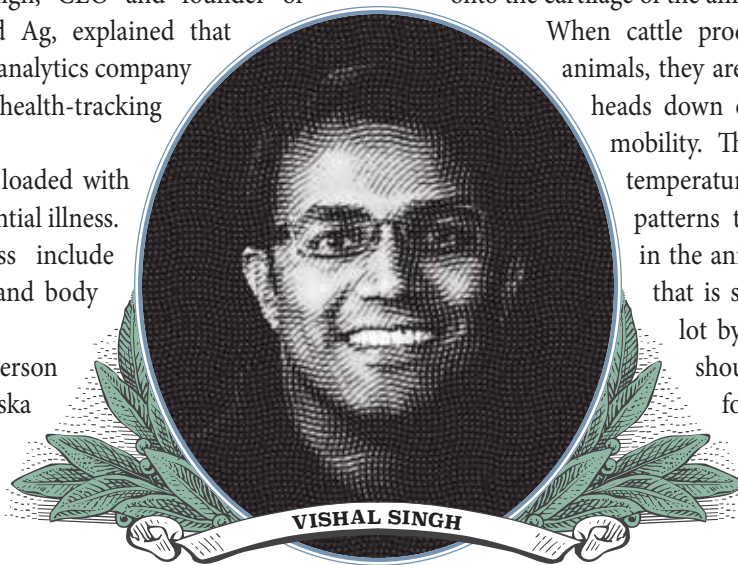
"There has been a lot of research on how cattle show their symptoms

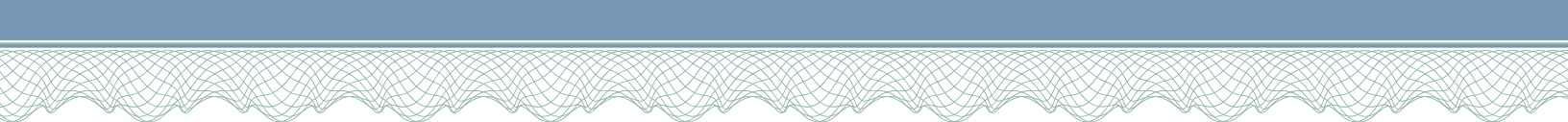
of illness and a lot of times, illness manifests itself with a high temperature," Singh said. "Beyond that, you want to track their mobility. Mobility can be how much they are walking around the pen, but more importantly, the range of motion during mobility."

Once the data is collected, it is then sent to internet-based data storage called "the cloud." Cattle producers pay a subscription fee on a cost-per-head basis to access the information, Singh said.

While many cattle producers rely on pen riders and their expertise to locate the sick animals, there are many benefits to investing in Quantified Ag's technology. By catching any signs of sickness early, producers can save on veterinarian bills or the death losses that can occur.

"If you are a 10,000-head feed yard, you are going to rotate through your inventory 2 to 2 ½ times per year and then, if you calculate death loss at say, somewhere around 2-3 percent just on death loss, you are losing almost \$700,000-\$800,000 per year," Singh said.





According to the Nebraska Department of Agriculture, Nebraska had more than 2.5 million head of cattle on feed in 2016. Quantified Ag is currently only being marketed for feed yard producers, but looking ahead, the company is hoping to work with other areas of the livestock industry.

“The system as we built it up is specifically built for feed yards, but we have had a lot of people in the livestock industry approach us saying they need something like this,” Singh said.

MENTORSHIP

Quantified Ag didn’t begin overnight. Singh developed relationships with mentors who helped guide him in creating a successful business.

Singh credited his mentors Tom Field and Vern Powers as sources of entrepreneurial advice and guidance during the entire business process. Field is the director of the Engler Agribusiness Entrepreneurship Program at the University of Nebraska–Lincoln; Powers is mayor of Hastings.

Singh believes the best mentors don’t necessarily come across as knowing everything about everything.

“They might have a really, really deep understanding in a specific area or multiple areas, and they are able to see your path,” Singh said. “If you are headed toward any problems, they alert you before you get there so you can be a little bit better prepared.

“Every day is definitely a new challenge and I learn all sorts of things as I go through this,” Singh said. “I think the best part is that is I have a lot of people around me who really believe in this.” ★

'CHIEF INSPIRATIONAL OFFICER' CHOOSES NEBRASKA INNOVATION CAMPUS FOR FOOD DREAMS MADE REAL

by ELIZABETH UEHLING

Every small business startup, every collaborator joins Nebraska Innovation Campus for a different reason. Suji Park, however, stands alone as the first international business to locate on the research campus of the University of Nebraska-Lincoln.

With Food Dreams Made Real, doing business as Suji's Korean Cuisine, Park is collaborating with The Food Processing Center in the UNL Department of Food Science and Technology to commercialize foods from her native South Korea. Park calls herself "chief inspirational officer" of the company.

"I love food," Park said. "Food brings everyone together. It doesn't matter who you are, where you're from, or your background, education or culture. Good food brings people together."

As an entrepreneur and business person, Park saw opportunity based on market trends, which showed increased interest in Korean food across the United States. "Our goal was to bring innovative Korean cuisine products to the global market," she said, branding her products in a way similar to other popular products on store shelves.

Park knew she needed help to achieve her dream of bringing Korean food products to the world market. But the help came in a surprising way.

STUMBLING ONTO NEBRASKA

Park attended an International Food Technology (IFT) convention in Las Vegas in 2012, where she took a mini-course

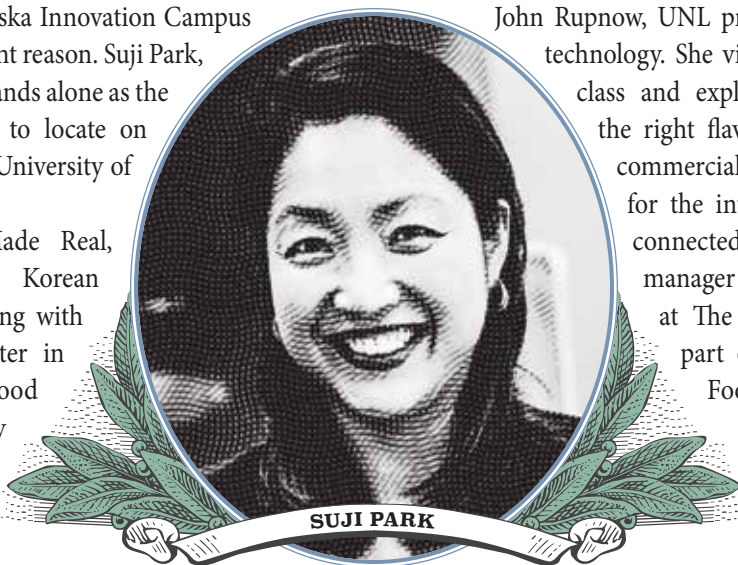
called "Food Science for the Non-Food Scientist," taught by John Rupnow, UNL professor of food science and technology. She visited with Rupnow after the class and explained her goals of finding the right flavors for the U.S. palate and commercializing Korean food products for the international market. Rupnow connected her with Laurie Keeler, then manager for product development at The Food Processing Center, a part of the UNL Department of Food Science and Technology.

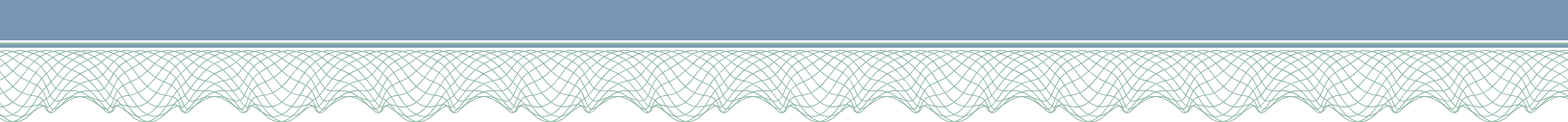
Keeler was staffing a booth at the IFT convention and introduced Park to the services of The Food Processing Center.

"I said 'where's Nebraska?' and Laurie said 'it's in the middle of the U.S.," Park said. Within a few months, Park was in Lincoln meeting with Department Head Rolando Flores and others who would help her move her business forward.

A year later, Park had moved to Nebraska to have access to the services of The Food Processing Center.

In the summer of 2015, the entire Department of Food Science and Technology moved to Nebraska Innovation Campus, to a building called the Food Innovation Center. The building contains teaching laboratories, classrooms, research facilities and The Food Processing Center. The facilities of The Food Processing Center increased in capacity with the move to the Food Innovation Center, from three pilot plants in 8,000 square feet in the former location, to seven pilot plants in 20,000 square feet in the new location. Suji's Korean Cuisine's culinary team accesses the people, sensory laboratory, research laboratory and pilot plant facilities to test flavors, recipes and processes, then works with the center's specialists on labeling the products.





“We developed all of the product lines,” Park said. “Now, we have 10 products,” she added, including beef bulgogi, which is Korean barbecue; rice bowls; and sauces used on pizzas, wings and fried chicken. Park said 80 percent of Suji’s Korean Cuisine products are USDA-approved and label-approved, with assistance from The Food Processing Center team.

MAKING AND MARKETING SUJI’S KOREAN CUISINE

Some of Suji’s Korean Cuisine products were launched in the University of Nebraska–Lincoln dining halls, but most products are being marketed elsewhere. By the middle of 2016, her products had launched in more than 200 Costco stores — about half of those in the United States, Texas powerhouse H.E.B. Supermarkets, and through other regional retail outlets.

Meeting consumers’ expectations requires more than the perfect recipe; it is essential to understand trends, according to Park. There are three words that represent trends in the food industry: convenience, authenticity and “clean label.” Park said consumers want convenience — restaurant-quality food at home that can be served within just a few minutes. Consumers also desire authenticity — food made with ingredients that would actually be used in the food product’s country of origin. For example, Park said some companies use tomato puree in Korean-inspired food products — but tomato puree is not used in Korea. Younger people, especially, want to see authentic food ingredients. Finally, Park said, a “clean label” means the product is healthy and minimally processed.

All of Suji’s Korean Cuisine products are made in the United States, collaborating with food manufacturers to produce the products on a commercial scale instead of buying her own production equipment. “We want to use the latest technologies and techniques in the world,” she said, and by contracting with other food companies, she can accomplish that.

NEBRASKA INNOVATION CAMPUS

“Having Nebraska Innovation Campus as a physical facility with smart students and faculty, and the private sector is a like a marriage,” Park said. “That’s how I see Nebraska Innovation Campus. It’s a great opportunity, especially for small companies like us, to have opportunities to work with the academics and big companies,” she added.

“Personally, I believe Nebraska Innovation Campus is the future of Nebraska.” ★

SAFER FOOD FOR A HEALTHIER WORLD

by SARAH SCHELLPEPER

MetaGenome Analytics harnesses the power of DNA by analyzing genes to advance food safety. Andrew Benson, a professor of biotechnology in the Department of Food Science and Technology at the University of Nebraska–Lincoln, conceived this idea in 2014. MetaGenome Analytics works with DNA sequencing data to assess the microorganisms in food processing facilities.

A metagenome is a “collection of all the genetic material of all the organisms that might be present inside an environment,” Benson said. DNA sequencing provides an analytical platform to define the genetic material in a sample. It can be scaled to define subsets of specific genes, the entire genetic content of a single organism or the entire genetic composition of complex communities of many different organisms. From subtypes, whole genomes of single species or complete metagenomes, MetaGenome Analytics works across all levels of scale.

The MetaGenome Analytics team uses DNA sequencing to measure communities of organisms, according to Benson, and the species composition of these communities can help clients understand how their production practices affect the microbial community in a production operation. Ultimately, the information can be used to improve best practices for cleaning, to grade quality of incoming raw agricultural ingredients or to optimize production processes for shelf life or sensory properties of the food.

A FASTER PROCESS

DNA sequencing can reduce the time that food scientists

need to interpret results. Benson said “the idea with sequencing is that you can avoid all of that cultivation-based methodology, which is really time consuming.”

An example of how DNA sequencing can expedite answers is the NeoSeek Salmonella test, a test that MetaGenome Analytics co-developed with Neogen and Geneseek. The traditional test for Salmonella is called the five-day Salmonella test because it takes five days to complete it, and determining which type of Salmonella is present can take an additional one to three weeks, Benson said.

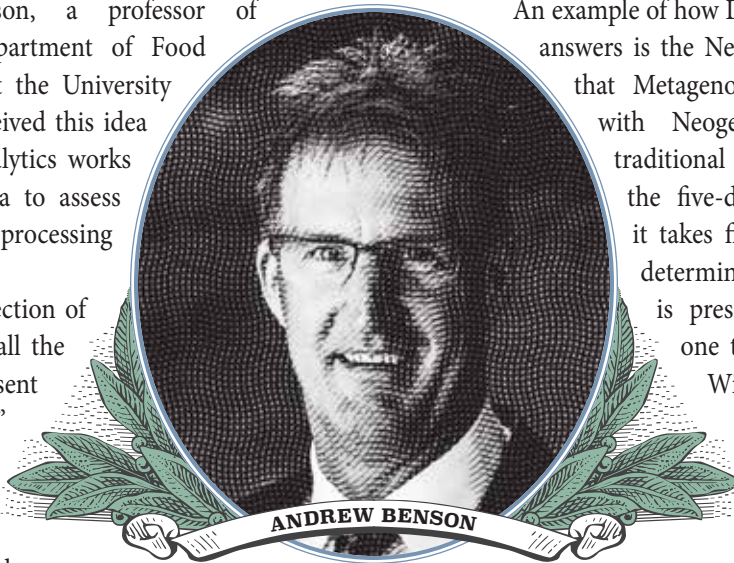
With DNA sequencing, “we can now do it in 48 hours and we have actually pushed it to go faster than that,” he added. Therefore, the food processing facilities

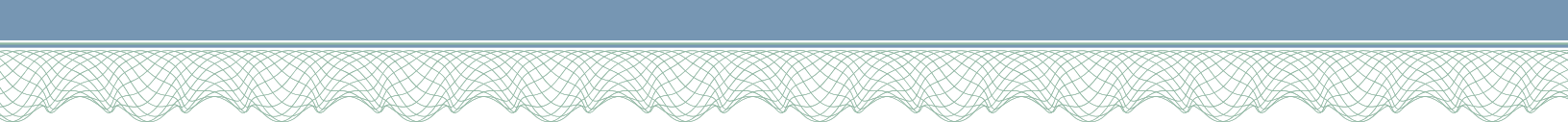
have more knowledge and control over a product to keep the consumer safer.

COLLABORATION WITH UNL

MetaGenome Analytics develops its technology in its offices at Nebraska Innovation Campus (NIC), located between the University of Nebraska–Lincoln City Campus and East Campus. Benson says that locating MetaGenome Analytics at NIC “means access and opportunities.” The company has access to potential clients and UNL students who may fill future intern positions.

The Department of Food Science and Technology and The Food Processing Center are located on Nebraska Innovation Campus, where faculty members conduct many kinds of training sessions for food producers. When producers come to campus for food science microbiology workshops, Benson said, MetaGenome Analytics can show these producers the technology. MetaGenome Analytics has the opportunity to





introduce the company to potential clients. That proximity to potential clients can help MetaGenome Analytics help food producers provide safer food to consumers.

FOR NEBRASKANS

For students, MetaGenome Analytics has brought new technology to the classroom. Benson's microbiology class performs a Salmonella detection lab each year. In the fall semester of 2015, students were able to use traditional methods and current DNA sequencing methods with Metagenome Analytics, Neogen, Geneseek and Illumina all gifting thousands of dollars in free services for the classroom exercise. According to Benson, this puts students in a more competitive position as they enter the food industry. "Students may not necessarily know all of the nuts and bolts that underlie this new generation of DNA testing, but their knowledge base will have already outpaced many people who work in food processing facilities today," he said.

Food production is important to Nebraska's economy, but also "being able to have access to the latest and greatest and best approaches for diagnostic microbiology is important for food safety," Benson said. ★

ENHANCING HEALTH IN THE MIDWEST:

ENHANCE Health Network strengthens rural health care

by DANIELLE FRANCK

“Our health is determined by where we live — more by our zip code than by our genetic code,” according to Dr. Michael Hein,

President and CEO of ENHANCE Health Network, formerly known as RPN, LLC. ENHANCE Health Network is a for-profit partnership formed by nine Nebraska-based health care systems and is designed to strengthen health care in member communities across the region, where poverty level, major community employers, education level and food availability all affect health, he said. Those social determinants also drive health care costs and services, he added.

Dr. Hein, an internal medicine physician with many years of private-practice experience, said his concept of health care is to provide exceptional, accessible care, led by caring health care providers, even if the patient lives miles away. Goals of ENHANCE Health Network are to eliminate duplicate services, improve the quality of care and lower the cost of health care, all at the community level.

ENHANCE Health Network was founded in late 2013 as a unified regional provider network of hospitals and physicians. The nine founding members are Bryan Health, Columbus Community Hospital, Faith Regional Health Services, Fremont Health, Great Plains Health, Mary Lanning Healthcare, Nebraska Medicine, Nebraska Methodist Health System and Regional West Health Services.

The corporate office of ENHANCE Health Network is on Nebraska Innovation Campus. As of mid-2016, ENHANCE Health Network included 59 affiliate members — 54 critical access hospitals and five specialty hospitals. More than

3,000 health care providers in Nebraska, western Iowa and northwest Missouri participated in the network as of mid-2016, including physicians, physician assistants, nurse practitioners and other allied health professionals, he said. By the end of 2016, Dr. Hein expects more than 3,500 providers to be in the network.

The focus of ENHANCE Health Network is clinical integration and enhancing the health of communities, according to Dr. Hein. He explained clinical integration as “delivering care the way we always wanted to deliver care — safe, equitable, accessible, efficient, high quality and centered on the needs of

patients.” The enhancement of health in communities, Dr. Hein said, is about improving the health of individuals in a community in a measurable and meaningful way.

“Our unique structure builds on the principle of maintaining autonomy and independence but at the same time, agreeing to work together,” Hein said.

IMPROVING PATIENT CARE

The network focuses on continuous patient care rather than just the traditional face-to-face visit in the hospital or office, he said.

“Maybe email, virtual visits, nursing, phone calls,” he said. Being successful in that future model — and in the way health care providers are paid — is a goal of ENHANCE Health Network. “We call it a ‘value-based world,’” he said. Virtual patient visits, also known as telemedicine or telehealth, are conducted by a physician connecting with a patient through a computer. The physician and patient can see and talk with one another and the cost is often lower than a traditional office visit.



“I think telehealth and virtual care services are both ways to meet the needs of patients in their communities,” Dr. Hein said. “If we’re successful, those critical access hospitals’ and health care providers’ doors stay open,” he added. “Keeping the care in those rural communities and not pulling it into urban centers is one of our aspirations. If we’re successful, we will keep our care local.”

Extending the reach of specialists is a priority, he said. Under the traditional health care model, patients from rural communities often had to travel hundreds of miles to access specialty health care, he said.

‘THE ECONOMIC CENTERPIECE’

It is essential that health care providers stay in rural communities and that the critical-access hospitals in which they practice stay open. “Rural health is a major economic issue for our state,” he said. “Those critical-access hospitals must stay financially viable. If they go under, you lose providers, so access diminishes. But more concerning — for many of our communities, the hospital is the economic centerpiece of the community,” he explained; hospitals often are major community employers. If a hospital closes its doors, it would be “devastating to the economic climate of rural Nebraska.”

Access to services, specialty care and sustainability sum up the reasons ENHANCE Health Network exists, but finding opportunities to help members save money in delivery of

services to patients is essential. ENHANCE Health Network will be able to extend opportunities and cost savings to member hospitals by working together to purchase services, supplies or contracts, which can be acquired at a discounted rate and a lower cost than individual members would be able to access.

Partnering with a large organization such as Nebraska Medicine, for example, allows health care services to be secured at costs individual hospitals could not access on their own. Nebraska Medicine, one of the founding members of ENHANCE Health Network, is a collaboration of the University of Nebraska Medical Center, Bellevue Medical Center and University of Nebraska Medical Center Physicians.

ACCESS TO ACADEMICS

“Nebraska Innovation Campus puts us in a position to have interactions, learn from each other, and be in an environment where we can do research,” Dr. Hein said. ENHANCE Health Network’s team will work with students and faculty to study how health care is delivered and determine what does and doesn’t work.

“I think our presence on the campus opens up access to hospitals more quickly than if we weren’t here,” he said. “I think it’s a two-way sharing and bridging of health care with the academic environment.” ★

NEBRASKA'S GREAT ASSET HELPING TO CHANGE WORLD HEALTH

by DANIELLE FRANCK

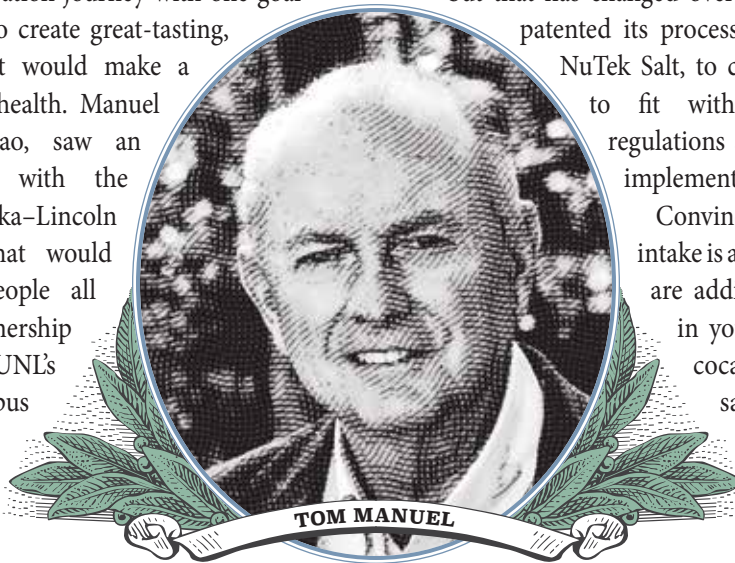
Tom Manuel, co-founder and chief executive officer of NuTek Salt, started his most recent food innovation journey with one goal in mind: to create great-tasting, new food ingredients that would make a positive impact on world health. Manuel and co-founder, Sam Rao, saw an opportunity to partner with the University of Nebraska–Lincoln to develop a product that would benefit the health of people all over the globe. The partnership between NuTek Salt and UNL's Nebraska Innovation Campus allows for the research to be conducted, innovation to flourish and impact to be made.

Manuel said they pondered the issue of world health and pinpointed one of the major issues facing the globe: sodium. NuTek Salt is potassium chloride that has gone through a patented process so it tastes like sodium salt and has the same properties. Potassium is a salt but it has a metallic taste, so the process NuTek Salt uses eliminates that metallic taste. Manuel worked with Rao to design the process. Rao, who has a doctorate in Food Science and Technology from Kansas State University, worked with ConAgra developing whole-grain products, probiotics and prebiotics, all with the goal of improving human health. Manuel's and Rao's patented process to change the flavor of potassium salt occurred during research at Nebraska Innovation Campus. Manuel and Rao determined that potassium is an ideal alternative to sodium due to its abundance in the raw form and the health benefits it provides.

"We're consuming about twice as much sodium as we are potassium. For proper health, the recommendation is you

consume twice as much potassium as sodium," Manuel said. "In the past, nobody was too interested in sodium reduction but that has changed over time." The NuTek Salt team patented its process and is selling the product, NuTek Salt, to companies all over the world to fit within new sodium-reduction regulations some world governments are implementing.

Convincing people to reduce sodium intake is a difficult task. "People actually are addicted to sodium; it lights up in your brain in the same way as cocaine or marijuana," Manuel said. Manuel and Rao knew the key to getting people to use an alternative to sodium would be to make a product that tastes just like salt.



FINDING SOLUTIONS

The first challenge was to remove the metallic taste of potassium chloride, Manuel said. Rao, who has a doctorate in food science and technology and is an adjunct professor of food science in the UNL Department of Food Science and Technology (FDST), found the solution. Rao, using FDST pilot plant facilities at Nebraska Innovation Campus, discovered a process that increases the surface area of the potassium crystal, which removes the metallic taste, Manuel said.

The company is expanding and has recently built a new factory in a closed-down bakery in Fargo, North Dakota, Manuel said. Even though NuTek's headquarters is in Omaha, mines with the highest-quality potassium chloride are in the province of Saskatchewan, in Canada. Locating the factory closer to the mines enables the company to reduce the transportation cost of getting potassium to the factory, he added.



SALT FOR LIFE

NuTek Salt's retail product, Salt for Life, is a blend of sea salt and NuTek Salt that replaces 50 percent of sodium salt with NuTek Salt. Salt for Life is available in 4,000 stores in the U.S., Manuel said. "Potassium has all of the same food safety aspects of sodium; the reason it's used all over the food industry is that it is a salt," he added.

THE PARTNERSHIP

Manuel and Rao selected Nebraska Innovation Campus as a place where they could further develop their product and use the research facilities available to partners of NIC.

"This is one of the finest food processing research facilities we deal with. The faculty here is magnificent, and you've got some of the brightest minds in the food industry; I think everybody can be so proud of it," Manuel said.

NuTek Salt is working on new innovative processes and products at Nebraska Innovation Campus in The Food Processing Center. The partnership between NuTek Salt and the University of Nebraska–Lincoln is leading to many benefits. The company is creating more jobs as it grows, students get hands-on experience and the investment made at NIC is being used for innovation that can benefit world health. Students graduate prepared to enter the workforce with a deeper understanding and real-world application of their education. As Manuel said, "it's a win-win situation for both the students and the industry." ★

SENSING, INSIGHTS AND A STARTUP COMPANY

by RACHEL NOE

Sensing and data are likely to be a major component of future gains in agricultural productivity. Smart systems help to reduce waste, increase productivity and produce more food on the same amount of ground, according to Steve Tippery, co-founder, president and CEO of IntelliFarm. IntelliFarm is a startup product development company headquartered at the University of Nebraska–Lincoln’s Nebraska Innovation Campus.

“IntelliFarm is not just another company creating products to gather data. We’re interested in aggregating Small Data into useful information and providing data-driven solutions to real problems,” Tippery said. “Farmers are looking for solutions that combine their data in insightful ways and provide ways of saving time and money while increasing productivity. The farmers don’t need more data. They need more answers or recommendations on what to do with their data. They need solutions that make their job easier, not more complicated.”

IntelliFarm is developing sensing technologies to connect with connected IoT devices in the field and on the farm. The term IoT, or “Internet of Things,” refers to technology that can connect a variety of smart devices to the internet. According to Tippery, such devices can vary from a smart mobile phone to a smart grain bin to a smart combine to a smart irrigation system. The electronics hardware developed by IntelliFarm allows for collection of agricultural data, uploading the resulting data to the information cloud for aggregation, analysis, and generation of insights, and ultimately autonomous control of machines. Tippery explained that the value IntelliFarm provides lays in having the expertise to develop low-cost electronics to help producers and agricultural retailers obtain sufficient and accurate data for data-driven decision-making.

“IntelliFarm is in the process of capturing a variety of forms of data on the farm. Some of these agricultural data sets come from traditional sources; other data is now possible because of technology that has made collection cost-effective,” Tippery said. “We’re leveraging high-volume mobile phone technology into new electronics hardware that significantly lowers product cost.”

DEVELOPING THE PRODUCT

IntelliFarm works with customers to understand problems that exist in the agricultural industry.

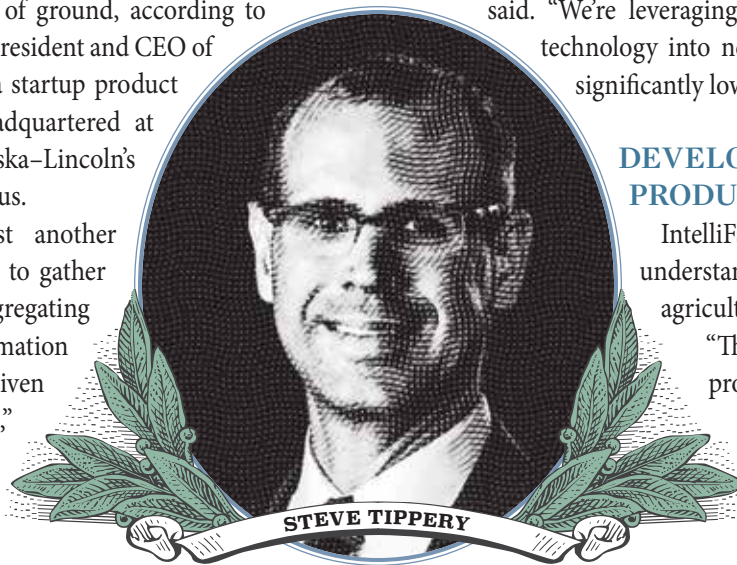
“The company plans its product roadmap around solving common customer problems,” he said. Tippery and his team perform “Voice of Customer” (VOC) visits where they

converse with their target market to better understand challenges customers face in their operations.

When a similar problem, or “pain point,” occurs in multiple conversations, IntelliFarm might add a specific feature to its product roadmap. “Once sufficient market demand has been demonstrated, the prospective feature shows sufficient payback, and adequate development resources are available, the company initiates a project to deliver the product to the market to alleviate that pain point,” Tippery explained.

“You can create a product that a few people want to buy or you can create a product that many people want to buy,” Tippery said. “We’re trying to focus our activities on really scalable products that the masses want to buy.”

“One of the advantages of a startup company is the ability to make rapid decisions and iterate products quickly, compared with more established companies,” Tippery said. When IntelliFarm launches a product into the market, it might take large competitors several years to respond. The IntelliFarm



team knows that a given product launch must be exploited because its competitive advantage only lasts for a period of time. “One of the biggest competitive risks that startup companies face comes from other startups because of their relative fast speed-to-market,” he explained.

“It’s a matter of satisfying the customer need with the right technology, at the right price, at the right time,” Tippery said. Once other startup companies see a good idea, they are more apt to react quickly and develop a competitive product versus a larger competitor. Over the long term, mature companies present competitive pressures, specifically in regard to distribution and customer service.

“You give away your ‘secret sauce’ and somebody else might respond in the market pretty quickly,” Tippery said.

10 TIMES BETTER

“Being a startup company, we target at being at least 10 times better than an established company or product,” Tippery said. “No customers are even going to try our product if we are only two times better. We have to literally be 10 times better or 10 times cheaper to get noticed.”

One of the ways IntelliFarm is achieving its goals is by headquartering at Nebraska Innovation Campus. IntelliFarm is an innovative, patent-generating company because its co-founders see great value in owning assets that can be protected prior to product commercialization, Tippery explained. “Nebraska Innovation Campus is the ideal location where IntelliFarm can collaborate with university professors on state-of-the-art technology,” he said.

“IntelliFarm desires access to industry-respected professors and researchers who are performing leading-edge research. It’s a perfect combination when applicable research ties directly into products that we are already trying to commercialize,” Tippery said. “Startup companies face the challenge of the industry not knowing who they are. By collaborating with professors conducting research at a respected, independent university, such as the University of Nebraska–Lincoln, the relationship adds credibility to the startup’s products and reputation,” Tippery explained. “Companies are often interested in technology that can be quickly taken to market because it pays the bills while research universities are

typically interested in long-term underlying research; many researchers do not initiate a research project with the intent to commercialize their technology.

“A potentially big value of the Nebraska Innovation Campus is the target to merge the short-term commercial goals of a private company with the long-term goals of a research university,” he said. Tippery is working to harness these partnerships by working with UNL professors to supplement research and development that IntelliFarm is already performing internally.

STARTUP CHALLENGES

Tippery identified cash and speed-to-market as the two biggest challenges currently facing startups like IntelliFarm.

“If we had more cash, we would be hiring more people right now and developing products faster,” he said. While some startups find hiring the right people a challenge, Tippery said that hasn’t yet been the case for IntelliFarm. “Fortuitous timing is beneficial for startup companies and IntelliFarm’s founders have a wide network and has had little trouble thus far finding the people the company needs,” he explained.

Tippery and his two co-founders all worked in industry before founding their company. They have been able to use their professional connections to set up meetings with corporate partners who, according to Tippery, wouldn’t have given them the “time of day” had they started the business right out of college.

CREATING YOUR OWN DESTINY: INSIGHT INTO THE MIND OF AN ENTREPRENEUR

While growing up on the farm, Steve Tippery imagined driverless tractors and the creation of his own company. Now co-founder, president and CEO of IntelliFarm, Tippery is making his childhood dreams a reality.

“I remember growing up on the farm and my dad always wanted me to cultivate. I was thinking, ‘why doesn’t the tractor drive itself? Why do I have to be here doing this?’” Tippery said. After 20 years in progressive product development leadership roles in the agricultural equipment industry, Tippery decided that the time was right to follow his dream of starting his own product company.

IntelliFarm wasn't Tipperly's first foray into the entrepreneurial world. While growing up on the farm, he owned his own swine production business and farrow-to-finish hog operation. All he had to do was go back to his roots to remember how to be an entrepreneur. Tipperly said he credits much of IntelliFarm's success to his and his co-founders' professional industry experience, industry connections, as well as a good bit of luck along the way.

"I can't imagine starting the business we're in right now with no previous work experience," he said.

TAKING THE LEAP

"It is a difficult decision to leave a highly compensated position in an established company to start your own business," Tipperly said. He explained that there are limitations when working for a company, especially when playing politics becomes a large part of the job.

"Every job has some kind of limit to what it allows you to do," Tipperly said. "There's always some glass ceiling no matter what job you're in. So if you're going to work for somebody else, you're always going to limit yourself over time." Despite these limitations, Tipperly advised potential entrepreneurs to work for a company before founding a startup. He explained that working for a company can train entrepreneurs to think critically about a target industry, understand how Standard Operating Procedures make a good company operate efficiently, learn how to manage people, and to learn from early mistakes.

"I have heard many people suggest that you should jump feet first into your startup. I completely disagree with that," Tipperly said. "I think there's a lot of value to working for a company and finding out what good and bad looks like." Tipperly even suggested working for more than one company before starting a business. He explained that these experiences prepare entrepreneurs to compare the workings of mature companies to the company they are trying to build.

"I think it's valuable to know what good is and that only comes from experience. I don't think you can learn that without seeing it somewhere and feeling some personal frustration," Tipperly said. "Without working in those environments and feeling some workplace pain, I don't think you can effectively manage people. You just don't know what you don't know."

LISTEN TO YOUR GUT

"The biggest and most surprising thing I've learned in the last year is to listen to my gut," Tipperly said. "Mentors all have an opinion and some people may get offended when you don't use their suggestions. While other people may give great advice, they aren't necessarily looking out for your best interests," he explained. "Listen to what other people say, but then make up your own mind on what to do."

"Your job as CEO or leader of any business, or any entity for that matter, is to make the best possible decisions for your organization based on the best information you have available at that time," Tipperly said. "It doesn't really matter what other people think. You cannot continuously second-guess yourself. You have to be confident making decisions that you believe are healthy for your organization and that are self-sustaining over time. It's also about inspiring people to participate in a greater vision than they could accomplish on their own." ★

Virtual Incision Corporation: PARTNERING ENGINEERING WITH MEDICINE

BY ELIZABETH UEHLING

Shane Farritor's career so far has included research for NASA in its Mars Rovers project; miniature surgical robots; highway safety markers; and improving the maintenance and safety of railroad tracks.

And he's just getting started.

Farritor is a professor of mechanical and materials engineering at the University of Nebraska-Lincoln, where teaching and research balance with collaborations on projects that save lives, improve surgical outcomes and make a substantial economic impact.

In 2003, Farritor partnered with Dr. Dmitry Oleynikov, chief of gastrointestinal and minimally invasive surgery at the University of Nebraska Medical Center in Omaha, to produce a robotic arm that could perform abdominal colon resection surgery.

The University of Nebraska Medical Center bought a very early version of a robot, Farritor said, but Farritor and Oleynikov knew it could be improved.

"It was a big robot outside the body, and we thought that was the mainframe computer of its day. What we really need are small, agile things," Farritor said. "We need little robots that go on the inside instead of big robots that go on the outside."

The two co-founded Virtual Incision Corporation, a privately-funded company that partners with the University of Nebraska, to create robot-assisted surgical technologies. The target application for the robots is a procedure called colon

resection surgery, Farritor said. Patients with diseases of the gastrointestinal system such as diverticulitis, inflammatory bowel disease and colon cancer may need surgery, which, up to now, signaled a major surgical procedure with a long recovery period.

The Virtual Incision robot, however, enters the body through a 4-centimeter incision (less than 2 inches) in the belly button, he said. The robot is guided by a surgeon using a computer. "You can be out of the hospital in two days,"

Farritor said, adding that it is better for the patient and also has a significant economic benefit.

The Virtual Incision robot was used successfully in a human surgery in the spring of 2016.

The success of small robots attracted the interest of the U.S. Army and also NASA. "Both NASA and the army want to do surgery in crazy, remote locations, and our robots are very portable," Farritor said.

"There are about 300,000 people in the United States every year who have an 8- to 10-inch incision through their abdomen," Farritor said. "It's very traumatic. You will be in the hospital for 10-12 days, and it will take six weeks before you start to feel normal again."

"I tell my graduate students every day 'we need to make a robot so that 300,000 people per year in the U.S. can go from a 10-day hospital stay to a two-day hospital stay.' And that's a good reason to get up in the morning." ★



P.O. Box 830924
Lincoln, NE 68583-0924

