

TABLE OF CONTENTS

EARLY CHILDHOOD

| | |
|---|---|
| Strengthening Child Welfare Workforce | 2 |
| Educators Lead Way on Early Childhood Workforce Commission .. | 3 |
| Ensuring Quality Child Care for Military Families | 4 |

PLANT SCIENCES

| | |
|------------------------------------|---|
| Foiling Rice-spoiling Fungus | 6 |
|------------------------------------|---|

TRANSPORTATION

| | |
|--|----|
| Improving Road and Railway Safety | 8 |
| Cyber Barriers Keep Vehicles on Course | 10 |

FOOD AND HEALTH

| | |
|---|----|
| Food for Health Center Focuses on Gut Microbes | 12 |
| Academic, Industry Partners Exploring Prebiotic's Potential | 13 |

ECONOMIC DEVELOPMENT

| | |
|--|----|
| Nebraska Innovation Campus Inspires Growth | 14 |
| Nebraska Among Best in Tech Transfer | 16 |

ARTS AND CULTURE

| | |
|--|----|
| Reaching Across Nebraska Through Art | 16 |
| Showing Impact of Whiteclay Alcohol Sales | 18 |
| Tool Identifies Traits of Literary Blockbusters | 20 |
| Carson Center Aims to Shape Future of Media Arts | 21 |

To view stories and additional multimedia features, visit the online edition: research.unl.edu/annualreport/2017.

BIOMEDICAL

| | |
|--|----|
| Pioneering Work in Global AIDS Fight | 22 |
| Unraveling Biomolecular Communication | 24 |
| Soft Robot Could Improve Colonoscopies | 25 |

VETERINARY AND ANIMAL SCIENCE

| | |
|---|----|
| Targeting <i>E. coli</i> 's Threat to Food Safety | 26 |
| Enhancing Protection for Nebraska Livestock | 27 |

CAREER DEVELOPMENT

| | |
|--|----|
| CAREER Awards Support Diverse Research | 28 |
| Supporting Future Math Teachers | |
| Expanding Network Visualization Capabilities | |

| | |
|---------------------------|----|
| Research Highlights | 29 |
|---------------------------|----|

| | |
|-----------------|----|
| Accolades | 35 |
|-----------------|----|

| | |
|-------------------------------------|----|
| Nebraska Research at a Glance | 36 |
|-------------------------------------|----|

The Faces of Nebraska Research



Steve Goddard

This report tells stories of research at Nebraska, where talented, creative people are making an impact on our world.

Nebraska researchers' work is changing lives, creating new businesses, informing social policy, enlarging perceptions of the world, transforming institutions and providing students with intensive research experiences that prepare them for jobs of the future.

Our faculty are published in top journals, cited by their peers and recognized with prestigious awards. In 2016, computer scientist Mehmet Can Vuran was named to Clarivate Analytics' Highly Cited Researchers list for a third consecutive year, an honor for authors who rank among the top 1 percent of most-cited works in their field. Agronomist Kenneth Cassman won the 2017 Bertebos Prize from the Swedish Academy of Sciences for his key role in developing the concept of ecological intensification of agricultural production.

The impact of research at Nebraska is evident in virologist Charles Wood's 20 years of work in Zambia, where he and colleagues built an internationally recognized research and clinical laboratory that will continue life-changing research on HIV/AIDS and associated diseases far into the future.

At other times, the impact is immediate. An in-depth reporting project produced by 11 undergraduate journalists brought national attention to the consequences of alcohol sales in Whiteclay, Nebraska, a decades-long issue that has decimated Native American lives.

University startups are sparking growth at Nebraska Innovation Campus, our public-private research campus. Entrepreneurship is one reason the

Milken Institute ranked the University of Nebraska system 35th among 225 institutions for technology transfer. NUtech Ventures, the University of Nebraska-Lincoln's technology transfer and commercialization affiliate, works closely with NIC to commercialize faculty research and support faculty and staff startups.

At Nebraska, our faculty is our greatest resource. Strategic hiring initiatives over the past five years have expanded the university's expertise in high-impact areas and enhanced research infrastructure. Most exciting is a 24 percent increase in early career tenure-track faculty since 2012. They are our future, and it looks bright.

Leadership is another key resource. Donde Plowman and Michael Boehm, two leaders who started new roles in January, are energizing the campus with their enthusiasm and experience. Plowman is executive vice chancellor and chief academic officer after serving as College of Business dean for more than six years. Boehm is Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources and University of Nebraska vice president for Agriculture and Natural Resources, joining Nebraska from The Ohio State University.

This report covers a fraction of the innovative work that drives Nebraska's research growth, with 2016 research expenditures totaling \$295 million, and garners recognition and awards for creativity and scholarship.

Great things are happening at Nebraska, and we are confident that our continued pursuit of excellence and investment in faculty will sustain this momentum.

Steve Goddard
Interim Vice Chancellor for Research
and Economic Development



Strengthening Child Welfare Workforce

Tending to the nation’s vulnerable children and families takes a toll. Staff turnover at child welfare agencies stands out at six times the national average across all jobs. Ultimately, it’s kids and families who suffer.

Nebraska’s Center on Children, Families and the Law is leading a long-term multidisciplinary project to strengthen the nation’s child welfare agency workforce and improve children’s lives.

To study and test promising strategies for recruiting and retaining child welfare workers, the center is receiving \$15 million over five years from the U.S. Department of Health and Human Services’ Administration for Children and Families-Children’s Bureau.

“The ultimate goal is to improve child and family outcomes, but the way to get there is to improve the workforce,” said project director Michelle Graef, a research associate professor at the center. “Nationally, for many years, it’s been an urgent issue.”

Above from left: Mark Ells, Kate Stephenson, Megan Paul, Stephanie Weddington and Michelle Graef



Michelle Graef

Public child welfare agencies are tasked with protecting children from neglect and abuse and with strengthening families who need assistance. The job can be emotionally taxing and complex. Difficult conditions and low pay lead to burnout.

The national turnover rate for child welfare jobs averages 20 percent but approaches 50 percent at some agencies, Graef said. In addition to high turnover, other workforce issues include insufficient supervision and difficulties in attracting and hiring good staff.

The center has selected a small group of state, county and tribal child welfare agencies in urban and rural areas around the nation that are dealing with a range of workforce issues.

Consulting teams visit sites to assess each agency’s issues. Teams work with staff to develop and implement solutions, then test the strategies for effectiveness. The center will share results nationally.

The center, which specializes in research on workforce issues related to child welfare, is collaborating with three national child welfare consultants and researchers at the University of Colorado, Denver; the University of Louisville; and the University of Tennessee, Knoxville. The project draws on a range of expertise, from social work and human resources management to psychology and the law.



Educators Lead Way on Early Childhood Workforce Commission

Some of Nebraska’s children, especially those at risk, lack adequate care from qualified adults.

To help expand and strengthen the state’s early childhood workforce, the universitywide Buffett Early Childhood Institute tapped three campus experts to participate in a new, comprehensive statewide commission. Marjorie Kostelnik, a renowned education researcher and senior associate to University of Nebraska President Hank Bounds, co-chairs the Nebraska Early Childhood Workforce Commission. Beth Doll, interim dean of the College of Education and Human Sciences and professor of educational psychology, and Linda Boeckner, program leader with Nebraska Extension and professor of nutrition and health sciences, also participate.

About 40 commission members represent government, higher education, public schools, child care, philanthropy, health care and business.

The group is developing a statewide plan to address three urgent issues: caregiver and teacher shortages, training and education for early childhood professionals, and reducing workforce instability through better compensation.





Kathleen Lodl

Ensuring Quality Child Care for **Military Families**

Child care is a worry for military families amid frequent moves and deployments, especially if they live off installation.

Nebraska Extension leads a nationwide program to improve access to quality child care for military families living off base. To date, over 60,000 child care providers have participated, benefiting more than half a million children.

The Child Care and Youth Training and Technical Assistance Project delivers professional training to child care providers and distributes information about starting a child care business. Launched in 2010, it operates in 20 states with high numbers of off-base military families.

Tapping the nation's extensive land-grant university extension network, the project employs a train-the-trainer model, providing extension staff with the skills to conduct workshops for child care providers who work in centers and in-home settings.

Extension staff also can use their knowledge to support providers in non-military settings that have limited child care options, such as rural communities. "Extension is uniquely positioned to do this work because we're in every county in the country," said project leader Kathleen Lodl, associate dean of Nebraska Extension.

In collaboration with Penn State Extension, certification-approved professional development curricula also are available online. Workshops and online content are free in targeted areas and publicly available elsewhere, improving child care nationally.

The U.S. Department of Defense Office of Family Readiness Policy and the U.S. Department of Agriculture's National Institute of Food and Agriculture fund this project.

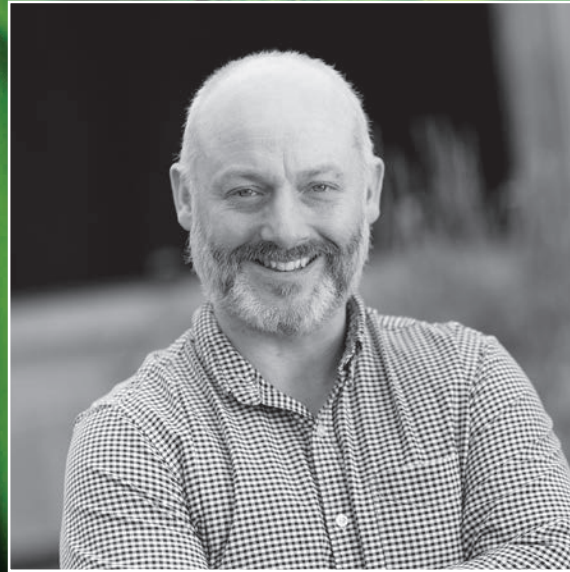


Foiling Rice-spoiling Fungus

Rice blast spoils between 10 and 30 percent of annual rice yields worldwide — enough to feed as many as 60 million people. Recent outbreaks of the disease, which also strikes wheat and grass crops, have ranged from Brazil to Bangladesh.

Plant pathologists at Nebraska have revealed how the fungus behind blast disease can evade rice’s first immune response and silence the molecular sirens that mobilize reinforcements. The team’s identification of a key fungal gene and associated protein could inform genetic modification efforts to combat the disease.

When a rice plant detects signs of fungal intrusion, it responds by unleashing a burst of reactive oxygen species – molecules that become toxic in large doses, alerting the rest of the plant to the threat and cueing secondary defenses.



Richard Wilson



Rice paddy

The Nebraska team found that a protein called NMO2 helps the fungus feed on nitrogen-based molecules and suppress the damage from reactive oxygen species. In doing so, the fungus avoids detection long enough to build up its forces in living rice cells before spreading to and destroying others.

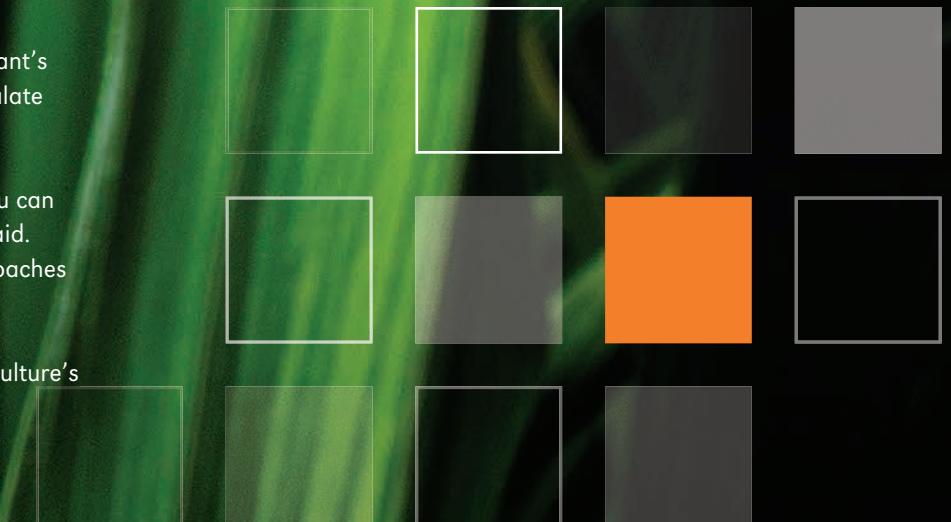
Plant pathologist Richard Wilson, recent doctoral graduate Margarita Marroquín-Guzman and colleagues concluded that the NMO2 gene also helps deploy so-called effector proteins that intercept the distress calls sent out by plant cells.

Rice has evolved genes to recognize effector-related damage and coordinate a counterattack. The team discovered that if the initial burst of reactive oxygen species is not suppressed, it can disrupt the accumulation of

effectors and stymie the infection even without support from the plant’s backup defenses. The finding could redirect existing efforts or stimulate new approaches to fighting blast disease in rice and other crops.

“That’s a novel observation because it moves the point at which you can prevent the infection higher up the chain, to the surface,” Wilson said. “That would conceivably enable you to develop more general approaches to breeding.”

The National Science Foundation and the U.S. Department of Agriculture’s National Institute of Food and Agriculture fund this research.



Margarita Marroquín-Guzman



Improving Road and Railway Safety

Freight trains and trucks crisscrossing the Plains are a familiar sight. Less visible is what's inside — some of that freight is hazardous. With shipping expected to increase nearly 50 percent by 2040, improving rail and truck transportation safety is critical.

Hazardous material transportation is just one focus of a five-year, multi-institutional program Nebraska is leading to improve transportation safety regionally and nationally.

The Mid-America Transportation Center, a consortium of academic institutions in Nebraska, Iowa, Missouri and Kansas, received \$13 million from the U.S. Department of Transportation to develop tools and methods addressing a wide range of safety priorities, particularly in rural and underserved areas.

"The center isn't just about conducting cutting-edge safety research, it's also about implementing it," said center director Laurence Rilett, Keith W. Klaasmeyer Chair in Engineering. "Our goal is to have a suite of products that promote safety and lead to measurable safety improvements."

The program focuses on both preventing accidents and mitigating problems after accidents or natural disasters. For example, researchers are developing methods to monitor railroad and truck operators' health and attentiveness in real time. They're also developing crash barriers able to withstand freight trucks and prevent the turnovers that release material.

Flooding, another major regional issue, can scour out bridge foundations, causing collapses. Researchers are creating tools to identify and

monitor vulnerable bridges and also to provide real-time diagnostics of a bridge's condition following a flood.

Rural and tribal communities with limited resources are at particular risk from human-caused and natural disasters. The center is collaborating with these communities to develop disaster relief protocols and other strategies to improve their emergency response.

Other projects include communication tools to alert authorities when accidents occur, devices that monitor and relay workers' hazardous material exposure to local medical facilities, and better bridge design guidelines.

These complex projects require multidisciplinary approaches. Over 40 researchers from five colleges are partnering with consortium colleagues. Partnerships also encompass numerous private- and public-sector entities, including the Nebraska Department of Transportation.

MATC, which serves as the Region 7 University Transportation Center, is one of 32 university transportation centers funded through the Fixing America's Surface Transportation Act.



Laurence Rilett



Cyber Barriers Keep Vehicles on Course



The day when cars routinely warn each other of impending crashes is near. Yet half of all traffic deaths involve a lone vehicle running off the road.

Mehmet Can Vuran

To help reduce single-vehicle crashes, Nebraska computer engineer Mehmet Can Vuran and his team, experts in barrier design, vehicular networking and vehicle automation, are developing cyber barriers that can talk to cars.

“Existing vehicle-to-vehicle technology cannot solve all run-off-road problems. We hope cyber barriers will bridge that gap,” said Vuran, Susan J. Rosowski Associate Professor of Computer Science and Engineering.

Cyber barriers – both physical and virtual – will alert vehicles when they’re heading off course by sending speed, angle and road condition information to the car’s onboard computer. As vehicle technology advances, cars will one day use the information to take over vehicle control and avoid or mitigate accidents.

Rapid changes in speed and angles during a vehicle’s impending crash into a barrier make the work more challenging than communicating between vehicles, Vuran said. Quick decreases in communication distances affect wireless communication reliability. His team’s preliminary work has shown ways to maintain reliability under those conditions.

Avoiding an accident also depends on road and roadside conditions, such as whether they are pavement or gravel. Cyber barriers will need

to store and send relevant information to vehicles so they can incorporate it in calculating the best split-second action to take.

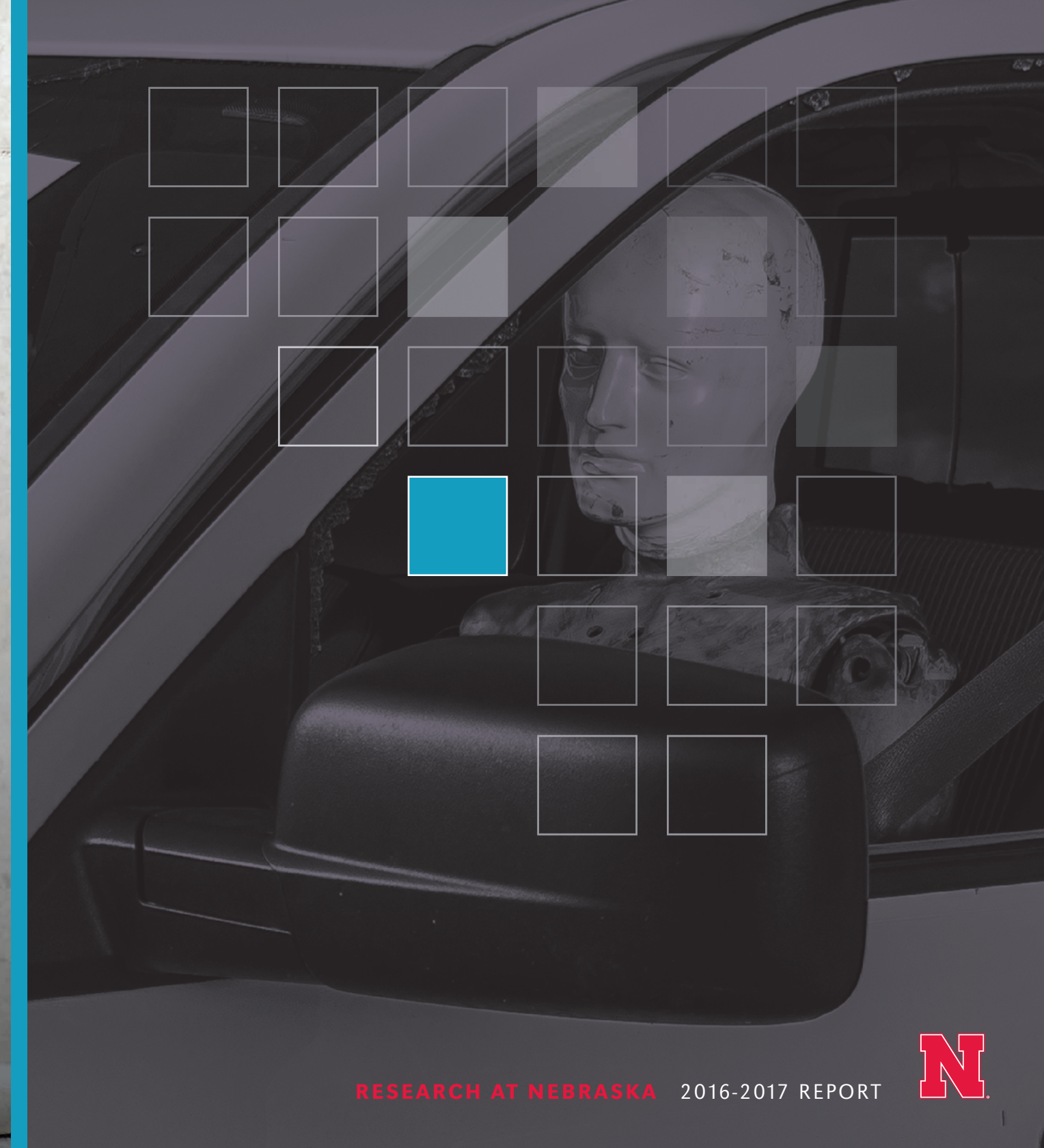
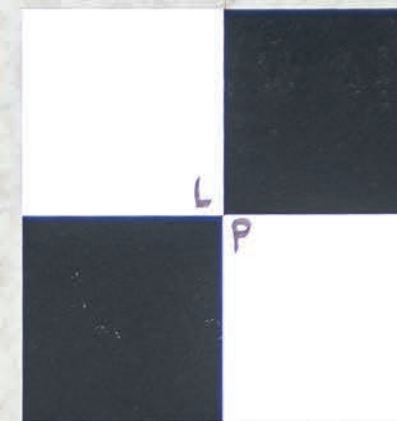
Vuran and his team are in the early stages of finding answers to these challenges. They must ensure their solutions are compatible with existing and developing vehicle-to-vehicle technology. They are testing solutions in collaboration with the university’s Midwest Roadside Safety Facility.

As vehicle technology advances, upgrading roads and infrastructure to take advantage of new cars’ capabilities will be costly. Vuran envisions next-generation cyber barriers initially going up in crash hotspots. As barriers are built or maintained, replacing them with cyber barriers will become routine.



Mehmet Can Vuran (center) and researchers Abdul Salam, Mohammad Mosiur Rahman Lunar and Ronald Faller

WITD-1



Food for Health Center Focuses on Gut Microbes

When you reach for that box of cereal in the morning, you're feeding not just yourself, but the 100 trillion microbes living in your gut.

This complex gut microbiome – the collection of microorganisms residing in the digestive system – significantly influences your health, from supporting the immune system to contributing to diseases, such as obesity, diabetes, inflammatory bowel disease and even depression.

The university launched the Nebraska Food for Health Center to help prevent diseases by developing foods with ingredients clinically proven to promote a healthy complement of bugs in your gut.

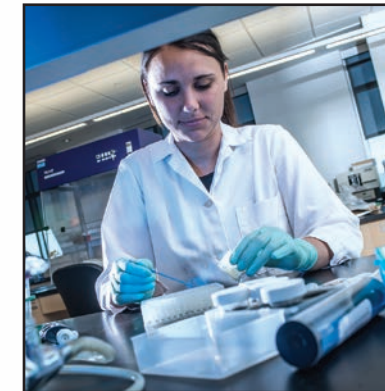
Combining Nebraska's strengths in agriculture and medicine, this multi-disciplinary center creates a complete research pipeline, from identifying molecules in plant-based foods that support the gut microbiome to translating those discoveries into palatable, healthy foods.

"Uniting agriculture and medicine lets us think differently about agriculture. This new interface ... holds tremendous potential to transform how we think about preventing and treating disease," said center director Andrew Benson, W.W. Marshall Distinguished Professor of Biotechnology.

The center is the first to integrate large-scale agricultural research with biomedical and food science research to develop food products that help prevent and treat health issues. The University of Nebraska Medical Center and the University of Nebraska Omaha are center partners.

"Nebraska is distinctive in its ability to combine expertise in agriculture, medicine and food science, enabling our leadership in this important emerging area of food for health," Chancellor Ronnie Green said.

Andrew Benson



Lab manager Mallory Suhr

The research takes advantage of the tremendous natural genetic diversity of crop plants. Instead of breeding for traits that increase yields, researchers target a unique trait: grains' ability to affect the gut microbiome. These traits are ultimately validated in animal models and human clinical studies.

The center's work advances several accomplishments that established Nebraska's international reputation in the emerging gut microbiome field. Benson and colleagues found, for example, that diet exerts a stronger effect on the gut microbiome than individual genetics. Therefore, diet is the best tool available for manipulating the gut microbiome and influencing health.

The Raikes Foundation and the Bill & Melinda Gates Foundation contributed \$5 million toward the center, headquartered at the Food Innovation Center on Nebraska Innovation Campus. Over the next five years, university funds and private donations will provide about \$35 million to support this initiative.



Amanda Ramer-Tait

Academic, Industry Partners Exploring Prebiotic's Potential

The Nebraska Food for Health Center is collaborating with a pharmaceutical company to explore how manipulating microorganisms in the digestive tract could thwart metabolic-related diseases.

Nebraska microbiologist Amanda Ramer-Tait leads the center's partnership with Ritter Pharmaceuticals. The company, which develops novel therapeutic products that modulate the human gut microbiome to treat gastrointestinal diseases, is supplying researchers with its patented prebiotic RP-G28. Beyond its known potential for combating lactose intolerance, the compound may guard against heart disease, stroke, diabetes and other health problems.

"We are grateful to Ritter Pharmaceuticals for providing RP-G28 so we can study how manipulation of the microbiome may impact metabolic syndrome," said Ramer-Tait, Harold and Esther Edgerton Assistant Professor of Food Science and Technology. "There is great potential to take prebiotic-based gut microbiota modulators and explore how they may help human health."

Ramer-Tait and collaborator Jens Walters, a former Nebraska researcher, have designed a new mouse model to evaluate the health benefits of RP-G28 and to study how gut bacteria respond to the prebiotic. The next step is translating the mouse study results into human feeding studies.

She received a \$50,000 Young Investigator Grant for Probiotics Research award from the Global Probiotics Council to support this work.



Nebraska Innovation Campus Inspires Growth

An aerial photo and architectural rendering frames a view of Nebraska Innovation Campus at present and future, when a new multi-tenant building (bottom right) is complete.

Nebraska Innovation Campus has become a destination for innovation. Just two years after its grand opening, the public-private research campus is nearing capacity, and expansion is underway to draw entrepreneurs and startups to its world-class facilities.

By fall 2017, Innovation Campus' current facilities were fully leased, including space in the new Biotech Connector. With companies five years old or less driving a significant portion of U.S. job growth, expansion will enable Innovation Campus to attract entrepreneurs who want to work closely with university faculty and students, said executive director Dan Duncan.

Construction began in July on an 80,000-square-foot multi-tenant building to be completed in 2018. Plans include a business incubator that could house National Science Foundation I-CORPS teams, student startups and community startups. The idea is to create a one-stop shop for resources to support entrepreneurs' success, including office space and access to mentoring and development programs, Duncan said. NIC is seeking potential partners and funders for this project.

Driving the state's economic growth is a key goal of Innovation Campus. A recent Bureau of Business Research report showed that the annual economic impact from NIC business development and operations was \$139.9 million in fiscal year 2016.

New partners in 2017 are expanding that economic growth. In July, Bolero Information Systems LLC became the first university staff spinoff company to join NIC. Bolero is a web application development and design company specializing in research administration and business process automation.

Adjuvance Technologies Inc., a biopharmaceutical company, announced plans in March to become the first tenant in the Biotech Connector, a research space that offers wet laboratory space for small- and medium-sized companies. Adjuvance holds a Phase II Small Business Innovation Research grant from the National Institutes of Health and will continue development of vaccine adjuvant products at NIC.

Enhancing the campus' social and cultural vibe is The Mill Coffee & Bistro, a local favorite that opened its third location in June at NIC.

Several NIC partners plan to expand in the coming year. Access to faculty expertise, student talent, and equipment and facilities has driven their rapid growth, Duncan said.

"We are moving forward rapidly. Nothing out here is stagnant," Duncan said. "Even internationally, there is great interest in coming to Nebraska because of Innovation Campus."



Nebraska Among Best in **Tech Transfer**

A universitywide commitment to providing a pipeline from the lab to the marketplace is paying off for the University of Nebraska system, named a leading U.S. institution for technology transfer.

A 2017 report from the Milken Institute, an independent economic think tank, ranked the system's combined technology transfer efforts 35th among 225 institutions. NUtech Ventures and UNeMed are the technology transfer and commercialization affiliates for the University of Nebraska-Lincoln and the University of Nebraska Medical Center, respectively.

The institute's top picks actively promote technology transfer and lead efforts to move innovative technologies into the marketplace to enhance economic growth. Rankings are based on data from the Association of University Technology Managers and reflect successes in patents issued, licenses issued, licensing income and startup formation.

"We've made it a priority across all our campuses to create a culture of innovation where bold and entrepreneurial thinking are encouraged," said University of Nebraska President Hank Bounds.

One example is Virtual Incision Corp., a spinoff of research by Nebraska engineer Shane Farritor and UNMC surgeon Dmitry Oleynikov. Headquartered at Nebraska Innovation Campus, the growing company is developing a miniature robot for general abdominal surgery.

NUtech Ventures works closely with NIC and Industry Relations to commercialize faculty research, support faculty and staff startups, and advance partnerships between the university and industry.

"Nebraska innovation is changing lives," Chancellor Ronnie Green said. "We are leaders in invention and enterprise, driven by the high-quality, relevant research from our faculty."

Industry-Sponsored Research

\$140M

ANNUAL ECONOMIC IMPACT

\$20 million

UNIVERSITY EXPENDITURES SUPPORTED BY INDUSTRY SPONSORSHIP

\$23M

LICENSING INCOME OVER FOUR YEARS

822

JOBS CREATED STATEWIDE

Source: Bureau of Business Research. Figures represent fiscal year 2016, the most recent year for which information is available.

Reaching Across Nebraska Through Art



For artist Karen Kunc, moving to a rural acreage – with its 30-mile commute to her Lincoln studio – created an intimacy with the land and seasons that inspires her artwork.

"I love the graphic nature of our landscape here," said Kunc, Willa Cather Professor of Art.

Internationally renowned for her abstract woodblock prints, Kunc's art conveys pride in her Nebraska roots, but also aims to provoke.

"I like the idea that our earth has been shaped by nature, by time, by weather forces and by mankind," she said. "Of course, when we get to the mankind part, then we're talking about issues we're all concerned about."



Karen Kunc



Three of Kunc's woodblock prints

Beautiful and edgy in its contrasting shapes and forms, Kunc's work asks viewers to question how we live in the world and our role in shaping natural forces. It touches deeply personal emotions about often intense, politicized issues.

After 30 years of working with communities worldwide, Kunc now concentrates on expanding artistic appreciation and opportunities in Nebraska, particularly in printmaking.

In 2013, she opened Constellation Studios in Lincoln to attract international print artists, support local artisans and create a collaborative atmosphere important to equipment-heavy printmaking.

She also helps coordinate the university's Art at Cedar Point Biological Station near Ogallala in western Nebraska. The interdisciplinary program blends art and science through undergraduate field art courses, artist residencies and community outreach. A two-year grant from the University of Nebraska's Rural Futures Institute helps fund the program.

Kunc is committed to connecting her creative activities with all of Nebraska.

"I think the arts in Nebraska is an untapped resource, but it needs people to support it," she said. "There are artists everywhere who want to work in their beautiful environment and prove that art belongs there."

Kunc has won numerous awards for her artwork and teaching, and her art has been exhibited in more than 350 galleries and public collections worldwide, including the Museum of Modern Art in New York.



Showing Impact of Whiteclay Alcohol Sales

Chris Bowling recalls his first visit to Whiteclay, Nebraska.

The senior Nebraska journalism student knew the town's dark backstory. The 12-person village, dubbed the "skid row of the Plains," neighbors South Dakota's Pine Ridge Indian Reservation, where rates of poverty, domestic violence, murder, suicide and birth defects are among the nation's highest. Whiteclay's four liquor stores sold more than 42 million cans of beer over the past decade, fueling social decay.

"I was in disbelief that so much cultural destruction came from this one little area," he said.

For two semesters, Bowling and 10 other undergraduates immersed themselves in shining a light on Whiteclay and Pine Ridge, ultimately producing a multimedia report, "The Wounds of Whiteclay: Nebraska's Shameful Legacy," with guidance from Nebraska journalism faculty Joe Starita and Rebekka Herrera Schlichting.

The online project captures diverse snapshots of life in this remote area, including a foster mother raising nine children with fetal alcohol spectrum disorder in a doublewide trailer, a 22-year-old Minnesotan ministering to Whiteclay's street people and Nebraska's first Native American state senator campaigning for office.

Prominent media outlets – Esquire, The New York Times and The Economist – picked up the stories. The students won 14 Top 10 Hearst Journalism Awards. And the team became the first-ever college group to win the Robert F. Kennedy Human Rights Journalism grand prize, edging out The New Yorker, HBO and National Geographic.

But the project's most crucial impact is the role it played in shuttering Whiteclay's liquor stores. The report debuted at a time of mounting public pressure to close the stores. In April, the Nebraska Liquor Control Commission refused to renew their liquor licenses. Though a district judge overturned that decision, an appeal from the Nebraska Attorney General's Office sustained the closures. In September 2017, the Nebraska Supreme Court rejected the store owners' appeal to reopen, all but guaranteeing permanent closure.

Starita said his team helped drive this change by exposing the insidious relationship between Whiteclay and Pine Ridge.

"The students' greatest accomplishment is that they did something to improve lives," Starita said. "They should be most proud of that."



Joe Starita



Through photography, journalism students James Wooldridge and Jake Crandall captured life in Whiteclay, Nebraska.



Tool Identifies Traits of **Literary Blockbusters**

“There are three rules for writing a novel. Unfortunately, no one knows what they are.”

— W. Somerset Maugham, novelist and playwright

The popular early 20th-century novelist made this remark long before anyone could imagine programming a room-sized computer to “read” thousands of books and analyze their traits using artificial intelligence.

But that’s just what Nebraska researcher Matt Jockers pulled off with collaborator Jodie Archer, a former acquisitions editor for Penguin Books UK. Their work, a blend of computing and the humanities, produced a predictive algorithm capable of forecasting a manuscript’s potential to hit the best-seller list. The research is summarized in *The Bestseller Code*, a book that sheds light on key ingredients of literary blockbusters.

“The primary distinguishing feature is human closeness,” said Jockers, Susan J. Rosowski Associate Professor of English and associate dean for research and partnerships in the College of Arts and Sciences.

“Closeness” refers not to sexual intimacy, he said, but to the everyday, meaningful interactions between people. Other recurring traits are colloquialisms, active and determined characters, and plots with a steady rhythm of highs and lows.

To develop the algorithm, the researchers harnessed the power of Tusker, a supercomputer at the university’s Holland Computing Center, to analyze 4,800 novels published in the past 30 years, including smash hits like *Fifty Shades of Grey*, *The Da Vinci Code* and *Gone Girl*. Using this data, they identified roughly 2,800 characteristics that a computer can use to differentiate between novels that sink or swim to the top.

From this, the “best-seller-ometer” was born. The algorithm scores books according to their likelihood of becoming a New York Times best-seller. In tests, the model correctly categorized novels 80 percent of the time.

The algorithm could shake up the publishing industry, enabling authors to examine manuscripts for missing features and publishers to rate promising books.

But Jockers and Archer agree the tool cannot substitute for skill, creativity and instinct – prerequisites for superb writing. The aim is not for a computer to script a best-seller, but to develop a valuable tool for writers, readers and publishers.

They recently formed a consulting company, Archer Jockers LLC, and are working with NUtech Ventures, Nebraska’s technology commercialization affiliate, to license the technology.

“We’re keen to see the algorithm leveraged to help writers find a market and to help readers find new books,” Jockers said.



Matt Jockers

Carson Center Aims to Shape Future of **Media Arts**

Utah has Sundance. Nevada has Burning Man. The French Riviera has Cannes. Nebraska’s Johnny Carson Center for Emerging Media Arts aims to make the state the next hot destination for media artists. The new program will welcome its first students in fall 2019.

“The challenge is to create something completely unique for the 21st century. That’s a rare opportunity so everyone’s keen to participate,” said founding director Megan Elliott, who arrived in 2017 from the University of Technology Sydney in Australia.

The prospect of shaping the future of media arts is attracting the industry’s world leaders to Nebraska. Twelve experts participated in the Carson Conversations Forum in May. Speakers included Robert Tercek, author of *Vaporized*; Roy Taylor, corporate vice president of AMD Radeon Technologies Group; and Charles Wang, deputy director of China’s Advanced Innovation Center for Future Visual Entertainment.



Theater student Adam Turner tests virtual reality equipment.

Speaking to a sold-out crowd of 170 university and community members, they emphasized the importance of meeting the challenges of a society in rapid transformation. Students must learn to not only use cutting-edge storytelling technologies – such as artificial intelligence, game engines and virtual production – but also to help shape the future of storytelling.

“About 60 percent of the jobs that our graduates will be doing haven’t been invented yet,” Elliott said. “So we want to help students develop resilient and adaptive mindsets and skill sets so they can flourish in a time of constant change.”



Megan Elliott

The Carson Center interdisciplinary program will include storytelling, creative coding, virtual production and entrepreneurship. The facility will offer design labs, studios and virtual reality technologies. It is establishing strong industry collaborations to ensure graduates have the necessary skills and internship opportunities and to attract leading experts to instruct and mentor students.

The program aims to offer coursework that fosters collaboration among students from many disciplines and to become a community resource in digital communication.

The center is a \$57 million university investment made possible by a \$20 million gift from the Johnny Carson Foundation, named in honor of the late entertainment icon and Nebraska alumnus.

Pioneering Work in Global AIDS Fight

When Charles Wood learned Zambian children commonly suffer from Kaposi's sarcoma, a rare skin cancer associated primarily with AIDS in adults, he decided to learn why and do something.

Twenty years later, the Nebraska virologist has made important discoveries about how children contract the Kaposi's virus and has developed public health intervention strategies to prevent the disease.



Charles Wood (center) and virologists Salum Lidenge, Eun Hee Kwon, Danielle Shea, Lisa Poppe, John West, Godefroid Musema and Dongmei Li

Wood and colleagues built an internationally recognized research and clinical laboratory in Zambia that will continue important research on HIV/AIDS and associated diseases in the future.

Because people with HIV are living longer on new drugs, secondary diseases, like Kaposi's, are getting more attention. Wood's early research focus and strong collaborations in Zambia put Nebraska at the forefront of research on HIV and related diseases.

"We started from scratch. When we first went (to Zambia) in 1997, we thought, 'How do you do research when there's no infrastructure?'" said Wood, the Lewis Lehr/3M University Professor of Biological Sciences and director of the Nebraska Center for Virology.

He and a Zambian colleague began the arduous process of building a fully functional research and clinical facility in the capital, Lusaka, where patients receive free treatment.

They also began training personnel, offering specialized instruction and educating Zambian graduate and postgraduate students at Nebraska. Today, this new generation of researchers is preparing to lead the way, ensuring the program's sustainability.

Wood's team found immunosuppression caused by HIV is a risk factor for acquiring the virus that causes Kaposi's. The virus is endemic, infecting about half of all Zambians, but jumps to over 70 percent in those with HIV, including infants.

Researchers learned that mothers and other household members pass the Kaposi's virus to babies through saliva, but treating HIV-infected newborns with antiretroviral drugs dramatically reduces infection risk.

Staff educate patients on reducing transmission and work with the Zambian government on reduction and other public health measures.

Wood's team continues studying many aspects of HIV and related diseases. The researchers also have begun developing research and clinical facilities in neighboring Tanzania.

Charles Wood

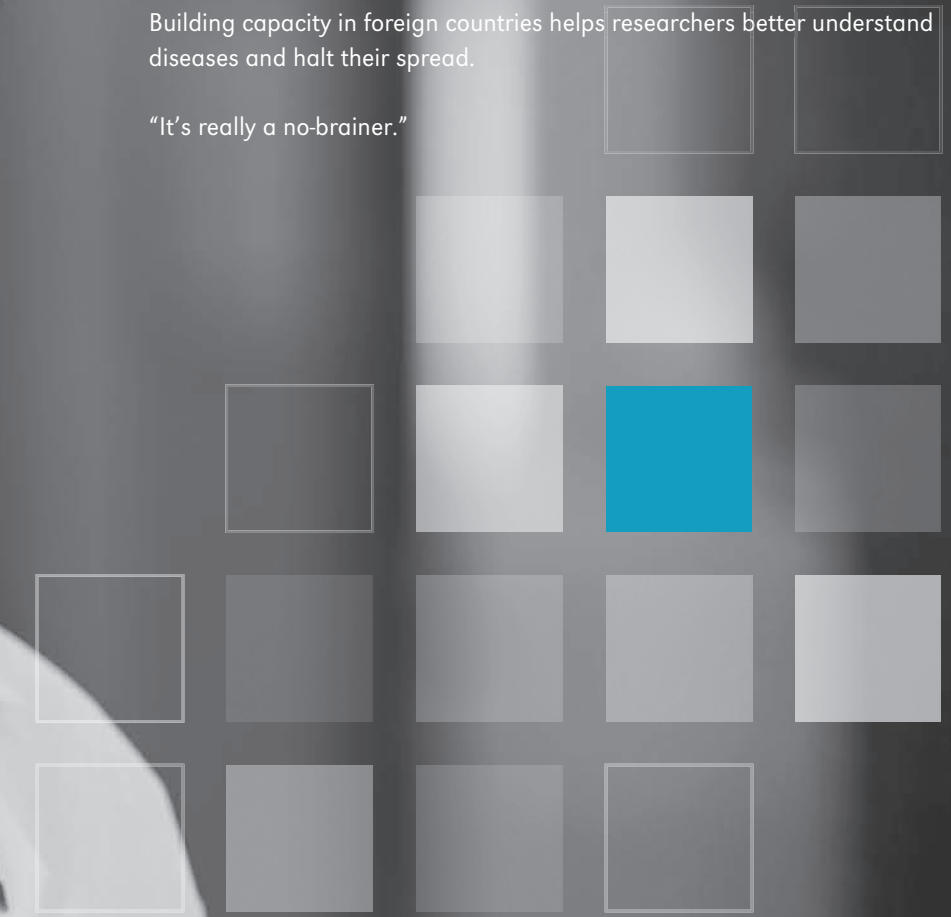


The National Institutes of Health's Fogarty International Center and the National Cancer Institute provided significant funding for this research and capacity building in Zambia.

"HIV and other viruses, like Zika, even the flu, are global. They travel and affect the U.S.," Wood said.

Building capacity in foreign countries helps researchers better understand diseases and halt their spread.

"It's really a no-brainer."



Unraveling Biomolecular Communication

As with any successful team effort, the human body's cells must communicate effectively to function properly. Miscommunication within or between cells leads to complex diseases such as cancer, diabetes and chronic liver disease.

The university created the Nebraska Center for Integrated Biomolecular Communication, or NCIBC, to better understand how cells communicate and the role miscommunication plays in diseases.

The university received \$11.3 million from the National Institutes of Health's Centers of Biomedical Research Excellence program to establish the center. The COBRE program funds health-related research and fosters faculty development and research infrastructure.

The center promotes interdisciplinary research collaborations, merging new techniques with investigating disease pathways that arise from miscommunication at the molecular level.

"It's basic research, but this is where the therapies of the future are going to come from," said center director James Takacs, Charles J. Mach University Professor of Chemistry. "An interdisciplinary team working together will bring a unique perspective to complex diseases."

The center fosters a systems approach, which combines research by chemists, biochemists, engineers and bioinformaticists and includes University of Nebraska Medical Center faculty.

One research collaboration, for example, models communication pathways between microorganisms in the gut. Another studies the interactions involved in liver disease progression.

The center also mentors young faculty, providing funds and advice to help them establish biomedical research programs and compete for independent



Concetta DiRusso and James Takacs

funding. Expediting new faculty members' transition into independent careers increases the university's overall research capability and competitiveness.

The center is developing core facilities to complement existing university resources. Staff work with the Holland Computing Center and Center for Biotechnology to help faculty use and store big data.

Center researchers also are developing connections with the Nebraska Food for Health Center and the Nebraska Center for the Prevention of Obesity Diseases through Dietary Molecules to share resources and strengthen collaborations.

This is the university's fourth NIH Center of Biomedical Research Excellence.

"Those centers have helped build infrastructure and propelled the careers of young scientists in specific areas of biomedical research. We plan to build on those past successes," said co-director Concetta DiRusso, George W. Holmes University Professor of Biochemistry and interim associate vice chancellor for research and creative activity.

Soft Robot Could Improve Colonoscopies



Inside this capsule, a camera captures images of the colon.

For most people, the thought of a colonoscopy evokes dread. It's invasive. It's uncomfortable. And it's pricey, costing several thousand dollars.

Nebraska researchers aim to change that. They hope that replacing the traditional colonoscope with a more patient-friendly robotic device encourages more people to have the procedure, considered the Cadillac of colorectal cancer screenings. The disease is the second-leading cause of cancer-related deaths in the U.S.

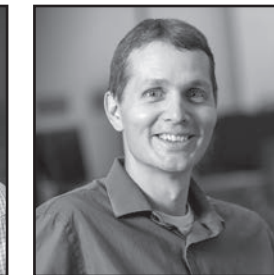
"If colonoscopies can be made less uncomfortable, more people will accept their doctors' recommendations to have the examination," said Nebraska engineer Carl Nelson. "This could lead to better prevention and treatment of cancers and digestive disorders."

Hossein Dehghani, recent doctoral graduate in engineering, led design of the robot, which uses compressed air to inflate a latex tube that elongates throughout the 5-foot-long colon. An attached camera captures images of the colon's surface, enabling a physician to detect precancerous or cancerous polyps lining the large intestine.

The robot uses pliable latex, eliminating friction between the colon wall and the robot. This minimizes potential for a colon rupture and removes the chance of looping, the most common source of pain during a colonoscopy. The latex is disposable, cutting infection risks.



Hossein Dehghani



Benjamin Terry



Carl Nelson

"Imagine a robot that deforms itself instead of deforming the colon," Dehghani said. "That would decrease the pain significantly."

The goal is a self-driving robot, enhancing precision, reducing chances of human error and cutting costs by replacing the physician with a robot that can navigate.

"If you have an autonomous robot, where the physician can press a button and the robot does everything, he or she can just focus on the video," Dehghani said. "We're taking a big and significant step toward autonomous colonoscopy."

Automation paves the way for telemedicine, Nebraska engineer Benjamin Terry said. Using the robot, doctors could perform colonoscopies remotely, increasing rural patients' access to care.

Because the system's sterile components are disposable and inexpensive, it also would be ideal for use in developing countries, where people have limited access to lifesaving exams.

Dehghani, Nelson and Terry are teaming with University of Nebraska Medical Center surgeon Dmitry Oleynikov, University of Nebraska Omaha computer scientist Prithviraj Dasgupta and Nebraska alumni Abolfazl Pourghodrat and Charles Welch.

The team is patenting this technology through NUtech Ventures, Nebraska's technology commercialization affiliate. The Nebraska Research Initiative supports this research.

Targeting *E. coli*'s Threat to Food Safety

The U.S. beef industry – and the public – are benefiting from a major Nebraska-led effort to improve food safety.

The multi-institutional research and outreach project, launched in 2012, is reducing the public's risk from Shiga toxin-producing *E. coli*, or STEC, in the nation's beef supply. The broad-ranging project has produced detection, intervention and food safety education techniques to minimize STEC contamination in the supply chain and improve food safety.

Illnesses from STEC should decline as the beef industry and public adopt these methods, said project director Rodney Moxley, Charles Bessey Professor in Veterinary Medicine and Biomedical Sciences.

STEC organisms are harbored by cattle and may enter beef during harvest. Other foods, such as lettuce, can become contaminated by cattle feces or undercooked beef. Most infections resolve themselves, but serious, sometimes fatal, complications can occur. The U.S. Department of Agriculture estimates that STEC-related illnesses cost the U.S. economy about \$500 million annually.

The federal government regulates seven STEC strains as adulterants in raw beef, but controlling the bacteria is challenging.

The USDA selected Nebraska to lead a \$25 million Coordinated Agricultural Project to tackle the complex issue on multiple fronts. More than 50 researchers at 18 institutions have collaborated. The project is expected to be extended through 2018.

"Nebraska has the highest number of cattle on feed in the country," Moxley said. "We have the expertise, the cattle industry and the connections to lead this project. We linked up with others, including consumer researchers, to put together a huge team."

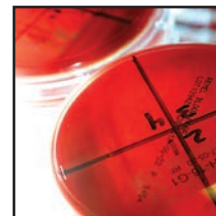


Rodney Moxley

Researchers have developed detection methods to better identify contaminants before they lead to food recalls or illnesses. Two rapid screening techniques, both based on detecting DNA or other molecules unique to toxic strains, offer significant advances over current methods, Moxley said.

Other studies have elucidated STEC biology, baseline contamination levels and STEC proliferation. Researchers also have improved surveillance methods, developed intervention strategies for meatpacking plants and investigated food-handling practices.

The project also targeted education and outreach, helping to train a new generation of food safety researchers and specialists. It provided over 100 internships for students, including those from minority-serving institutions, and developed educational materials for K-12 students and the public, among other activities.



Above: Microbiology student Chloe Buzz

Enhancing Protection for Nebraska Livestock

When farmers or ranchers discover scores of sick animals – as happened when porcine epidemic diarrhea virus decimated swine herds a few years ago – they need answers fast.

Nebraska's Veterinary Diagnostic Center stands on the front line of disease outbreaks in the state's animal populations, from livestock and poultry to pets and wildlife. Early diagnosis and quick action are key to protecting Nebraska's multibillion-dollar livestock production industry.

The new state-of-the-art veterinary diagnostic facility improves the state's ability to keep animals – and people – healthy.

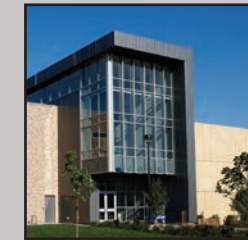
Completed in 2017, the center features cutting-edge diagnostic equipment and a Biosafety Level 3 laboratory for research and scientific services for foreign animal disease emergencies. The 40,500-square-foot building is four times larger than the previous center.

"We're often the ones to see new and emerging diseases. The new building gives us a lot more space to investigate the origin of new diseases," said Alan Doster, center director and professor of veterinary medicine and biomedical sciences. "It also allows us to expand our applied research program and investigate diseases important to the Nebraska livestock industries."

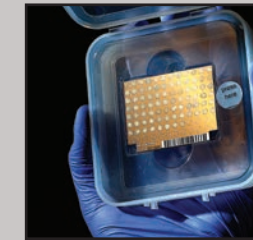
The center, the state's only laboratory in the U.S. Department of Agriculture's National Animal Health Laboratory Network, works with producers, state and federal officials, veterinarians,



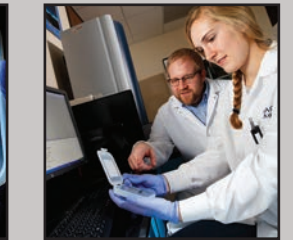
Alan Doster



Veterinary Diagnostic Center



MALDI-TOF sample plate



Researchers Dustin Loy and Kara Robbins

producers and wildlife personnel to diagnose and investigate animal diseases, which sometimes can infect humans and cause significant illness.

The center features a cutting-edge instrument that identifies potentially deadly bacteria within minutes instead of the several days required previously. The matrix-assisted laser desorption/ionization time-of-flight, or MALDI-TOF, mass spectrometer is one of about 30 available at veterinary diagnostic laboratories nationally. It also supports the center's research on innovative diagnostic methods to detect virulent factors, or potential harm, associated with certain bacteria and to predict antibiotic sensitivity patterns based on specific virulent factors.

University extension staff share space in the new facility, improving communication between diagnosticians and those routinely working with producers.

The facility also benefits veterinary students, providing additional classrooms and a new necropsy viewing space where they observe animal necropsies firsthand and learn what to expect as professionals. Space is available for the university's Professional Program in Veterinary Medicine in cooperation with Iowa State University.

Approved by Nebraska's Legislature in 2012, the \$44.7 million center on the university's East Campus was financed by donors and state bonds to be paid over the next 10 years.

CAREER Awards Support Diverse Research

Nebraska researchers are solving today's complex challenges with Faculty Early Career Development Program awards from the National Science Foundation. These prestigious five-year awards support promising pre-tenure faculty. Recent winners are investigating K-12 math curricula and computer network visualization tools.



Lorraine Males

Supporting Future Math Teachers

While developing math curricula receives much research attention, little effort goes toward helping K-12 math teachers use textbooks effectively. Nebraska education researcher Lorraine Males received a \$630,000 CAREER award to support future teachers in employing math curricula.

Males studies how teachers currently approach textbooks. She will use the results to develop teacher education materials for college-level courses, with the goal of better preparing students for teaching positions.

Males' team is interviewing Nebraska teachers as they actively plan a classroom lesson to understand their rationale as they move through the planning process. Males also uses eye-tracking technology, which monitors eye movements, to observe how teachers visually approach the material.

From this research, Males will develop college-level instructional materials. To evaluate effectiveness, her team will follow up with former students as they begin their teaching careers. She'll make the materials available nationally.



Hongfeng Yu

Expanding Network Visualization Capabilities

Solving a mystery usually involves understanding connections. Nebraska computer scientist Hongfeng Yu received nearly \$477,000 to expand network visualization capabilities that could help crack complex scientific puzzles.

Yu is creating software that allows users to visualize and explore billions, even trillions, of interconnected entities. Expanding that capability has diverse applications, from better understanding gene regulation networks to improving supercomputing speeds and investigating large social networks. These advancements could lead to better disease treatments, climate change mitigation and improved disease-spread tracking, among many other applications.

Network visualization can be a simple family tree or a complex map illustrating connections among Facebook's 2 billion users. As the number of entities increases, individuals disappear into a solid mass.

Yu is developing techniques to identify, extract and organize information from within densely interconnected large graphs. Preprocessing information allows users greater manipulation and visualization options. Nebraska's Holland Computing Center facilitates his research.



BIOLOGY

MicroRNA Discovery

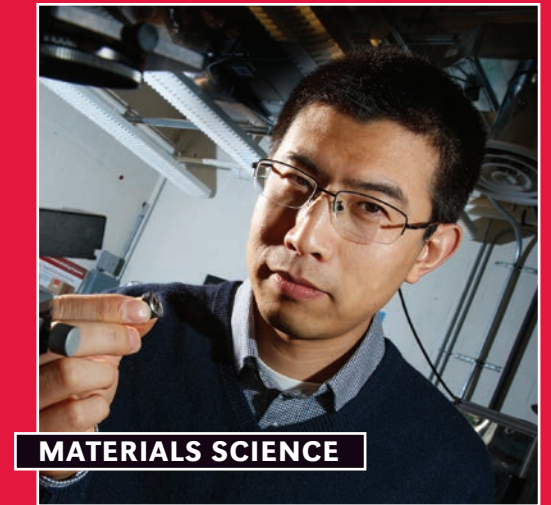
Nebraska biologists recently discovered an important component plants need to make microRNAs, tiny molecules critical in regulating gene expression. Despite their vital role, microRNAs are little understood. Bin Yu and colleagues discovered a protein that plays a role in the early stages of microRNA creation. Uncovering new clues improves understanding about how crops respond to droughts and other stressors. The protein is found in humans and other organisms so these findings may help elucidate microRNA processes in other fields. This is the latest of several discoveries by Yu's team that expand knowledge of microRNAs. Findings appeared in the *Proceedings of the National Academy of Sciences*. The National Science Foundation helped fund this research.



BIOLOGY

Finding Clues to Alcohol Tolerance

Using modern molecular biology techniques, Nebraska biologist Kristi Montooth and colleagues refuted a long-held theory about how fruit flies developed a high alcohol tolerance. More than two decades ago, scientists hypothesized that an adaptive change in the flies' alcohol dehydrogenase protein – an enzyme that breaks down alcohol – enabled them to colonize ethanol-rich habitats. But Montooth's team used genetic engineering to resurrect the protein from fruit flies' ancestral species and found that changes in the protein did not improve alcohol tolerance. This trait must be due to other genes, Montooth said. Identifying these key pathways in fruit flies may offer clues about human alcohol tolerance. Findings also show that understanding molecular evolution requires more than intuition – scientists must test how changes actually function in an organism. The study, funded in part by the National Science Foundation and the National Institutes of Health, appeared in *Nature Ecology and Evolution*.



MATERIALS SCIENCE

Nanoscale Secrets of Beetle Shells

Beetles wear a body armor that should weigh them down but actually is surprisingly light. Better understanding beetle exoskeleton properties could help scientists engineer lighter, stronger materials. Revealing exoskeleton architecture at the nanoscale has proven difficult. Mechanical and materials engineer Ruiguo Yang and colleagues developed a way to analyze the fibrous nanostructure in the common figeater beetle. Their technique can be used on other beetles and hard-shelled creatures and might extend to artificial materials with fibrous structures. Comparing beetles with differing demands on their exoskeletons, such as defending against predators, could lead to evolutionary insights and a better understanding of relationships between structural features and properties. The Nebraska team's findings were featured on the cover of *Advanced Functional Materials*. The Air Force Office of Scientific Research's Multidisciplinary University Research Initiative funded this research.



JOURNALISM AND MASS COMMUNICATIONS

Partnering on **Drone Journalism Training**
Nebraska's Drone Journalism Lab in the College of Journalism and Mass Communications is a partner in an innovative program to train journalists in using drones for news coverage. The project included three-day workshops in 2017 covering safe drone operation, best practices in drone journalism, legal and ethical issues with hands-on flight training, and information to study for federal drone certification. Online training is available at The Poynter Institute's News University. The program is a partnership with Poynter, Google News Lab, National Press Photographers Association and drone industry leader DJI. University of Georgia, Syracuse University, University of Wisconsin-Madison and University of Oregon hosted workshops. The nationwide training expands on the 2016 Drone Journalism Boot Camp in Nebraska, which drew 62 national journalists and journalism educators. Nebraska professor of practice Matt Waite launched the Drone Journalism Lab in 2011.



DIGITAL HUMANITIES

Charting *Leaves of Grass* Variations
Researchers from Nebraska's Center for Digital Research in the Humanities are identifying and cataloguing variations among the first editions of Walt Whitman's seminal work, *Leaves of Grass*. With a \$300,000 grant from the National Endowment for the Humanities, Kenneth Price, Hillegass University Professor of American Literature and center co-director, and colleagues are examining at least 20 copies of the original 1855 edition of the book, recording and providing a background on each variation. The team will develop a digital variorum – a collection containing different versions of the text as well as Whitman's earlier manuscripts connected to *Leaves of Grass* – as part of the online Walt Whitman Archive. The project is the first to make accessible the significant changes within the first edition. Price's team aims to make the online tool accessible to as wide an audience as possible.



LAW

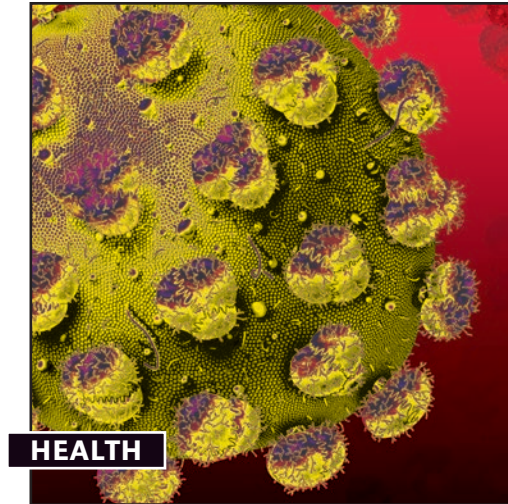
Targeting Nebraska's Legal Needs
Some Nebraska communities lack sufficient legal services. To strengthen the state's legal options, a new Nebraska program encourages students from underserved communities to pursue a legal education. Through the Underserved Law Opportunities Program, undergraduate students study at the University of Nebraska Omaha and obtain a legal education at the University of Nebraska College of Law. Students attend special programs, meet with peer mentors and intern with a nonprofit legal organization. The program targets first-generation or bilingual college students with a record of community service who meet minimum grade and admissions test scores. "There is no question that Nebraska has a need for bilingual attorneys and attorneys who will practice law in the public interest. This is an important step toward meeting that need," said Richard Moberly, Nebraska College of Law dean and Richard and Catherine Schmoker Professor of Law.

Above: Richard Moberly (center right) and law students



HEALTH

Heart-reactive T-cells' Role in Myocarditis
Heart failure, a leading cause of death, can originate with a virus. But the body's own immune system sometimes plays a role by attacking heart tissue after the virus is gone. The autoimmune response begins when a virus damages cells, releasing their internal components. Nebraska immunologist Jay Reddy has pinpointed a component that appears to be a target for certain T-cells, front-line defenders against invaders. The T-cells mistake the newly exposed protein as foreign, and the reaction triggers heart inflammation, or myocarditis. The discovery could lead to better diagnosing and treating myocarditis by targeting heart-reactive T-cells, while sparing the rest of the immune system. Reddy worked with a large multidisciplinary Nebraska team that published its findings in *The American Journal of Pathology*. The National Institutes of Health's National Heart, Lung and Blood Institute and National Institute of General Medical Sciences funded this research.



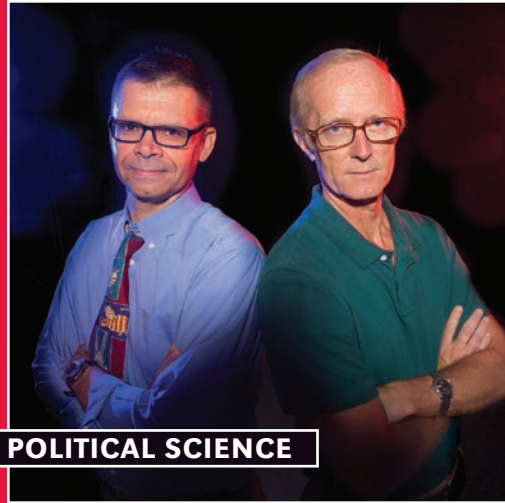
HEALTH

Needle Exchanges and Rural Epidemics
Growing injection drug abuse in rural America is fueling the spread of HIV and hepatitis C. Syringe exchange programs reduce disease transmission by providing clean injection supplies and education, but sociologists in Nebraska's Research, Evaluation and Analysis for Community Health Lab found access to such programs may be limited in rural areas. The study assessed these programs in rural and urban Puerto Rico, which saw an explosion of HIV and hepatitis C a decade ago. Research showed 79 percent of urban drug users took advantage of the programs in the previous year compared to 58 percent of rural users. More urban than rural users also talked with an outreach worker about preventing disease spread. Melissa Welch-Lazoritz, REACH Lab project director, said U.S. states may need to expand rural access to clean needle programs to prevent epidemics. The study, funded by the National Institutes of Health's National Institute on Drug Abuse, appeared in the *International Journal of Drug Policy*.



FOOD SECURITY

Nebraska Leads Hybrid Wheat Project
Nebraska leads an international effort to increase wheat yields and help feed a growing global population. The project aims to develop hybrid wheat lines that boost yields and climate resiliency through breeding. "With new genetic and chemical tools available ... we think the time is right to attempt to create a viable hybrid wheat market again," said agronomist Stephen Baenziger, Nebraska Wheat Growers Presidential Chair, who leads the project. Plans include developing a public foundation for hybrid wheat research and creating hybrid seed on a commercial scale. Collaborators include Texas A&M University, Kansas State University and the International Maize and Wheat Improvement Center (CIMMYT). The U.S. Department of Agriculture's National Institute of Food and Agriculture funds this three-year project. It's part of the U.S. contribution to the International Wheat Yield Partnership, a consortium of public and private partners.



POLITICAL SCIENCE

Nebraska Researchers Among the Most Connected

Nebraska political scientists John Hibbing and Kevin Smith ranked among the top 20 most central political science authors in the world, according to research published in the journal *PS: Political Science and Politics*. Using social network analysis, the study's German authors assessed more than 67,000 articles published from 1990 to 2013 by over 40,000 political scientists worldwide. They found Smith and Hibbing, Foundation Regent University Professor of Political Science, are among the most connected authors in the field. The pair has long collaborated to explore the biological underpinnings that affect people's political views. They established the university's Political Physiology Lab and co-authored *Predisposed: Liberals, Conservatives and the Biology of Political Differences*.

Above: Kevin Smith and John Hibbing



BIG DATA

Doctoral Program Links Big Data, Life Sciences

Technological advances in life sciences research require dealing with massive amounts of data. To give future life scientists a foundation in data sciences, Nebraska established a new doctoral program that provides the skills and experience to answer questions only big data can handle. The Complex Biosystems program assembles more than 100 faculty from across four colleges to train students in acquiring, evaluating and analyzing big data. This highly interdisciplinary program exposes students to five specializations, encompassing a range of quantitative approaches and life sciences – from mathematical models and algorithms to ecosystem dynamics and host-microbe interactions. The program director is Jennifer Clarke, head of the Quantitative Life Sciences Initiative. The first students graduated in 2017.



DEFENSE

Exploring Cybersecurity Defense Threats

Nebraska researchers are helping to investigate potential security challenges in cyber-physical systems that support operations, telecommunications and information technology systems. Facilitated by the university's National Strategic Research Institute, the cybersecurity defense project unites the Nebraska team with Iowa State University researchers and cybersecurity industry experts. They will explore strategies for reducing and mitigating attacks on these systems. Hamid Sharif, Charles J. Vranek Professor of Electrical and Computer Engineering, leads the Nebraska team that will collect data and analyze threats and vulnerabilities to industrial control system devices that control operations such as the opening and closing of valves and breakers, collecting sensor system data and monitoring alarm conditions. NSRI is one of 13 University Affiliated Research Centers in the U.S.



SOCIOLOGY

Understanding Girls' Attitudes Toward Science

Gender norms, stereotypes and friendships all play a role in curbing middle school girls' interest in science, a team of Nebraska sociologists found. A survey of 444 middle school students showed girls and boys had similar comprehension and grades in science. When asked about their friends, both genders were more likely to consider boys as a "science kind of person." Yet when asked to consider whether that label applied to themselves, both genders answered similarly, indicating that social perceptions about gender influence girls' career choices. The survey found that girls interested in science are more likely to have close friendships with like-minded girls. The study suggests educators can use inclusive science clubs, presentations from diverse scientists and lessons relating science to students' everyday interests to encourage girls' interest in science. The team, co-led by sociologists Patricia Wonch Hill and Robin Gauthier, published its findings in *Social Sciences*. The National Institutes of Health funded this research.



COMMUNITY

Charting Physiological Responses to Neighborhood Environment

Does a cracked sidewalk, broken window or graffiti make a neighborhood feel less safe? An interdisciplinary Nebraska team aims to find out using sensory assessment tools that measure pedestrians' physiological responses to environmental conditions. The research provides evidence-based data of perception to augment traditional methods of visual audits and surveys. Construction engineer Changbum Ahn and community and regional planner Yunwoo Nam are teaming for the National Science Foundation-funded project. In the study, GPS-enabled smartphones are synced to motion sensors attached to participants that measure gait stability, walking patterns, heart rate and skin temperature. Physiological data help researchers identify problem areas – for example, if participants' heart rates, gaits or skin temperatures change when they encounter a pothole. Ultimately, researchers plan to make recommendations for safer, more walkable neighborhoods.



PUBLIC POLICY

Building Trust in Government

Citizens who feel they've gained knowledge about government institutions may be more likely to trust those institutions, according to University of Nebraska Public Policy Center research. Trust may grow when people perceive they know more, regardless of whether they actually do. Nebraska psychologists, led by Lisa Pytlik Zillig, gave one group of people specific information about water regulatory agencies. Another group learned about a different agency. Though both groups showed increasing trust in water agencies, members of the first group perceived that they knew more about the agencies and their trust in them was less likely to be affected by overall trust in government. Results suggest institutions can build trust by communicating effectively, building familiarity and treating people fairly. But personality still matters. A person's natural inclination to trust or mistrust plays a significant role. The National Science Foundation-funded study was published in *PLOS One*.



RESEARCH HIGHLIGHTS



BUSINESS

Howard L. Hawks Hall

New Business College Building Opens

Move-in day on campus held special meaning this year for Nebraska's College of Business. Construction of the \$84 million, 240,000-square-foot Howard L. Hawks Hall wrapped up in August and doors opened for the fall semester. Located in the heart of campus at 14th and Vine streets, the state-of-the-art facility offers high-tech classrooms, a 400-seat auditorium and space for experiential learning and research. It is the university's largest academic building project in recent history and was funded exclusively through private donations and alumni support. Hawks Hall is named for the University of Nebraska regent who was a lead project donor. Donde Plowman, executive vice chancellor and chief academic officer, provided significant project leadership while serving as the college's dean. The growing college has 4,200 students, 117 faculty and 65 staff members, with an additional 1,500 students taking courses to complete business minors.

SEC Letters Boost Tax Compliance

Companies that receive "comment letters" from the Securities and Exchange Commission tend to increase their tax compliance the following year, according to a study co-authored by Nebraska's Tom Omer, Delmar Lienemann Sr. Chair of Accounting. The SEC issues these letters to comply with the Sarbanes-Oxley Act of 2002, which requires it to review companies' financial reports every three years. If filings are deficient or unclear, the SEC requests additional information so investors have access to companies' financial details. Though the SEC and the Internal Revenue Service do not communicate directly, this research revealed that when a company received a tax-related letter, it increased its provision for income taxes by about 1.4 percentage points and actual cash payments by 1.5 percentage points. In total, comment letters triggered firms to pay up to \$3 billion in additional federal, state and foreign government taxes in a year. Findings were published in *The Accounting Review*.



LEADERSHIP

Michael Boehm

Boehm, Plowman Lead IANR, Chief Academic Roles

Chancellor Ronnie Green filled key leadership positions during his first year at the helm. Michael Boehm and Donde Plowman started new roles Jan. 1.

Boehm is Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources and University of Nebraska vice president for Agriculture and Natural Resources, roles previously held by Green. In addition to leading all agriculture and natural resources affairs, Boehm oversees the Rural Futures Institute, the Daugherty Water for Food Global Institute and the Nebraska College of Technical Agriculture. Boehm came from The Ohio State University, where he was vice provost for academic and strategic planning and a professor of plant pathology. He brings vast experience in systemwide strategic planning; coordinating partnerships with K-12 and community colleges; and overseeing a library system, institutional research and planning, and academic units. A turfgrass management researcher, Boehm was the 2013 president of the American Phytopathological Society, the world's top organization for plant pathology.

Plowman is executive vice chancellor and chief academic officer, a position created after Green, who was serving as interim senior vice chancellor for academic affairs, became chancellor. Plowman is charged with leading the university's academic enterprise and setting standards of excellence across the university. She oversees Nebraska's academic deans, the Office of Research and Economic Development and Student Affairs. An expert in leadership and organizational change, Plowman came to Nebraska in 2010 and was the James Jr. and Susan Stuart Dean of the College of Business. As dean, Plowman created new College of Business programs, including an honors academy, a career services program and a master's program in intercollegiate athletics administration; increased college enrollment 22 percent; and led fundraising efforts for the college's new headquarters. Plowman is a renowned scholar in leadership and organizational change and has been published in leading journals in management and organization.



Donde Plowman

ACCOLADES

Five Faculty Named AAAS Fellows

Patrick Dussault, Mary Anne Holmes, Gary Pickard, Robert Powers and Mary Willis were named American Association for the Advancement of Science Fellows in 2016.

- Dussault, Charles Bessey Professor of Chemistry, was recognized for contributions to the chemistry of organic peroxides.
- Holmes, emeritus professor of earth and atmospheric sciences, was honored for contributions to combating gender inequity in geoscience and the advancement of science through teaching, administration, research and service.
- Pickard, professor in the School of Veterinary Medicine and Biomedical Sciences and in the Iowa State University/Nebraska Cooperative Professional Program in Veterinary Medicine, was recognized for contributions to neuroscience.
- Powers, professor of chemistry, was recognized for contributions to the fields of biological nuclear magnetic resonance and metabolomics.
- Willis, professor of nutrition and health sciences, was honored for contributions to basic and applied anthropology and the advancement of science through teaching, mentoring and service.

Engineer Shane Farritor was named a National Academy of Inventors Fellow in 2016. The distinction is a high honor bestowed on academic inventors whose inventions improve quality of life, spur economic development and benefit society. Farritor, Lederer Professor of Mechanical and Materials Engineering, was recognized for contributions in robotics and sensor systems. He holds 48 patents for surgical devices and railroad technologies. He is co-founder and chief technology officer of Virtual Incision Corp., a medical device company that is developing advanced miniaturized robots for general abdominal surgery procedures.

Two faculty members became American Society of Plant Biologists Fellows in 2016. Ed Cahoon, George W. Holmes Professor of Biochemistry and director of the Center for Plant Science Innovation, was selected for

contributions to research on plant lipid metabolism aimed at enhancing the nutritional and industrial value of crops. Daniel Schachtman, professor of agronomy and horticulture and director of the Center for Biotechnology, was selected for contributions to research focusing on the interaction between plant roots and soil microbes with the goal of improving crop yields with less water and fertilizer.

Kenneth Cassman, emeritus Robert B. Daugherty Professor of Agronomy, won the 2017 Bertebos Prize from the Swedish Academy of Sciences. The biennial honor is awarded by the Royal Swedish Academy of Agriculture and Forestry. Cassman was honored for his key role in developing the concept of ecological intensification of agriculture production. He and colleagues created the Global Yield Gap Atlas, which addresses reducing the gap between current and potential crop yields while minimizing negative environmental impacts.

Chemist Xiao Cheng Zeng received the 2017 Surfaces and Interfaces Award from the Royal Society of Chemistry. The annual award honors outstanding and innovative research on the behavior of chemical systems at surfaces or interfaces. Zeng, Chancellor's University Professor of Chemistry, is the first winner from a university outside Europe.

Five Nebraska animal scientists were honored by the American Society of Animal Science in 2017. Archie Clutter, dean of the Agricultural Research Division and professor of animal science, received the Rockefeller Prentice Memorial Award in Animal Breeding and Genetics, which recognizes research excellence in breeding and genetics. Andrea Cupp, Omtvedt Professor of Animal Science, received the Animal Physiology and Endocrinology Award, which honors basic or applied research in physiology and endocrinology. Rick Funston, Nebraska Cow-Calf Professor in Animal Science, won the Animal Management Award, which recognizes basic or applied research in animal behavior, environmental science, economics or other biological or production management. Ronnie Green, chancellor and professor of animal science, earned the Morrison Award, the association's most prestigious honor. It

recognizes research with direct and international importance to livestock production. Lisa Karr, associate professor of animal science, received the Corbin Companion Animal Biology Award, which is given to animal scientists who contribute through teaching, research or service to companion animal nutrition or biology.

Three Nebraska faculty received 2017-2018 Core Fulbright U.S. Scholar grants from the Council for International Exchange of Scholars. In South Africa, Dawne Curry, associate professor of history and ethnic studies, will conduct research, write and build scholarly relations between that nation and the U.S. Amelia Montes, associate professor of English and ethnic studies, will teach and collaborate in Serbia with Aleksandra Izgarjan, an expert in gender studies and transnational literature. Anthony Zera, Kate Foster Professor of Biological Sciences, will teach a class on evolutionary endocrinology, conduct research and write review articles in Belgium.

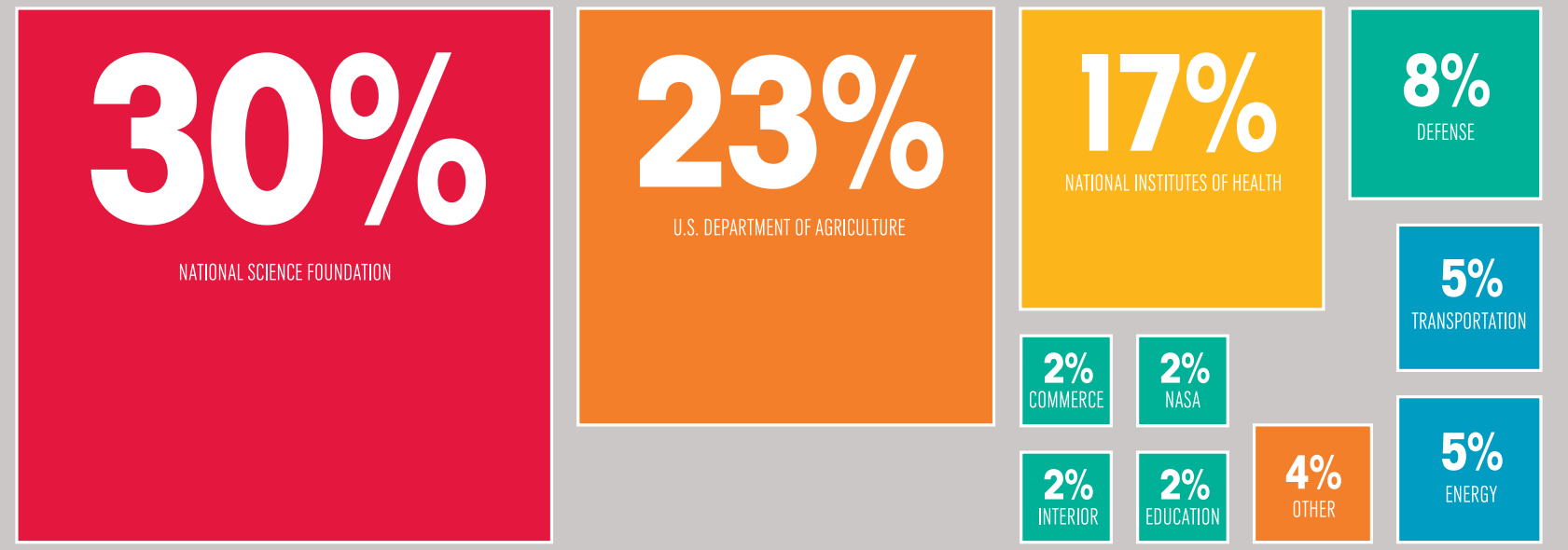
Mark Riley, professor of biological systems engineering and associate dean for research in the College of Engineering, was named to the College of Fellows of the American Institute for Medical and Biological Engineering in 2017. Riley was recognized for outstanding contributions to biological engineering through development of noninvasive biological measurements and professional leadership.

Two faculty members were named Institute of Electrical and Electronics Engineers Fellows in 2017. Hamid Sharif, Charles J. Vranek Distinguished Professor of Electrical and Computer Engineering, was selected for his work to develop railroad wireless communication. Gregg Rothermel, Dale M. Jensen Chair of Software Engineering, was honored for contributions to software testing and end-user software engineering.

Roger Elmore, Heuermann Chair of Agronomy and Horticulture, was named a Fellow of the Crop Science Society of America in 2017. Elmore studies production practices that increase profit by optimizing yields and water use. He co-leads a cover crop research project supported by the Nebraska Soybean Board and the Nebraska Corn Board.

NEBRASKA RESEARCH AT A GLANCE

FY 2016 FEDERAL EXPENDITURES BY AGENCY



\$295M
TOTAL RESEARCH EXPENDITURES
FY 2016

1,378
SPONSORED AWARDS

25,897
STUDENTS

29%
INCREASE IN
RESEARCH EXPENDITURES
OVER THE PAST 10 YEARS

1,720
RESEARCHERS

1M
SQUARE FEET OF SPACE
FOR RESEARCH

2016-2017 NEBRASKA RESEARCH REPORT

©2017, University of Nebraska-Lincoln Office of Research and Economic Development

MANAGING EDITOR
Ashley Washburn

EDITORS/WRITERS
Monica Norby | Tiffany Lee

CONTRIBUTING EDITORS/WRITERS
Gillian Klucas | Vicki Miller | Scott Schrage | Elizabeth Banset
Some articles based on stories from University Communication and other sources

PHOTOGRAPHY
Craig Chandler | Alan Jackson | Greg Nathan | James Wooldridge | Jake Crandall | College of Business
Shutterstock/Miki Studio, p. 5 | marekuliasz, p. 8 | sergioboccardo, p. 8
Shutterstock/Dmytro Zinkevych, p. 33 | Photoman29, p. 33 | holbox, p. 33

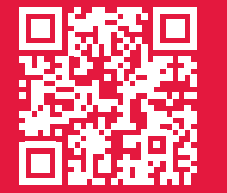
DESIGN
Modus Persona

ONLINE EDITION/ILLUSTRATION
Joel Brehm

CONTACT US
Steve Goddard
Interim Vice Chancellor for Research and Economic Development
University of Nebraska-Lincoln
301 Canfield Administration Building
Lincoln, Nebraska 68588-0433
402-472-3123 | goddard@unl.edu
research.unl.edu

CONNECT WITH US

- UNLresearch
- UNLresearch
- UNLresearch
- UNLresearch



This report is available online:
research.unl.edu/annualreport/2017

The University of Nebraska does not discriminate based on race, color, ethnicity, national origin, sex, pregnancy, sexual orientation, gender identity, religion, disability, age, genetic information, veteran status, marital status, and/or political affiliation in its programs, activities, or employment.

