2018-2019 REPORT

RESEARCH AT NEBRASKA | 150

Contents

This report is available online:
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Background: Husker geneticist and Nobel Prize recipient George W. Beadle studied the link between biochemistry and genetics. View more stories about notable Nebraska researchers and scholars on Pages 30-33.

FROM THE VICE CHANCELLOR

Charting a Bold Future, While Honoring Our 'Prairie University' Past

This year our university is celebrating N150 – the sesquicentennial of the University of Nebraska's founding in 1869. There is much to celebrate as we commemorate our past and plan for the future, building on our strengths to ensure we continue our rich history of contributions to Nebraska and our world.

Throughout this report are glimpses at Nebraska faculty and alumni whose widely recognized work helped build our university over the past 150 years. From a small university on the vast prairie, Nebraska has become a complex enterprise with an annual operating budget of $1.3 billion and an economic impact on Nebraska in excess of $2 billion annually.

During this anniversary year, we are focusing our energy and talents on the future and the N150 challenge from University of Nebraska–Lincoln Chancellor Ronnie Green: to be a world-leading 21st-century land-grant university with research expenditures approaching $450 million by 2025.

It is a big challenge that we are well on our way to meeting. Nebraska ended fiscal year 2019 with record research growth. Federal research awards increased 20 percent over last year to $130 million and total sponsored research awards increased 14 percent. This growth reflects strategic hiring and our emphasis on transdisciplinary research to tackle complex problems.

Our faculty are nationally recognized for their work. For example, engineer Angela Pannier received the Presidential Early Career Award for Scientists and Engineers for her research on biomaterials and gene delivery systems. Historian Margaret Jacobs was selected for membership in the American Academy of Arts and Sciences for her work on the separation of indigenous children from their families. And our talented early career faculty, like the National Science Foundation Faculty Early Career Development Program awardees in the accompanying photo, represent our future.

For the second consecutive year, the University of Nebraska system ranked among the top 100 academic institutions worldwide in earning U.S. patents. This strongly reflects our research priorities and our commitment to expanding the pipeline from research to economic development. Our Nebraska Innovation Campus is home to more than 40 private and public sector partners and generated a total statewide economic impact of $238 million, fueling 1,430 new jobs in 2018.

Whether tackling rural drug addiction, developing lifesaving treatment for soldiers with lung injuries or leading the most ambitious drone-based investigation of severe storms ever conducted, we are making a positive impact on our world today and imagining a bold future for research at Nebraska.

Robert "Bob" Wilhelm
Vice Chancellor for Research and Economic Development

Vice Chancellor Robert "Bob" Wilhelm (standing) and faculty members who received National Science Foundation early career awards in 2019. Read their stories on Pages 26-29.

New Research Center Targets Rural Drug Addiction

Even as the rate of drug overdose deaths slows nationally, death rates in the Midwest continue to soar.

To better understand and address the region's drug addiction crisis, Nebraska created the multidisciplinary Rural Drug Addiction Research Center, or RDAR.

The university received a five-year, $11.85 million grant from the National Institutes of Health's Centers of Biomedical Research Excellence program to establish the center in 2019. The COBRE program funds health-related research and fosters faculty development and research infrastructure.

RDAR faculty conduct cutting-edge research to understand the extent and nature of rural addiction, develop evidence-based treatment methods, and support outreach and policy efforts to help reduce addiction and overdoses.

"The patterns of drug use addiction in the Midwest are so different from those on either coast or in Appalachia," said center director Kirk Dombrowski, John Bruhn Professor of Sociology. "This will be the only major research center in the country that focuses specifically on rural drug use in the Midwest."

Unlike other regions, Midwestern drug users tend to consume a combination of drugs, complicating prevention and treatment.

The center established the Longitudinal Network Core Facility, which studies rural drug users through pioneering cellphone survey software developed at the university. This research helps identify social patterns of abuse and is the only long-term drug use study outside of Appalachia, Dombrowski said.

The center supports a range of research on the neuroscience and cognitive implications of drug use through pilot project funding, new faculty hires and early career faculty mentoring.

RDAR also hosted the National Rural Addiction Research Symposium. The inaugural symposium brought experts to Nebraska to discuss advancing research. It is expected to become an annual event.

To promote effective treatment options through outreach and advocacy, the center will launch a second core facility in collaboration with the University of Nebraska Medical Center.

"Better understanding the actual psychopathology and biochemistry of addiction can help us understand other kinds of treatment options that may be available," Dombrowski said.

The center fosters interdisciplinary collaborations across the university as well as with researchers at UNMC and Boys Town National Research Hospital.

RDAR is the university's fifth NIH Center of Biomedical Research Excellence.

Kirk Dombrowski

Unraveling Link Between Cognitive Abilities, Obesity

When you opt for a salad instead of fries or hit the gym instead of the couch, you're making good use of a process in your brain called executive control.

This cognitive ability matures in childhood, but poor development may set people up for a lifetime of unhealthy choices, contributing to obesity in adolescence and adulthood.

Nebraska psychologist Timothy Nelson's research into the link between executive control development and risky health behaviors could lead to novel interventions to prevent and treat obesity, a disease affecting 40% of U.S. adults.

"We're hoping to make real recommendations about how and when to intervene to change health trajectories on this major public health issue," said Nelson, associate professor of psychology.

He received a five-year, $2.4 million grant from the National Institutes of Health's National Institute of Diabetes and Digestive and Kidney Diseases for this research. The project is conducted through Nebraska's Center for Brain, Biology and Behavior.

Executive control allows people to hold information in their mind and use it, shift between different tasks and inhibit urges, among other actions. It's critical to breaking bad habits and finding ways around challenges that hinder reaching goals, such as finding time for physical activity.

To better understand its relationship with healthy behaviors, Nelson's team is taking advantage of a longitudinal study examining executive control that began in 2006 at the university's Developmental Cognitive Neuroscience Laboratory.

Participants, who were in preschool when the study started, periodically take tests measuring their executive control. For Nelson's study, researchers are also gathering weight and health behavior data, such as food consumption and activity levels.

To incorporate the environment's role, such as proximity to parks and snack foods, they are geocoding participants' neighborhoods.

The information will help Nelson develop strategies to promote healthy weight by strengthening children's cognitive development and modifying food environments.

Nelson collaborates with researchers at the University of Nebraska Medical Center's College of Public Health, Boys Town Child and Family Translational Research Center, City University of New York and the University of Texas at San Antonio.

Above: Timothy Nelson

Collaboration Aims to End Homelessness Among Rural Youth

Homelessness in rural America, while less visible than its urban counterpart, is equally pervasive and just as difficult to overcome.

Nebraska's Center on Children, Families and the Law leads a collaborative effort to prevent and end homelessness among young adults in rural Nebraska. It's one of 11 projects funded nationwide in 2018 by the U.S. Department of Housing and Urban Development's Youth Homelessness Demonstration program.

"There's homelessness in all parts of Nebraska," said Jeffrey M. Chambers, CCFL project director. "Emergency shelters are extremely limited so there's nowhere to go if you find yourself without a place to stay."

People often end up couch surfing or living in a car, which typically are unstable conditions that focus attention on daily survival, not the future.

CCFL partnered with numerous state and local entities as well as youth who have experienced homelessness to develop a coordinated plan to prevent homelessness and support 18- to 24-year-olds in rural Nebraska who are already homeless.

Young people who experience homelessness are more likely to become homeless later in life, Chambers said. Transitioning into adulthood is difficult, particularly for those without family support. Nearly 30% of homeless young adults spent time in foster care.

The plan includes programs to find stable housing based on need and available resources, including identifying host homes, providing rapid temporary housing and finding permanent solutions for people with disabilities.

Jeffrey Chambers (center) with program trainees

Other programs help recipients learn to navigate community services, access available rentals and meet educational and employment goals.

"To the extent we can keep youth from becoming homeless and get them on the right track with education, employment and permanent connections, the better off they're going to be long term," Chambers said.

Since 2003, CCFL has provided planning, training, database support, analysis and reporting to support state and local agencies combating homelessness. This extensive background provided valuable guidance for this new statewide effort.

HUD provided $3.28 million for the plan's development and a year of implementation. Successful projects may receive ongoing HUD support and national promotion.

Combining Strengths to Improve Tornado Forecasting

For Great Plains residents, 2019's severe tornado season was alarming. But those threatening clouds had a silver lining: They helped further research on tornado-producing thunderstorms to improve forecasting.

Nebraska's Adam Houston, associate professor of earth and atmospheric sciences, led an ambitious investigation that sent high-tech sensors into violent storms to better understand tornado formation.

"We're lucky this happened to be a prolific year for tornado production," Houston said. "That said, unless you get your assets in the right position, it can all be for naught."

The project – Targeted Observation by Radars and UAS of Supercells, or TORUS – involved coordinating over 50 scientists and students from four institutions, and operating four drones, an airplane, eight specialized SUVs equipped with meteorological instruments, three mobile radar systems, a mobile remote sensing system and three balloon-borne sensor launchers.

The researchers pursued promising storms en masse across eight Great Plains states.

Sending radars and multiple drones carrying precise sensors into a storm from different points should provide the high-resolution data needed to reveal small-scale structures and processes important to tornado formation.

"Improving the conceptual model of supercell thunderstorms, particularly those that produce tornadoes, is going to invariably improve forecasting," Houston said.

Adam Houston

Currently, for every four tornado warnings, three are false alarms.

TORUS' cutting-edge equipment will also help advance next-generation forecasting tools.

Because supercell storms occur throughout the United States, this research will aid tornado forecasting nationally.

Despite the high-tech equipment, TORUS relies heavily on its crew's extensive storm-chasing experience. Identifying which storms to target and how best to approach them is based on learned intuition, though the pursuit is unpredictable.

"If we knew which storms were going to produce tornadoes, we wouldn't need this project," Houston said.

Researchers will be back out chasing storms for TORUS' final field season in spring 2020.

The university partners with Texas Tech University, University of Colorado Boulder and the National Oceanic and Atmospheric Administration's National Severe Storms Laboratory.

The National Science Foundation and NOAA fund this project.

The team uses specialized equipment, including drones and balloon-borne sensor launchers, to collect data from severe storms. Photos courtesy of Nebraska graduate students Alex Erwin and Stephen Shield.

Improving Outcomes for People with Cochlear Implants

For many people who have severe hearing loss, cochlear implants can be life changing. Nebraska's Michelle Hughes is improving lives by making this device even better.

Hughes, director of the university's Cochlear Implant Research Lab, is exploring ways to enhance outcomes for people with cochlear implants. Her research aims to both obtain better results, especially for the implants' youngest recipients, and simplify follow-up care through remote testing.

Federally approved in 1984, cochlear implants are an electronic device that bypasses damaged portions of the inner ear to directly stimulate the auditory nerve. The surgically implanted devices are programmed to achieve optimal sound quality. Today, recipients can be as young as age 1.

"An adult can tell you what they hear, but young children can't," said Hughes, associate professor of special education and communication disorders. "So we have to come up with other ways to make decisions about how to program the device for them."

To reduce reliance on verbal feedback and improve accuracy, Hughes' team is identifying objective, physiological responses of the auditory nerve to sound.

For young children, accurate programming is critical to developing language skills.

"Language has a huge impact on education," Hughes said. "The earlier we can provide a better fidelity signal to them, the earlier they can use that information to develop speech and language."

The research will also help others unable to communicate, such as people with cognitive disabilities, and fine-tune and support feedback for all users.

Cochlear implants require frequent, lifelong follow-up in clinics with specialized equipment and sound booths, which can be a burdensome commitment. Hughes is researching solutions to conduct speech perception testing and programming using distance technology or videoconferencing. Such virtual care may one day be conducted through a cloud-based service via a computer or even a smartphone.

The National Institutes of Health's National Institute on Deafness and Other Communication Disorders funds this research.

Above: Michelle Hughes with cochlear implant user Sophie, who received her devices as a young child.

Viral Discovery Could Aid Vaccines, Treatments

A virus's genetic loss can become its evolutionary gain.

This surprising discovery by Nebraska virologists provides some of the clearest experimental evidence that losing a gene can improve evolutionary fitness – in this case, by helping a virus regain the ability to replicate.

The team made the discovery after deleting the so-called B1 gene from the vaccinia virus. Because B1 helps silence a host's antiviral alarms and allows vaccinia to copy itself, deleting the gene threatens vaccinia's survival, said team leader Matt Wiebe, associate professor of veterinary medicine and biomedical sciences.

But the researchers continued culturing the B1-free strain before sequencing its genetic code to gauge how it evolved. The strain responded by deleting a single base pair – a fundamental component of DNA – while leaving nearly 200,000 others untouched. The seemingly miniscule loss corresponded with a 10-fold increase in the strain's otherwise stunted replication.

"We were expecting that the virus may adapt another gene to compensate," said Wiebe, a member of the Nebraska Center for Virology. "What we found instead is that the virus adapted by inactivating another gene. It was as if, upon cutting one wire, the best way to fix the problem was to cut another wire."

That inactivation occurred in a gene, B12, whose purpose is largely unknown. Previously, when researchers elsewhere deactivated just the B12 gene, leaving all others intact, they found no effect on the vaccinia virus. Wiebe said the findings indicate that when B1 is absent – but only then – B12 actually inhibits viral replication by alerting the host's immune system.

Leveraging that knowledge to hijack viral machinery could further the development of vaccines and treatments.

"It's very interesting to understand what viruses might teach us," said Wiebe, whose research was funded by the National Institutes of Health and the Fred & Pamela Buffett Cancer Center. "If this virus has a mechanism of activating our immune system, can we eventually use that to inhibit the growth of other viruses? We're trying to ask those questions already."

Above: Matt Wiebe (center) and Annabel Olson (right) examine viral cultures. Also pictured are Nebraska virologists Zhigang Wang, Amber Rico and Allie Linville.

Mapping Genome Promises to Enhance Ancient Grain

Humanity has finally gotten to know one of its oldest, most water-efficient crops on a genetic level.

Nebraska's James Schnable and an international team have sequenced and mapped proso millet's genome. This information is essential to increasing the drought-resistant crop's yields in Nebraska's Panhandle and semiarid regions worldwide, where population growth foreshadows food shortages.

Because millets can grow in poor soils and need less water than other cereal crops, several have become popular among subsistence farmers in ever-hotter, drier swaths of Africa and Asia. But millet's relatively low yields and traits that make harvesting difficult limit its viability as a food, feed or fuel staple.

To inform future breeding efforts, Schnable and colleagues sequenced more than 90 percent of the genetic code in proso millet, a species grown mostly in the American Great Plains, northern China and parts of Europe.

The ability to pinpoint the location, composition and size of proso's genes should help researchers rapidly improve traits and tailor varieties to climates around the world, said Schnable, associate professor of agronomy and horticulture.

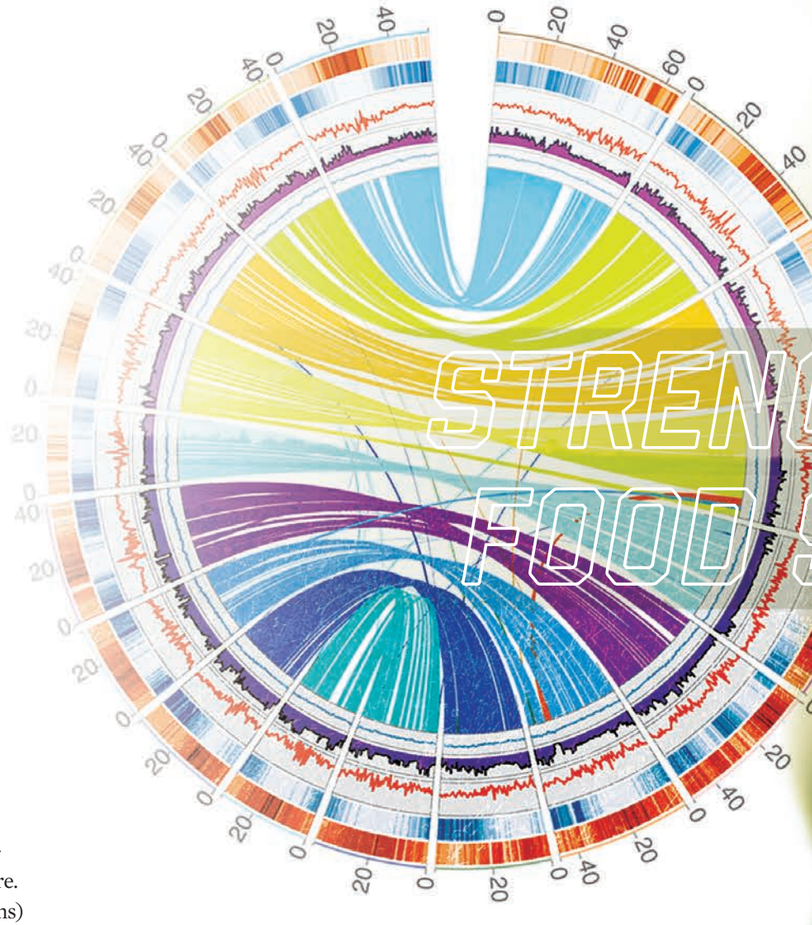
"There's potential to grow it on a much larger scale and take a significant bite out of the amount of additional grain we need to meet the demand for feed and food and ethanol," he said.

Nebraska's farmers will benefit from that genome-guided work, said Dipak Santra, associate professor of agronomy and horticulture at the university's Panhandle Research and Extension Center.

"This will have a huge potential impact on the rural economy of the region," said Santra, the lone public-sector proso millet breeder in the Western Hemisphere. "Proso millet's direct value to (the semiarid High Plains) is $45 million per year, but considering its benefits to the dryland production systems, its total value to the region's economy could be closer to a billion dollars."

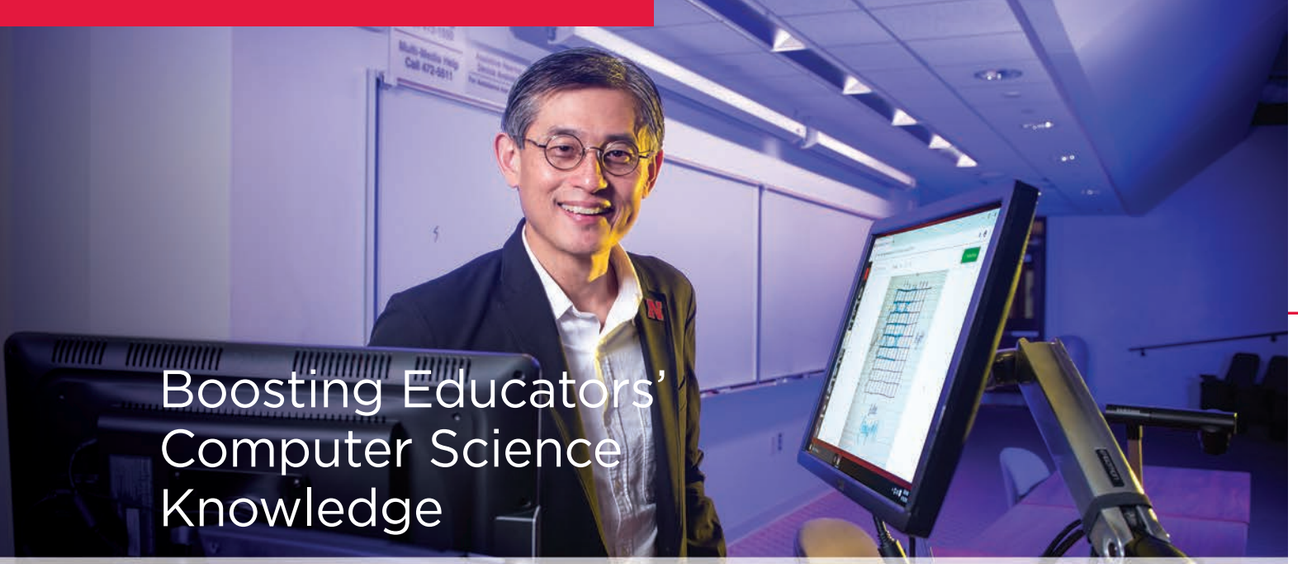
Researchers reported their findings in *Nature Communications*. Schnable's collaborators were from the Chinese Academy of Sciences, Iowa State University, Henan University, the Chinese Academy of Agricultural Sciences, Northwest Agriculture and Forestry University, Purdue University, Dryland Genetics LLC and Data2Bio LLC.

James Schnable studies the genetics of millet and corn, featured here.



STRENGTHENING FOOD SECURITY

"This will have a huge potential impact on the rural economy of the region."



Boosting Educators' Computer Science Knowledge

Computing is vital to nearly every facet of modern life. Yet teachers aren't always well prepared to help K-12 students learn what they need to succeed.

That's why an interdisciplinary Husker research team launched AIR@NE, a program boosting Nebraska educators' ability to effectively teach computer science. The group won a four-year, $2 million National Science Foundation grant to develop the program.

"Computer science isn't just for computer scientists anymore," said project leader Leen-Kiat Soh, professor of computer science and engineering. "It's fundamental, like math. Regardless of which field they choose, students benefit significantly from knowing programming and how to solve problems using computer science."

In Nebraska and many other states, there's no standardized K-12 computer science curriculum, no required training for teachers and few educators equipped to teach the subject. Teaching computing in Nebraska requires no specialized training.

AIR@NE is training about 100 educators from diverse districts statewide, including majority-minority, rural and native schools. Each summer, around 25 teachers take courses bolstering their computer science and teaching knowledge. They learn a highly successful K-8 computer science curriculum that the Lincoln Public Schools launched in 2014. Teachers will export this model curriculum to their districts, tailoring it to meet students' needs.

They'll also join a network linking experienced computer science educators with novices. This network is particularly crucial in Nebraska, where most schools have a single computer science teacher, if that.

"Unless we connect these teachers to a network, they're not going to be able to seek advice. They can't just walk down the hall and talk to someone else," said Wendy Smith, research associate professor and associate director for Nebraska's Center for Science, Mathematics and Computer Education.

Researchers will study the effects of the network and training program, and how each district adapts the curriculum.

Nebraska's team includes Gwen Nugent, research professor, Nebraska Center for Research on Children, Youth, Families and Schools; Kent Steen, LPS curriculum specialist; and Guy Trainin, Melvin C. and Jane N. Nore Professor of Teaching, Learning and Teacher Education.

Above: Leen-Kiat Soh

Developing Lifesaving Treatment for Lung Injuries

A soldier suffering a traumatic lung injury on the front lines faces a life-threatening Catch-22. The brain and other organs continue to demand oxygen, but taxing the damaged lung exacerbates the injury.

Because soldiers are often far from full-fledged treatment, the situation is even direr.

Husker engineer Benjamin Terry and colleagues with the Nebraska Strategic Research Institute are working on potentially lifesaving solutions with support from a $3.7 million Department of Defense contract.

"The best way to heal a lung is to not use it," said Terry, associate professor of mechanical and materials engineering. "But if you don't have the function of your lungs, you die. How do you let the lung heal and still get oxygen to the patient?"

Terry, Keely Buesing of the University of Nebraska Medical Center and Mark Borden of the University of Colorado Boulder are answering that question using microscopic oxygen bubbles that mimic the role of the lungs' alveoli, tiny air sacs that release oxygen and remove carbon dioxide. Placing these bubbles in the abdomen enables critical organs to continue working while affording crucial respite to the lungs.

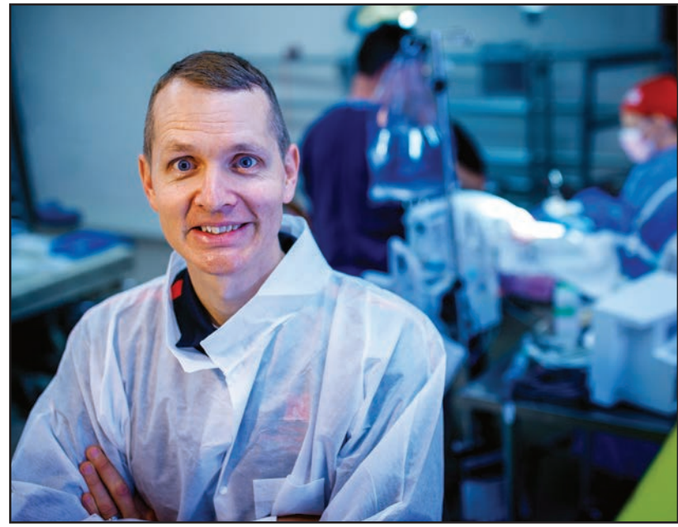
The bubbles are delivered via a portable catheter, making it possible to use the technology in soldiers being transported from remote locations. To make the approach even more battlefield friendly, Terry is developing a device to ensure that field medics, who lack advanced surgical training, are able to place the catheter.

Terry's is the only U.S. research group to use these oxygen bubbles in body cavities.

The method's potential extends beyond defense applications, Terry said. He envisions it could someday treat all patients, from newborns to the elderly, who have severe, acute lung problems.

"For the past decade, there's been a standstill in helping people with lung failure. This technology can break through that glass ceiling."

A University Affiliated Research Center, NSRI was established in 2012 as a partnership between the University of Nebraska system and the DOD.



Benjamin Terry

INSPIRING INNOVATION

Celebrating the Rise of Innovation Campus

The vision of a vibrant innovation hub that helps fuel Nebraska's economy began more than a decade ago. Today, that dream is being realized at Nebraska Innovation Campus.

The thriving research campus is now home to more than 40 private and public sector partners. With 455,000 square feet of collaborative office, conference, manufacturing, teaching, research and greenhouse space and cutting-edge facilities, companies and entrepreneurs work closely with Husker scientists and students.

In 2018, NIC generated $238 million in total economic impact, fueling 1,430 new jobs statewide and providing 75 student internships, according to a 2018 independent study.

"NIC is proving to be one of the fastest-growing facilities of its kind in the country," said Dan Duncan, NIC's executive director.

"We are fortunate to have had many things come together at the right time to enable NIC to grow this fast," Duncan said. "Companies like Spreetail, Virtual Incision, Adjuvance Technologies, Quantified Ag and several others are growing with the campus."

Virtual Incision, a medical device company founded by University of Nebraska faculty, located at NIC in 2016. Rapid growth – including several new employees and the next phase in commercializing its miniaturized surgical robot, designed to improve abdominal surgeries – spurred the need to expand. The company moved in 2018 to a larger space in NIC's newest structure, the $15.3 million, 75,000-square-foot Rise Building officially opened in January 2019.

Virtual Incision's facility, the first of its kind in Nebraska, includes a mock operating room and areas for manufacturing and prototyping. The manufacturing space enables the company to closely monitor production of its high-quality robots, cameras, consoles and surgical tools.

"When you produce medical devices, you have to maintain strict and regulated manufacturing best practices," said Shane Farritor, Lederer Professor of Engineering and the company's chief technology officer. "We've never had this capability before."

The company is preparing its robot for human trials and commercial approval by the U.S. Food and Drug Administration.

NIC's facilities are growing, too. A complete redesign of Nebraska Innovation Studio is enhancing the collaborative makerspace's role as a campus and community resource. The space will soon feature a metal shop, a larger instant prototyping inventory and a larger woodshop – all draws for current and prospective tenants.

An aerial view of Nebraska Innovation Campus

At full build-out, NIC will be a 2.2 million-square-foot campus that brings together private industry and the university community.

Innovative Tool Integrates Water Resource Management

Innovative groundwater management has long put Nebraska in the national spotlight. Now, with help from a multidisciplinary university team, the state is better managing all of its water resources.

Zhenghong Tang and Hongfeng Yu

In nature, surface water and groundwater are interconnected – siphoning one affects the other. States, however, have traditionally managed the two water sources independently.

To integrate water management, the university helped the Nebraska Department of Natural Resources create INSIGHT, the Integrated Network of Scientific Information and GeoHydrologic Tools. This advanced web-based tool consolidates hydrologic data from across the state into an easily accessible format.

INSIGHT provides a more detailed understanding of water conditions at state and local levels to water managers, municipalities, industry, farmers and other water users.

"With this kind of transparent data system, water managers can allocate water resources better to support the state's economy," said project co-leader Zhenghong Tang, professor of community and regional planning and Hyde Professor in the College of Architecture.

As climate change increases the number and severity of droughts, better managing water resources becomes even more critical to sustaining limited resources and reducing water conflicts.

Consolidating data from across government agencies and allowing diverse users to access and understand the data intuitively presented challenges. Tang brought geospatial and hydrologic experience to the problem. Co-leader Hongfeng Yu, associate professor of computer science and engineering, brought expertise in information technology.

Their solution was to create a scalable database system that uses an interactive map capable of zooming between state, basin and sub-basin levels. Data presented among the map changes automatically to coincide with the map view.

"The tool's design makes it easier to update the site with new data, saving the state time and money," Yu said. Its advanced visualization techniques can be upgraded as new technologies develop, keeping INSIGHT – and Nebraska – on the cutting edge.

"It's an excellent example of an interdisciplinary approach serving the state's need for its citizens," Tang said. "Individually, we could not have done it."

NeDNR funded this project.

Easing Internet Traffic Jams

With so many mobile devices and other wireless users jumping on the information superhighway, the airwaves are experiencing traffic jams.

That's a conundrum for internet service providers and their customers, who pay for services that ISPs will soon be unable to guarantee during wireless rush hours.

Nebraska supply chain researchers and computer engineers have teamed to help ease congestion.

In this case, the supply they're studying is spectrum, the range of radio frequencies along which wireless communication information travels. Spectrum is finite and allocated among users, including government entities, aviation, emergency services, broadcasting and ISPs.

Everyone must stay in their metaphorical lane. Yet the ISP's lanes may be severely jammed even when the government's lanes, for example, are only lightly used.

To improve spectrum efficiency, researchers are developing technologies to facilitate sharing lanes.

Demet Batur, associate professor of supply chain management and analytics, and her team are working to support spectrum sharing by developing algorithms to help spectrum's allocated users determine, in real time, how much lane they can afford to share.

Batur's team is also helping the wireless industry develop new business models that will ease congestion and fix ISPs' pending pricing conundrum.

Similar to how airlines change ticket prices in real time based on fluctuating supply and demand, Batur's team is developing algorithms to allow ISPs to dynamically price the internet. Dynamic pricing would shift cost-conscious users to less congested, cheaper times.

"It's an advanced model that looks at the current state of the system and probabilistically studies it to decide the best price to propose to customers," Batur said.

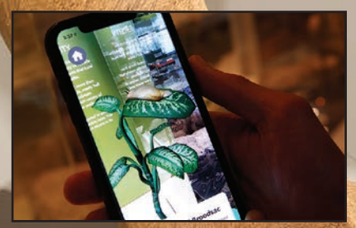
She envisions it operating like Uber, in which customers request a price via an app that they accept or reject.

Dynamic pricing would help give those unable to afford regular service an opportunity to access the internet when it's more affordable. By easing congestion, it would also allow ISPs to guarantee access to those who need it.

The National Science Foundation funds this project.

Above: Demet Batur with collaborators Jennifer Ryan and Mehmet Can Vuran

CHERISHING HISTORY



Great Plains Exhibits Illustrate Global Story

An interactive celebration of Nebraska's natural history and culture unfolds for visitors to the recently expanded University of Nebraska State Museum. These local examples illustrate a global story.

"Cherish Nebraska," Morrill Hall's five-year, $11.4 million expansion, opened in February 2019. Seven new galleries cover 11,000 square feet and highlight Nebraska's natural and cultural heritage.

Interactive exhibits engage the senses with touchscreens, games, microscopes and a "Visible Lab" where visitors can watch researchers examine fossils, plants and other specimens being prepared for the collections. Crawl-through spaces invite children to explore different environments, such as a hollow cottonwood log. A rattlesnake den plays the species' warning sound.

These exhibits have engaged thousands of visitors since the opening, helping fulfill a goal of strengthening links between university research and the public.

"The space is a science communication platform for researchers," said Susan Weller, museum director and professor of entomology. "If research stays only within the science community, it's not helping to move the public dialogue."

That's why Weller tapped more than 50 researchers across the university, state and world to contribute to exhibits. They include Clint Rowe, one of Nebraska's foremost climate scientists. Through the gallery's 5-foot-wide digital globe, which features short films about climate change, he shares his knowledge with the public.

"The museum is the science face of the university," said Rowe, professor of earth and atmospheric sciences. "It's a place where people bring their kids and grandkids. It's where you can display your research in a way that interests the public."

With diverse exhibits, researchers from wide-ranging disciplines can find ways to share their passion, Weller said. Many displays focus on climate change's impact on Nebraska ecosystems. Others provide guidance on cherishing natural resources, with exhibits on water quality and carbon footprints.

Though exhibits are Nebraska-based, they illustrate global patterns. They also highlight the state's unique crossroads position, where East meets West and North meets South. Weller wants visitors to see how this positions Nebraska researchers to solve future challenges.

"Nebraska will lead the way in feeding the future population of 9 billion people and managing natural resources wisely," Weller said.

Major contributors to the privately funded expansion include the Nebraska-based Theodore F. and Claire M. Hubbard Family Foundation, the Claire M. Hubbard Foundation, the William and Ruth Scott Family Foundation, the Donald F. and Mildred Topp Othmer Endowment, and the Nebraska Environmental Trust.

"Cherish Nebraska" includes interactive exhibits that engage audiences through features like touchscreens, games, crawl-through spaces and a 5-foot-wide digital globe.

Amid International Acclaim, Obioma Feels at Home in Nebraska

Being shortlisted for the prestigious Booker Prize for Fiction opens many doors. Chigozie Obioma has traveled the world since his debut novel, "The Fishermen," was a finalist in 2015. But the assistant professor of English said he's content to call Nebraska home.

Obioma, who grew up in Nigeria, published his second novel in 2019. "An Orchestra of Minorities" also made the Booker Prize shortlist and has received national media attention. He moved to Nebraska in 2015 after receiving his Master of Fine Arts at the University of Michigan.

Lincoln is conducive to writing, Obioma said, though he finds it amusing that, in his many travels, the most interesting thing about him seems to be his choice to live in the Cornhusker State.

"I'm a bit of a hermit. So, what we have here in Lincoln is just enough for me," he said. "I feel like it gives me the space to imagine myself a little removed from the serious urbanization happening everywhere, glass houses here and there."

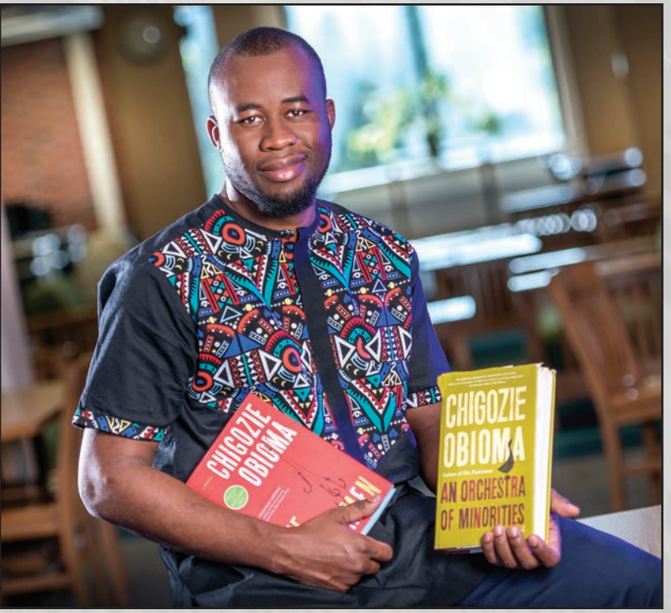
Obioma said he appreciates getting to know Nebraska writers and book lovers. He's spent evenings at local book clubs, engaging with readers in a way he doesn't think would happen if he lived in New York City, where he visits often.

Before moving to Nebraska, he was unsure how an academic career would affect his writing but finds he enjoys teaching.

"One grows as a writer by trying to help others learn the craft," he said. In his creative writing classes, he focuses on helping students develop their strengths and trust that their weaknesses will improve.

Obioma's books are set largely in Nigeria. "The distance is the reason I keep writing about Nigeria, because it feeds a kind of longing for the place," he said. "When I feel myself removed from a place is when I really want to write about it."

While Obioma's next few books will take place in Africa, as he gets to know Nebraska, he said he finds himself writing more frequently about his new home. "I like to do road trips. It feels empty, quiet. It really inspires me."



Chigozie Obioma

Documentary Tracks Pershing's Adventurous Life

Nebraska's Barney McCoy had only the vaguest idea of who John J. Pershing was before making a documentary about the distinguished World War I military commander.

But a call from a Pershing fan suggesting one was long overdue sent McCoy on a six-year journey into Pershing's adventurous life and Nebraska ties.

The documentary, "Black Jack Pershing: Love and War," premiered on NET Nebraska and is available on Amazon Prime Video. It won the Sigma Delta Chi Award from the Society of Professional Journalists and several awards of excellence.

Pershing's military career began after graduating from West Point in 1886. It included climbing San Juan Hill in the Spanish-American War, fighting in the Philippine-American War and pursuing Mexican revolutionary Pancho Villa. The documentary explores Pershing's successes – and heartbreaks – commanding the American Expeditionary Forces in World War I.

"It was a critical war in our country's history, what many people consider the forgotten war," said McCoy, Hitchcock Professor in the College of Journalism and Mass Communications. "The sacrifices America made really put us on a global stage."

Nebraska played an important role in Pershing's life. In the early 1890s, as the university's professor of military science and tactics, he formed a highly regarded university drill company, today's Pershing Rifles.

Pershing contemplated leaving the military, but his years in Lincoln, Nebraska, reinforced his career choice,

Barney McCoy

McCoy said. He maintained a Lincoln home for his sisters and visited often.

As McCoy dug into the archives, Pershing's letters to love interests over the years revealed the strict general's soft side. For McCoy, finding photos and flower petals inside deeply romantic love letters was a research highlight.

"Unlike many military biographies, we dug more deeply into Pershing's personal life. We felt it would make this documentary unique by adding more context to his life," McCoy said.

"It's not just a history lesson. There's an emotional connection that hopefully captures the audience's attention."

McCoy directed and produced the documentary in partnership with NET Nebraska. Humanities Nebraska, the Gilbert M. and Martha H. Hitchcock Foundation, the university and private donations provided funding.

From Mundane to Extraordinary: Uncovering Clues to Ancient Life

Nebraska archeologist Michael Hoff claims it's just as exciting to unearth potsherds and animal bones as, say, to exhume a dumped murder victim or catch ancient Romans engaging in potty humor.

But he admits that finding a million dollars or so in 17th-century pirate booty was pretty exciting.

Michael Hoff stands on the mosaic floor his research team uncovered in Turkey.

Hoff, professor of art history, has spent the past 14 summers leading the excavation at Antiochia ad Cragum, an ancient Roman city overlooking the Mediterranean Sea in southern Turkey.

For Hoff, every object helps him imagine the people who once went about their lives there. The object might attract international attention, such as 2018's discovery of a bawdy mosaic created to entertain users of a public latrine. Or it might be a simple gold hoop earring a woman lost one day down the swimming pool drain.

But potsherds and other everyday items help Hoff's team piece together trade routes, diets and how the Roman economy changed over time.

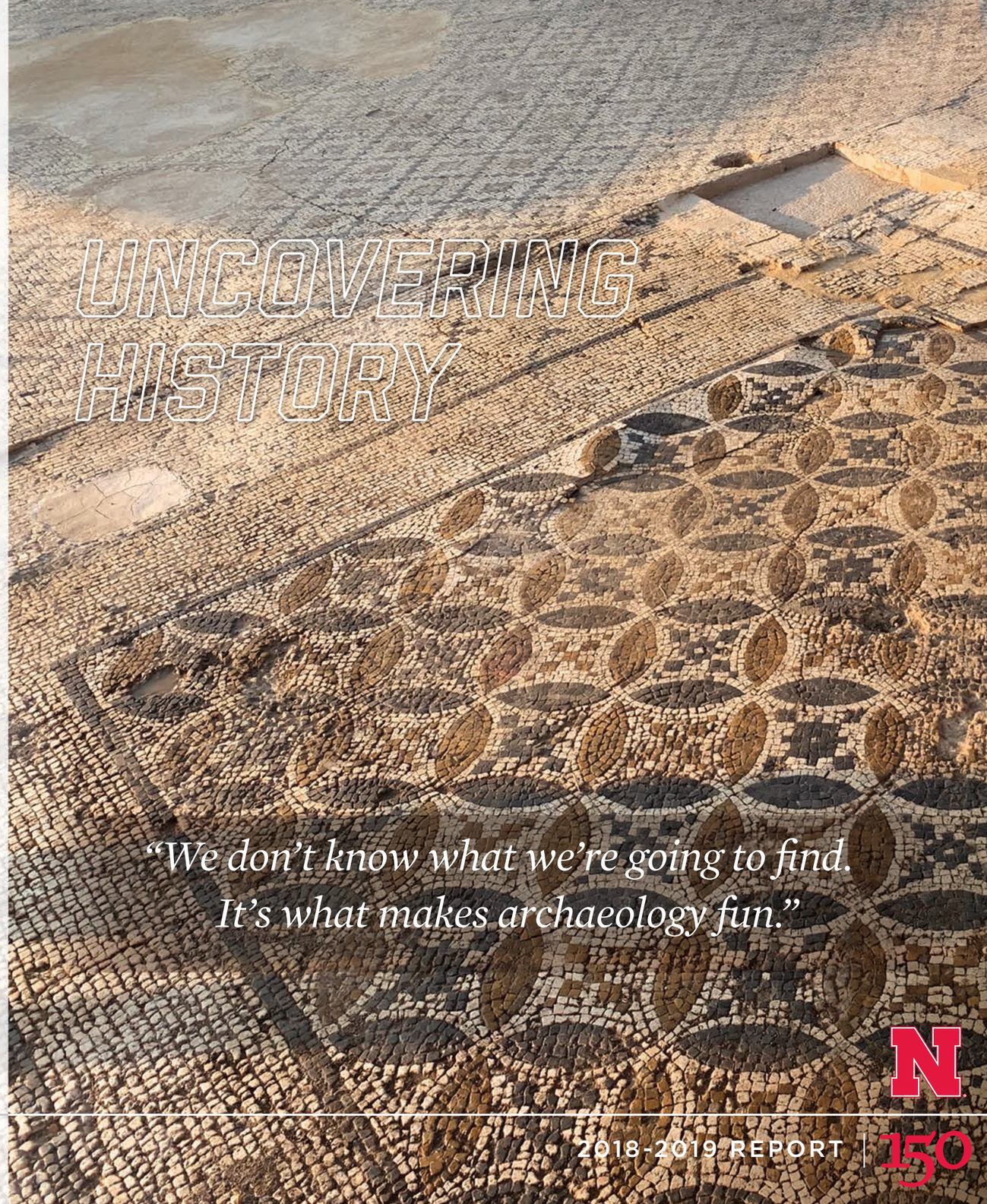
"All these tidbits make the site come alive," Hoff said. "We don't know what we're going to find. It's what makes archaeology fun."

Hoff oversees a large excavation program that attracts more volunteers, research staff and students from the United States, Turkey and elsewhere each year. The 2019 program drew 110 people.

Participants continue excavating the site's structures, including bath houses, a shop-lined street, council house, mausoleum and temple. In 2019, researchers also began exploring the city's aqueducts and roads to better understand the area's infrastructure.

And they continued conserving the dead man and pirate treasure, both discovered in 2018. Though they arrived – separately – after Antiochia was abandoned and had become a remote place to stash a body or loot, they're part of the site's ongoing human story. What, Hoff wonders, befell the man or the pirate who didn't return for his staggering load of silver and gold coins?

The Merops Foundation, participation fees and private donations funded the project's recent field work. St. Olaf College in Minnesota and several Turkish universities are associated with the program.



Reimagining New Paths for Tribal Property Systems

Of the many atrocities committed against indigenous people in the U.S. and Canada, upending their land tenure systems is not the first that comes to mind. But the legal quagmire it created in both countries contributes to poverty in many communities.

Unlike their southern neighbors, the Canadian government has engaged in a reconciliation process with native peoples.

To better understand Canada's approach, Jessica Shoemaker, associate professor of law, received a Fulbright Canada Research Chair in Aboriginal Legal and Resource Rights. She spent the 2018-2019 academic year at the University of Alberta Faculty of Law in Edmonton.

"We've used property laws in indigenous communities throughout history as basically social engineering, and it's had a lot of negative effects," Shoemaker said. "The United States hasn't really confronted this history of mistreatment."

For example, in the 19th century, the U.S. government sought to assimilate Native Americans into Western culture by allotting tribal lands to indigenous individuals in a restrictive federal trust and selling other reservation land to white settlers.

Generations later, reservation land ownership and federal property laws restricting land use are a mess, Shoemaker said. The current property system is inflexible, cumbersome and expensive, often costing more in bureaucratic upkeep than the land is worth. Most problematic, indigenous people can't freely use restricted property to advance economically or to reflect community choices.

"The history of property and indigenous people in the United States is one of dispossession and displacement of fundamental land governance rights," Shoemaker said. "There are living indigenous communities affected by this on a day-to-day basis."

In Canada, Shoemaker explored the country's reconciliation process, including ongoing land-claim litigation, treaty renegotiation and laws intended to improve relationships.

She's using what she's learned to reimagine new pathways for tribal property systems in the United States that include greater flexibility and tribal authority.

"This has been really fruitful for me to think more creatively about how this reimagining could happen in the U.S. as well," Shoemaker said.

Above: Jessica Shoemaker

Press-Faculty Partnerships Reach Readers Worldwide

Partnerships are critical in successfully sharing research and scholarship. At Nebraska, many faculty authors tap the expertise of the University of Nebraska Press to transform their work into books and journals that garner national and international readership.

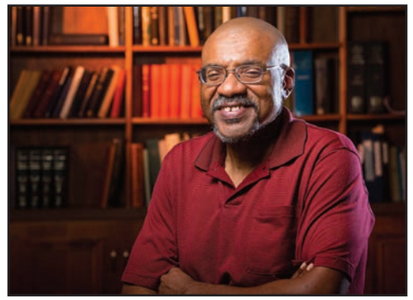
"While we publish scholarship from all over the world, we're especially proud to publish the research of Nebraska's own faculty," said UNP director Donna Shear. "Together, we share the university's research with readers all over the globe."

Margaret Jacobs

Since its founding in 1941, UNP has published more than 100 Nebraska faculty works, and its current book list includes 45 faculty.

"With its strong and enduring presence in Native American and Indigenous Studies as well as the American West, UNP has been such a great fit for me," said Margaret Jacobs, Chancellor's Professor of History. UNP published all three of Jacobs' books, including "White Mother to a Dark Race" (2011), which won the Bancroft Prize, the Athearn Book Award and the Armitage-Jameson Prize. Jacobs also works with UNP as editor of the New Visions in Native American and Indigenous Studies book series.

In 2019, Jacobs was the first female faculty member at Nebraska selected for membership in the American Academy of Arts and Sciences, and in 2018 was the first Nebraska professor to receive a Carnegie Fellowship.



Kwame Dawes

UNP has long published the *Prairie Schooner,* the university's nationally recognized literary journal, and, since 2004, the winners of the *Prairie Schooner* Book Prize. Kwame Dawes inherited this longstanding relationship when he became *Prairie Schooner* editor. Dawes, Chancellor's Professor of English and Glenna Luschei Editor of Prairie Schooner, said the publishing partnership has strengthened the journal's impact over the years.

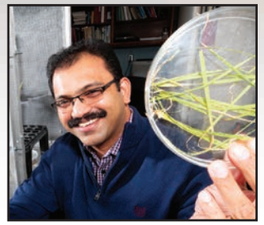
In 2019, Dawes earned the Windham-Campbell Prize for his poetry and the universitywide Outstanding Research and Creative Activity Award. He spearheads the African Poetry Book Fund, which has published 17 books with UNP, a collaboration that established UNP as a leading publisher in African poetry.

"The UNP team ... has proven to be a thoughtful, adventuresome and professional partner that epitomizes the kind of collaborations that are possible," Dawes said.

Husker Researchers Tie CAREER Award Record

Nebraska researchers are tackling today's complex challenges – from health and agriculture to improving computer technology – with Faculty Early Career Development Program awards from the National Science Foundation. In 2019, six Nebraska researchers received these prestigious five-year awards that support outstanding pre-tenure faculty, tying a university record set in 2018. Three additional Nebraska faculty members received CAREER awards at previous institutions and are continuing their work at Nebraska.

RISING RESEARCH STARS



Joe Louis

Investigating Sorghum's Natural Defenses

A tiny invader's march through U.S. sorghum fields is devastating crops, even as the cereal grain is gaining global prominence for standing up to climate change.

With a $1.5 million CAREER award, Nebraska's **Joe Louis**, Harold and Esther Edgerton Assistant Professor of Entomology, aims to help sorghum resist sugarcane aphids without pesticides.

To investigate sorghum's natural defenses against aphids, Louis' team turned to a special sorghum population created from varieties found globally to identify plants that are more resistant and those more susceptible to the pest.

By comparing their differences using a blend of molecular, biochemical and electrophysiological approaches, Louis is investigating the genetic basis for resistance. With this information, breeders and molecular biologists will be able to develop more resilient sorghum varieties.

The research may also help other crops defeat aphids and other sap-sucking insects.

NSF's Plant Genome Research Program and Established Program to Stimulate Competitive Research co-fund this project.

Rebecca Roston

Developing Cold-Hardy Crops

Despite its status as Nebraska's most iconic crop, corn just can't take the winters.

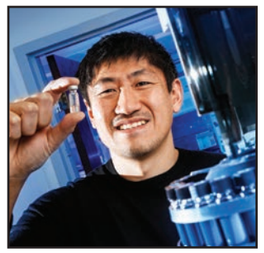
Temperatures below zero degrees Celsius trigger a cascade of lethal damage, limiting the crop's seasonal and geographic range at a time when a growing global population requires more food.

To help develop crops better able to tolerate freezing conditions, Nebraska's **Rebecca Roston** is studying *Arabidopsis thaliana* to identify what allows the plant to survive below-freezing temperatures.

Roston, assistant professor of biochemistry, is building on her previous research that identified a key protein in stymying cold-induced cellular damage.

Now, with a nearly $850,000 CAREER award, Roston is zeroing in on how the protein manipulates plant lipids to stabilize chloroplast membranes in freezing temperatures. She's also investigating what sparks this protective response, likely a biochemical process called phosphorylation initiated by a reaction to cold.

Roston is a member of the university's Center for Plant Science Innovation.



Toshihiro Obata

Uncovering How Metabolism Goes Awry

Missteps in metabolism are implicated in hundreds of human disorders – including the unwelcome middle-age spread.

Nebraska's **Toshihiro Obata**, assistant professor of biochemistry, is researching a key component of metabolic regulation that will improve understanding of the many ways metabolism goes awry.

Metabolism fuels numerous vital functions through a series of chemical reactions coordinated by a network of enzymes, many of them organized into multi-enzyme complexes.

With a nearly $750,000 CAREER award, Obata's team is manipulating multi-enzyme complexes involved in cellular respiration in yeast. They're investigating relationships between metabolic activity and the complexes' structures and interactions.

Obata's research may uncover genetic mutations that lead to metabolic disorders related to enzyme complex formation.

Because multi-enzyme complexes are found in nearly all living organisms, better understanding metabolic regulation will have broad benefits, from improving crop resilience and yields to new methods of synthesizing useful compounds, such as medicines.

Michael Sealy

Building Better Biodegradable Implants

Not all medical implants need to stick around after their job is done. Implants that dissolve over time are increasingly an option, particularly plates and pins used to repair bone.

Nebraska's **Michael Sealy**, assistant professor of mechanical and materials engineering, is bringing high-tech 3D printing to manufacturing biodegradable implants, making them stronger, lighter and less prone to corrosion and fatigue than conventional biodegradable implants.

The method he's developing with a $500,000 CAREER award is a mouthful — multi-process asynchronous hybrid additive manufacturing. It's a type of 3D printing that allows Sealy to precisely print a metal object layer by layer.

For medical devices, he's using magnesium, a lightweight metal that dissolves in the body. By altering printing formulas and layering patterns, Sealy can customize degradation rates and other behavior.

The approach also could be used to manufacture lighter, stronger components for airplanes, vehicles and the military.

Sealy uses specialized 3D printers available through the Nebraska Engineering Additive Technology Labs, a cutting-edge regional hub for additive manufacturing research.

Husker Researchers Tie CAREER Award Record (cont.)

RISING RESEARCH STARS

Rebecca Wachs

Targeting Pain Where It Hurts

Instead of giving back pain sufferers an opioid, a major source of the nation's drug-addiction crisis, Nebraska engineer **Rebecca Wachs** is tackling pain where it hurts.

With a $510,400 CAREER award, Wachs is engineering a solution targeted directly at treating nerve fibers that grow deep into deteriorating spinal discs, a source of chronic pain.

Wachs, assistant professor of biological systems engineering, is identifying and testing drugs and proteins that force nerve fibers to retreat from the disc. To block regrowth, she's investigating other materials known to prevent nerves from regrowing after spinal injuries.

The goal is to package the cocktail of biomaterials into a single injection or other noninvasive treatment, eliminating the cause of pain rather than masking it with opioids.

This nerve-targeting approach is novel because most research focuses on the degenerating disc, Wachs said. But many people with disc degeneration don't experience pain, suggesting other factors may be to blame.

Limei Zhang

Tracking Clue to TB's Toughness

Tuberculosis infects about 10 million people each year and kills 1.6 million, making it the world's deadliest infectious disease. Nebraska's **Limei Zhang** has discovered a clue that may help explain what makes TB notoriously difficult to treat.

With a $600,000 CAREER award, Zhang, assistant professor of biochemistry, is studying a shapeshifting protein in *Mycobacterium tuberculosis* that may help the bacteria evade the human immune system. Her research could lead to more effective treatments.

Zhang is investigating the protein's ability to sense small changes inside human cells that trigger it to alter its structure, which modifies its function. As cells adjust their biochemistry in response to an invasion, the protein seems to provide a protective response, causing the bacteria to enter either an active or dormant phase.

A bacterium important to soil health and antibiotic development contains similar proteins. Better understanding the TB protein may also improve the bioengineering of medications and other products.

These scientists earned CAREER awards as faculty members elsewhere and are continuing their projects at Nebraska.

Marc Libault

Boosting Nitrogen Fixation

Soybeans and other legumes can snatch nitrogen out of the air, an ability unique to few organisms.

They're aided by rhizobia, common soil bacteria that convert atmospheric nitrogen into a form plants can use in a process called nitrogen fixation.

Marc Libault, associate professor of agronomy and horticulture, seeks to better understand the relationship between soybeans and rhizobia. His research could lead to improving soybeans' nitrogen-fixing efficiency and to transferring the process to other crops.

Greater efficiency and expanding nitrogen fixation beyond legumes would allow crops to use atmospheric nitrogen and require less commercial fertilizer.

With a $575,000 CAREER award, Libault's team is focusing on the initial stages of rhizobial infection. Researchers are identifying and investigating plant genes important to coordinating the activation and timing of gene expression in root cells in response to rhizobia.

Libault is affiliated with the university's Center for Plant Science Innovation and Center for Root and Rhizobiome Innovation.

Bonita Sharif

Tracking Eye Movement to Improve Coding

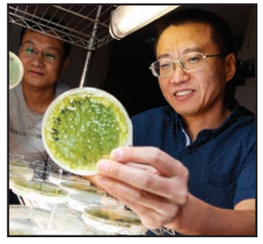
Nebraska's **Bonita Sharif** is helping software programmers write code better and faster by looking into their eyes.

With a $432,000 CAREER award, Sharif is using the latest eye-tracking technology to map exactly where coders look as they search for bugs or software features within thousands of lines of code. She's creating algorithms to analyze the eye movements.

With this information, Sharif is developing tools to show programmers where to look for similar code, automatically create links to recommended code and write English-language summaries to help orient others. These tools will also help beginning coders and students learn more quickly.

"By tracking what developers do while they're doing it, we can improve the software development process itself," said Sharif, assistant professor of computer science and engineering.

Sharif is also part of a multi-institutional team advancing eye-tracking software with funding through an NSF Community Research Infrastructure grant.



Yanbin Yin

Computational Tools ID Key Enzymes

With entire genomes available for study, finding specific genes is challenging. Nebraska bioinformatics specialist **Yanbin Yin** is creating computational tools to quickly identify a class of enzymes found in all living organisms.

Yin's tools will speed research across diverse disciplines, including biofuel production, crop diseases and his own study of human gut health and plant evolution.

Yin, associate professor of food science and technology, is building on his earlier work that identifies carbohydrate-active enzymes, or CAZymes, within genetic code that researchers upload to a website. CAZymes produce, modify and break down all carbohydrates.

With a $911,000 CAREER award, Yin is advancing his software to more thoroughly analyze CAZymes and predict how they function. The software's algorithms learn as data is added. He will package the software on a free, user-friendly website.

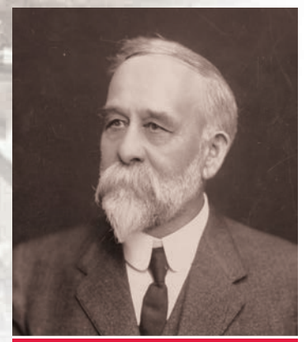
Yin is a researcher in the Nebraska Food for Health Center.

NOTABLE NEBRASKA RESEARCHERS AND SCHOLARS

George W. Beadle
(1903-1989)

Nebraska's Beadle Center for Genetics and Biomaterials Research – home to programs in biotechnology, biosciences and plant sciences – honors alumnus and geneticist **George W. Beadle**, who shared the 1958 Nobel Prize in Physiology or Medicine. Beadle may have become a farmer at his native Wahoo, Nebraska, had his teachers not pushed the bright student toward higher education. He earned a bachelor's degree in agriculture from Nebraska in 1926 and a master's in 1927. At Nebraska, he worked with professor F.D. Keim, a protégé of the great botanist Charles Bessey, on wheat breeding. Keim secured Beadle a position at Cornell University with R.A. Emerson, another Bessey protégé, for research confirming Mendelian genetics of corn. Beadle earned a doctorate in 1931 from Cornell. The research that earned the Nobel Prize was conducted at Stanford University in the late 1930s and early 1940s. With co-recipient Edward Tatum, Beadle proved that genes govern formation of enzymes and that each enzyme corresponds to specific genes; thus genes act by regulating chemical events. This research established the link between biochemistry and genetics, laying groundwork for the development of molecular biology. Beadle became chancellor and then president of the University of Chicago in 1961, serving until 1968.

Inset: An aerial view of City Campus in 1871
Top: Botanist Charles Bessey (third from left) and colleagues
Above: University Hall, the first building on campus



Charles Bessey
(1845-1915)

Pioneering botanist **Charles Bessey** changed the university's early trajectory when he arrived in 1884. He believed in experimentation to benefit agriculture. He wrote critical parts of the 1887 Hatch Act, which established agricultural experiment stations at land-grant universities and provided annual federal funding support. An exceptional scientist, teacher and administrator, Bessey established Nebraska's botany program. He taught more than 4,000 students over his career; 800 are said to have made significant contributions to science. Bessey mentored scientists who developed the disciplines of Plains ecology and range management, and advanced the fields of agronomy, plant genetics and crop physiology. Bessey devised a plant taxonomy system based on evolutionary principles that, with some revisions, is still used. His tree-planting experiment led to establishing the Nebraska National Forest, the world's first artificial national forest. He published more than 150 papers and two textbooks; edited two leading journals, *American Naturalist* and *Science;* and was president of the American Association for the Advancement of Science. Nebraska's Bessey Hall, completed after his death, bears his fingerprints. He laid out the building so labs would benefit from natural light. Since 2001, Charles Bessey professorships recognize faculty for exceptional scholarship and creative activity. The university also awards the Bessey Medal in recognition of distinguished achievement in the sciences and related fields. In 2009, Bessey was named to the Nebraska Hall of Fame.

Willa Cather
(1873-1947)

Author **Willa Cather** is among Nebraska's most significant graduates. Born in Virginia, she moved with her family to Nebraska at age 9. Cather entered the university intending to become a physician, but writing soon consumed her interests. Active in campus life, she was friends with peers Louise and Roscoe Pound, edited the student newspaper and wrote for local newspapers. After graduating in 1895, she moved to Pittsburgh and then New York City as managing editor for McClure's, a leading magazine. In 1913, she published "O Pioneers!," which captured the spirit of immigrant farmers who settled the Plains, following with "The Song of the Lark" and "My Ántonia." She won the Pulitzer Prize for literature in 1923 for "One of Ours." Strong Cather threads weave through humanities scholarship at Nebraska. With extensive Cather research and scholarship and a rich archive of Cather materials, Nebraska is home to the collaborative Willa Cather Archive, an internationally recognized digital resource for studying Cather's life and writings. The University of Nebraska Press publishes numerous Cather titles, scholarly editions and books about the author. In 2013, University Libraries Professor Andrew Jewell and Texas scholar Janis Stout co-edited "The Selected Letters of Willa Cather," the seminal collection of Cather's letters that is part of the Willa Cather Archive. Since 2001, Willa Cather professorships recognize faculty with exceptional records.

Above: George W. Beadle
Center: Louise Pound (seated)
Top Right: Love Library in the 1940s

CELEBRATING 150 YEARS

Aaron Douglas
(1899-1979)

A premier artist of the Harlem Renaissance, **Aaron Douglas** was the first African American to earn a degree in fine arts from Nebraska. A Kansan, Douglas was barred from college in his home state and worked as a laborer in Detroit before entering the university. After graduating in 1922, he taught high school art in Kansas City, Missouri. He moved to New York City in 1925, where he worked with other artists, was associated with civil rights activist W. E. B. DuBois and did illustrations for magazines published by the NAACP and Urban League. His murals, illustrations and graphic design, considered seminal to the Harlem Renaissance, remain enduring and important. Combining traditional African and African American images with the prevailing cubist and art deco stylings to explore themes of racism, segregation and modern society, he created a distinctive and imaginative visual form and a new black aesthetic. Douglas eventually moved to Nashville, Tennessee, where he founded the art department at Fisk University, teaching there from 1937-1966. Leading museums, including Nebraska's Sheldon Museum of Art, hold his work. In 2008, the university established the Aaron Douglas Professorship for Teaching Excellence in his honor.

Rachel Lloyd
(1839-1900)

Pioneering chemist **Rachel Lloyd** joined the Nebraska faculty in 1887, the second member of the chemistry department and the only one to hold a doctorate at that time. She was the first American woman to earn a doctoral degree in chemistry, granted in 1887 from the University of Zurich in Switzerland, where she had studied because women were barred from earning doctorates in the United States. At Nebraska, her research on sugar beet content and how to improve varieties laid groundwork for Nebraska's sugar beet industry. In 1889, she was elected a fellow of the American Association for the Advancement of Science. Lloyd founded several organizations in Lincoln, including the Nebraska Academy of Sciences, the Nebraska Local Section of the American Chemical Society and the Haydon Art Club of the University of Nebraska, a precursor to today's Sheldon Art Association. Lloyd suffered numerous illnesses and poor health prompted her resignation in 1894, which was accepted with regret. Information about Lloyd's life comes mostly from a biography written by her brother-in-law. A copy of this long-lost book was recovered in 2014 from a time capsule laid in 1916 in Avery Hall. To commemorate Lloyd's achievements, the American Chemical Society presented Nebraska with its first National Historic Chemical Landmark.

Louise Pound
(1872-1958)

A distinguished scholar, athlete, musician and women's sports advocate, **Louise Pound** worked to preserve Nebraska's native folklore and pioneered studies in philology, a combination of literary criticism, history and linguistics used to study language in written and historical contexts. She received a bachelor's degree in 1892 and a master's in 1895 from Nebraska. When American universities would not admit her, Pound earned her doctorate in Heidelberg, Germany. She returned to Nebraska and taught in the English department for nearly half a century. As a scholar, Pound crusaded for the serious study of American English, founding the field's leading journal. She was the first woman president of the Modern Language Association. She also fought to open athletic and professional opportunities for women. Pound established the Black Masque, a senior women's honor society, later known as Mortar Board. A lifelong athlete, she won numerous golf, tennis and cycling championships. Pound was part of a distinguished Nebraska family that included her brother, Roscoe, prominent legal scholar and dean of Harvard Law School, and sister Olivia, a highly regarded educator. The former College of Business Administration building was renamed Pound Hall in 2018 to honor Louise Pound. The original Pound Hall, a residence hall, was demolished in 2017.

Mari Sandoz
(1896-1966)

One of the state's most respected authors, **Mari Sandoz** lacked a high school diploma, and while she enrolled at Nebraska in 1922, she never earned a degree. But her more than 20 books and dozens of short stories earned her a place in the state's pantheon. Her biography of her father, "Old Jules" (1935), and works such as "Crazy Horse: The Strange Man of the Oglalas" (1942) and "Cheyenne Autumn" (1953) won her acclaim as a writer and chronicler of the settlement of the West and as a champion of Native Americans. Her childhood on a western Nebraska homestead, terrorized by her violent and erratic father, Jules Sandoz, informed her lifelong concern for poor people, women and those who were dispossessed of land. Her works are notable for extensive and detailed research. Sandoz reportedly received more than 1,000 rejection letters for her works and burned 70 of her manuscripts in frustration. The university conferred an honorary degree in 1950 and its archives hold much of her research collection. Many of her works are in print, published by the University of Nebraska Press. A university residence hall is named for Sandoz.

Theodore C. Sorensen
(1928-2010)

Sorensen Family

Theodore C. "Ted" Sorensen earned his bachelor's degree in 1949 as a Phi Beta Kappa and his law degree in 1951, both from Nebraska. He moved to Washington, D.C., where he worked for newly elected Massachusetts U.S. Sen. John F. Kennedy as a researcher, then trusted adviser and speechwriter. He contributed to Kennedy's 1956 book "Profiles in Courage," and reportedly penned the famous line: "Ask not what your country can do for you, ask what you can do for your country." Sorensen left the White House soon after JFK's 1963 death. He joined a New York law firm. As an international lawyer, he advised governments, multinational organizations and major corporations. He also wrote the bestselling biography "Kennedy." He advised Robert F. Kennedy during his ill-fated 1968 presidential campaign. Sorensen frequently visited Nebraska, delivering lectures and participating in other activities. The university conferred an honorary degree in 1969.

Other Sorensen family members are prominent in the university's history. Father **C.A. Sorensen** was twice Nebraska's attorney general and wrote the enabling legislation for public power in the state. Mother **Annis Chaikin Sorensen,** once a university employee, led the movement to put women's suffrage on Nebraska's ballot. In 1969, the family endowed a humanities teaching award in her name. The College of Journalism and Mass Communications presents an annual lecture endowed and named in honor of brother **Thomas C. Sorensen**, noted journalist and alumnus (B.A. 1947; honorary degree, 1996).

Clayton K. Yeutter
(1930-2017)

Clayton Yeutter intended to farm after earning a bachelor's degree from Nebraska in 1952. Instead, he joined the U.S. Air Force and earned a law degree and doctorate in agricultural economics from Nebraska in 1963 and 1966, respectively, while also managing his farm and ranch operation. He then launched a career that included serving as CEO of the Chicago Mercantile Exchange and holding three cabinet- or sub-cabinet-level posts for four U.S. presidents. As U.S. trade representative for President Ronald Reagan, he began the Uruguay Round of multilateral trade negotiations in 1986, which resulted in creation of the World Trade Organization. His work laid the groundwork for the North American Free Trade Agreement. He was secretary of agriculture for President George H.W. Bush and later served as a senior domestic adviser. Yeutter's gift to the University of Nebraska Foundation established the Clayton K. Yeutter Institute of International Trade and Finance at Nebraska. Launched in 2015, the institute prepares students to work in interconnected global economies. A statue of Yeutter was dedicated on East Campus in 2014, one of four honoring Nebraskans who have served as U.S. secretary of agriculture. The others are Clifford Hardin, Mike Johanns and J. Sterling Morton.

Accolades

Paul Black, Charles Bessey Professor of Biological Chemistry, was named a 2018 fellow of the American Association for the Advancement of Science. AAAS fellows are selected by their peers for scientifically or socially distinguished achievements that advance science or its applications. Black was recognized for contributions to the field of lipid biochemistry, particularly his role in defining the mechanistic basis of coupled fatty acid transport and activation across biological membranes.

Two Huskers were named fellows of the National Academy of Inventors. This is the highest professional distinction accorded to academic inventors whose inventions improve quality of life, spur economic development and benefit society.

- **Robert "Bob" Wilhelm,** vice chancellor for research and economic development and the Kate Foster Professor of Mechanical and Materials Engineering, was selected for his expertise as an engineer, inventor and administrator.
- **Lyle Middendorf,** senior vice president of advanced research and development, and chief technology officer at LI-COR Biosciences, was honored for his collaborations with Nebraska faculty on innovations in DNA sequencing and fluorescent-labeled DNA, resulting in eight university patents. Middendorf, a 1973 Nebraska alumnus, has strengthened ties between the university and LI-COR, a global manufacturer of scientific instrumentation.

Margaret Jacobs, Chancellor's Professor of History, became Nebraska's first female faculty member to earn membership in the American Academy of Arts and Sciences. One of the country's oldest learned societies and independent policy research centers, the academy's more than 5,000 elected members are global leaders in academia, business and government. Members respond to national and global challenges through nonpartisan recommendations. Jacobs, the author of 35 articles and three books, focuses her research on the history of the American West, emphasizing women, gender, children and families. She is the second Husker professor to earn this honor.

Two Nebraska researchers received Fulbright U.S. Scholar Awards. **Tracy Frank,** professor of earth and atmospheric sciences, is in Ireland delivering guest lectures on conditions surrounding mass extinctions in Earth's past, serving as a guest instructor on a geology field trip and collaborating on sedimentology and geochemistry research. **Edmund "Ted" Hamann,** professor of teaching, learning and teacher education, is studying and teaching at the Tijuana campus of Mexico's Universidad Pedagógica Nacional as part of a project aimed at meeting the needs of transnationally mobile children who circulate between the U.S. and Mexico.

Jeannette Eileen Jones, associate professor of history and ethnic studies, earned a fellowship from the American Council of Learned Societies. ACLS, the preeminent representative organization in the U.S. for scholarship in the humanities and social sciences, selects fellows based on potential to make original and significant contributions to knowledge. Jones was one of 81 fellows selected from more than 1,100 applicants. She will spend a year working on her next book, "America in Africa: U.S. Empire, Race and the African Question, 1821-1919," set to be published in 2021.

Susan Hermiller, Willa Cather Professor of Mathematics, was named a fellow of the American Mathematical Society. Fellowships recognize members who have made outstanding contributions to the creation, exposition, advancement, communication and utilization of mathematics. Hermiller was selected for contributions to combinatorial and geometric group theory and for her service to the profession, particularly in support of underrepresented groups. She was one of 65 mathematical scientists named an AMS fellow this year.

In addition to a record number of awards from the National Science Foundation's Faculty Early Career Development Program, featured on Page 26, Husker researchers earned other prestigious awards aimed at early career scientists. Here are the highlights:

- **Angela Pannier** and **Marilyne Stains** received Presidential Early Career Awards for Scientists and Engineers. The award is the U.S. government's highest honor presented to scientists and engineers in the beginning stages of their research careers. It recognizes individuals who demonstrate exceptional promise for leadership in science and technology fields. Pannier, professor of biological systems engineering, was nominated by the U.S. Department of Health and Human Services for her research on DNA vaccines, tissue engineering of developmental biology, and non-viral gene delivery systems for stem cell and medical device applications. Stains, who received the award while an associate professor of chemistry at Nebraska, was nominated by the National Science Foundation for her work to close the gap between research and practice in chemical and science education at the postsecondary level.

- **Christos Argyropoulos,** assistant professor of electrical and computer engineering, earned an award from the Office of Naval Research's Young Investigator Program. The awards support naval-relevant research that directly benefits sailors and Marines. With the grant, Argyropoulos will advance his research into using ultrafast short-pulse lasers to create metal surfaces with properties that open the door to an array of national defense applications. He is the first known Husker researcher to receive this award since the program's founding in 1985.

- **James Schnable,** associate professor of agronomy and horticulture, received the Early Career Award from the American Society of Plant Biologists. The honor acknowledges exceptionally creative and independent research by scientists at the beginning of their careers. Schnable was honored for his successful track record of collaborations, publications, funded research, editorial positions, work in the private sector and development of community resources. His research focuses on automated plant phenotyping and quantitative and functional genomics across grass species.

- **Casey Kelly,** associate professor of communication studies, received the Karl R. Wallace Memorial Award from the National Communication Association. The award, given to scholars in the first 10 years of their career, aims to foster and promote philosophical, historical or critical scholarship in rhetoric and public discourse. With the award, Kelly is completing his book, "Apocalypse Man: White Masculinity at the End of the World."

Nebraska Economic Development at a Glance

$20.4M
EXPENDITURES SUPPORTED BY INDUSTRY SPONSORSHIP

$5.1M
LICENSING INCOME

1,430
JOBS CREATED STATEWIDE BY NEBRASKA INNOVATION CAMPUS

$238M
ECONOMIC IMPACT OF NEBRASKA INNOVATION CAMPUS

79
UNIVERSITY OF NEBRASKA RANKING AMONG THE TOP 100 ACADEMIC INSTITUTIONS RECEIVING U.S. PATENTS

Source: Bureau of Business Research. Figures represent fiscal year 2018, the most recent year for which information is available.

FY 2018 FEDERAL EXPENDITURES BY AGENCY

Nebraska Research at a Glance

$308M
TOTAL RESEARCH EXPENDITURES
FY 2018

26%
INCREASE IN RESEARCH EXPENDITURES
OVER THE PAST 10 YEARS

1,556
SPONSORED RESEARCH AWARDS

25,820
TOTAL ENROLLMENT, FALL 2018

1M
SQUARE FEET OF SPACE
FOR RESEARCH

2018-2019 NEBRASKA RESEARCH REPORT

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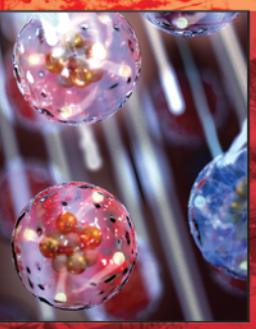

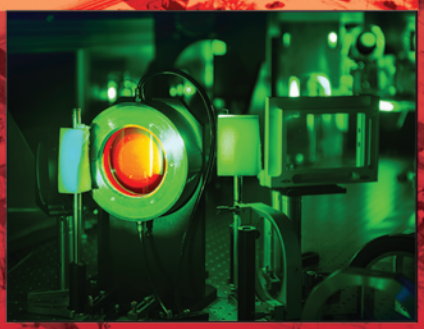

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UNIVERSITY of NEBRASKA–LINCOLN