



RESEARCH AT
NEBRASKA

2022-2023 REPORT

EXPLORE NEBRASKA RESEARCH

This publication is a snapshot of the fiscal year's activities. To read more stories about research and creativity at Nebraska, visit the online edition at research.unl.edu/annualreport/2023. Additional multimedia is available for many stories.

ONLINE EXCLUSIVES

TRANSPORTATION: Protecting military bases from EV threats

PSYCHOLOGY: Integrating mental health care

MARKETING: Fighting obesity can benefit both consumers, companies

ECOLOGY: Discovering virus's impact on food webs

FILM: Nebraska roots inspire award-winning screenplay

PARASITOLOGY: Parasite database provides global access

UNDERGRADUATE EDUCATION: Creating a culture where 'at-promise' students thrive

COMMUNITY, REGIONAL PLANNING: Countering killer heat in cities

EDUCATION: Improving elementary teachers' STEM skills

LAW: Expanding rural access to juvenile justice attorneys

BUSINESS: Understanding how employee turnover unfolds

JOURNALISM: Studying impacts of true crime media

NUTRITION: Breast milk research aims to improve infant nutrition

AWARDS: Early career awards fuel solution-seeking research

ABOUT THE COVER

The cover image of the Nebraska Sandhills was photographed by Dana Fritz, Hixson-Lied Professor of Art. This photograph, and many others, are compiled in Fritz's book, "**Field Guide to a Hybrid Landscape**," published in 2023 by the University of Nebraska Press.



Interim Vice Chancellor Sherri Jones



This report is available online:
research.unl.edu/annualreport/2023

FROM THE VICE CHANCELLOR

Outstanding faculty key to university's impact

When I'm asked about the University of Nebraska-Lincoln's research culture, I return to this theme: impact. Nebraska is a community of scholars who are changing the world through their research, scholarship and creative endeavors.

As the state's flagship, land-grant university and the only Carnegie R1 institution, our research significantly impacts economic growth and innovation – growing a talented workforce, stimulating new products and startups, and helping companies grow. Our faculty are exploring areas that directly benefit Nebraskans, including health disparities, early childhood education, climate resilience and much more. Faculty contributions in the fine and performing arts, and through the humanities disciplines, shape the broader culture and our understanding of the world.

A great example is illustrated on the cover image, photographed by Dana Fritz, Hixson-Lied Professor of Art, which visually represents the Great Plains' unique ecosystem (page 4). Her new book, "Field Guide to a Hybrid Landscape," became a vital historical document after fires devastated the Nebraska National Forest, the largest hand-planted

forest in the U.S. Fritz partnered with the University of Nebraska Press to publish her work.

Many other examples are presented throughout our report. I encourage you to learn more about the Grand Challenges initiative (page 11), a major investment to advance interdisciplinary research.

Nebraska's reputation and networks are growing because of our scholarly leadership and expertise, leading to even more opportunities to meaningfully address social, economic and cultural issues. That is where Nebraska research makes the biggest impact. We are committed to offering opportunities for students to learn alongside faculty mentors, contributing to research through organized programs and informal experiences.

None of these accomplishments would be possible without a world-class faculty. The Office of Research and Economic Development offers programs aimed at helping early and mid-career faculty members develop as researchers and leaders. These faculty members will play a key role in the future of our university.

Innovation by faculty, staff, students and partners is key to our impact. ORED is one piece of a strong regional network that drives innovation and encourages development of new intellectual property (page 11). Opportunities abound for researchers and private industry to connect, creating a pipeline from the laboratory to the marketplace.

We are Nebraska Research, and I am proud to share our 2023 accomplishments.

Sherri M. Jones
Interim Vice Chancellor for Research
and Economic Development



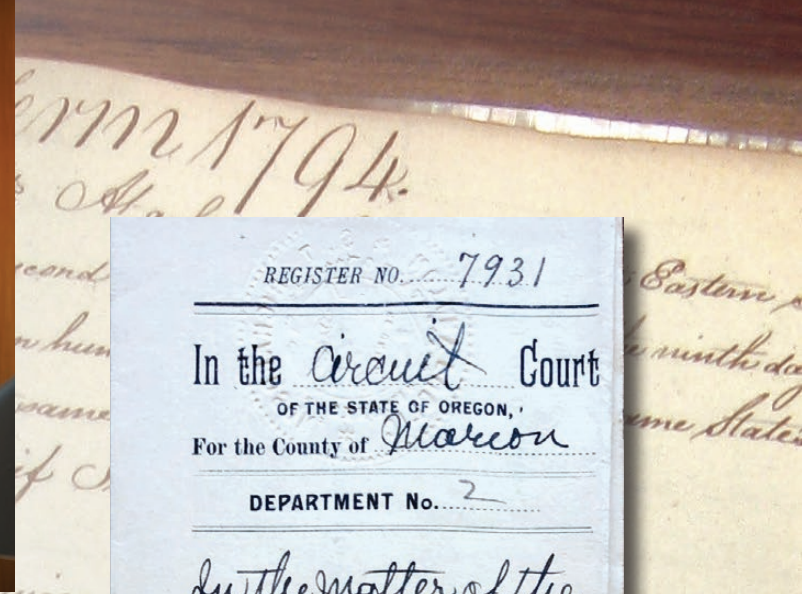
WE DO BIG THINGS



We are transforming society.

Highlights in fiscal year 2023 included advancing biofuels production; expanding opportunities for students to explore the ties between race, law and U.S. history; improving equity in transportation research; making healthy foods more accessible to urban and rural communities; and visualizing how human activity has changed the Great Plains' unique ecosystem.

More stories are available at research.unl.edu/annualreport/2023/#features.



Unlocking oilseeds' biofuel potential

Husker biochemist Edgar Cahoon is leading an interdisciplinary team representing eight institutions to explore an environmentally friendly, sustainable liquid fuel source. With a five-year, \$12.8 million grant from the U.S. Department of Energy, the team aims to unlock the potential for pennycress and camelina, both oilseeds, to produce renewable fuels, industrial chemicals and other bioproducts.

These oilseeds are resilient and capable of growing on marginal land that can't support food crops. Though they contain the right types of fatty acids, the seeds' current makeup isn't ideal. In addition to boosting the amount of oil per seed, Cahoon's team is working to make oil with a more defined chemical structure, which leads to biomaterials with uniform and consistent properties.

To accomplish this, the team is fusing fundamental and applied research. For the former, they're studying a cell part called the plastid, a fatty acid "biofactory" in oilseeds. For the latter, they're tapping CRISPR gene editing technology to design synthetic biology tools capable of genetically modifying plants rapidly and predictably.

Cahoon's team will use these tools to produce genetically enhanced camelina and pennycress. They expect their research findings and tools to fuel work by other scientists engineering next-generation plant oil feedstocks.

Full story: research.unl.edu/annualreport/2023/biofuels



Edgar Cahoon

Connecting civil rights, law and history

With a four-year, \$1 million grant from the Andrew W. Mellon Foundation, Husker researchers from the Department of History and the College of Law are launching a teaching, research and collaboration hub that will position Nebraska as a national leader in education and scholarship focused on the relationship between U.S. law and race in American history.

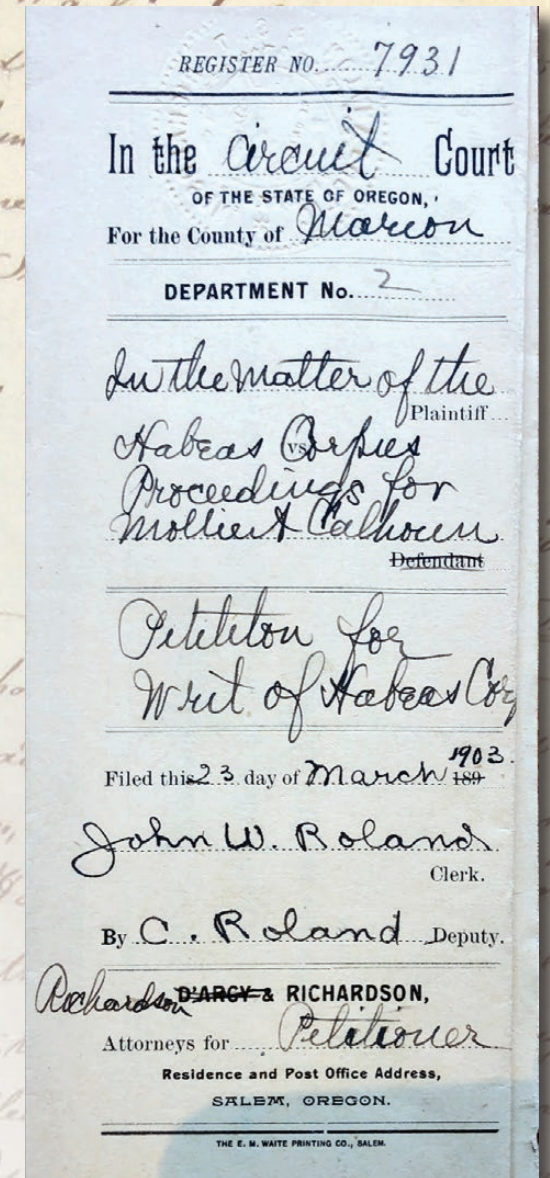
Historians William Thomas, Katrina Jagodinsky and Jeannette Eileen Jones lead the project, which aims to help students and the public understand how marginalized groups in American history used the law to contest and advance their rights. Currently, students encounter a small number of landmark cases during their education – but there are thousands of lesser-known cases from courthouses around the U.S. The project will shine a light on this large body of untapped historical evidence.

Above: William Thomas, Jeannette Eileen Jones and Katrina Jagodinsky

The new curriculum features an entry-level, team-taught course – the first of its kind at the university. For graduate students, there is a non-degree certificate program and a summer fellowship.

Collaborating with the Center for Digital Research in the Humanities, the team is building a first-of-its-kind open educational repository of digital and legal research tools. It will include the voices of people directly affected by this history through multimedia content and documentaries.

Full story: research.unl.edu/annualreport/2023/history



Example of a court filing that would be included in the digital repository

Improving transportation equity

Until recently, crash test dummies were modeled on the average 1970s man, leaving women more likely to be severely injured in a car accident.

To improve road safety and address other transportation inequities, Nebraska's Mid-America Transportation Center received \$15 million from the U.S. Department of Transportation. The award stems from MATC's nearly 30-year history of delivering road and railroad safety research for the real world.



Aemal Khattak

Using computer simulations and crash tests with newly available dummies, Husker researchers will develop road barrier guidelines and other safety systems that reflect different body types. Other equity projects include assessing medical care access for disadvantaged populations and improving education and workforce development.

In collaboration with the Nebraska Indian Community College, MATC is establishing free commercial and noncommercial vehicle driver training. The program aims to improve road safety, provide job training and address a commercial driver shortage. The award also funds existing MATC educational programs designed to encourage broader participation in higher education.

Nebraska partners with the University of Iowa, University of Kansas, Missouri University of Science and Technology, Nebraska Indian Community College and the University of Missouri-St. Louis.

Full story: research.unl.edu/annualreport/2023/transportation



Exploring how humans shape the ecosystem

Dana Fritz

Nebraska photographer Dana Fritz is intrigued by grand gestures. Few gestures are as grand as creating what was once the world's largest hand-planted forest.

Fritz spent years exploring Bessey Ranger District and Nursery of the Nebraska National Forest and Grasslands in north-central Nebraska near Halsey. The result is "Field Guide to a Hybrid Landscape," published in 2023 by the University of Nebraska Press.

Fritz uses her camera to document how humans shape the land. Her new book visually captures the forces – human and non-human – that formed today's forest. It includes historical photos, maps and essays by an ecologist, art historian, geographer and others to incorporate multiple perspectives.

The federal government established the tree nursery and forest in 1902 in the Nebraska Sandhills to create a national timber reserve. Since her book went to press, three forest fires have wiped out nearly half of the forest's trees. Scenes she captured no longer exist.

Her book is believed to be the most complete visual examination of the forest before the fires. It is also unique for its multifaceted viewpoints – artistic, scientific and philosophical, imparting lessons that transcend the book's locality.

Full story: research.unl.edu/annualreport/2023/ecosystem



Strengthening local food systems

Underserved rural and urban communities often lack access to affordable, healthy foods, a problem exacerbated by supply chain issues during the pandemic.

A regional initiative aims to connect and strengthen locally grown food systems to enhance healthy food options, nutrition and local economies. Nebraska is establishing the Heartland Regional Food Business Center with \$25 million from the U.S. Department of Agriculture. It's among the university's largest-ever awards.

The center will serve Nebraska, Missouri, Kansas, Oklahoma and Iowa. It's one of 12 food business centers USDA established nationwide with funds from the American Rescue Plan Act.

Online portals providing information, resources and connections will be available to those involved in regional food production and distribution. Farmers will be able to connect with local schools about meal programs, distributors with community leaders, and residents with local grocers. Planning and financial assistance will be available to people expanding their operations to meet regional food and nutritional needs.

Efforts also aim to boost local economies and create more vibrant rural communities.

Rural Prosperity Nebraska, a hub connecting communities with university resources, leads the project in cooperation with 33 partners, which include universities, extension programs and regional nonprofits. It is based in the Institute of Agriculture and Natural Resources.

Full story: research.unl.edu/annualreport/2023/food



Vendor at a local farmers market

RESEARCH AT A GLANCE

 **\$340M**

Total research expenditures,
FY 2022

 **34%**

Increase in research expenditures
over the past 10 years

 **1,668**

Sponsored research awards,
FY 2022

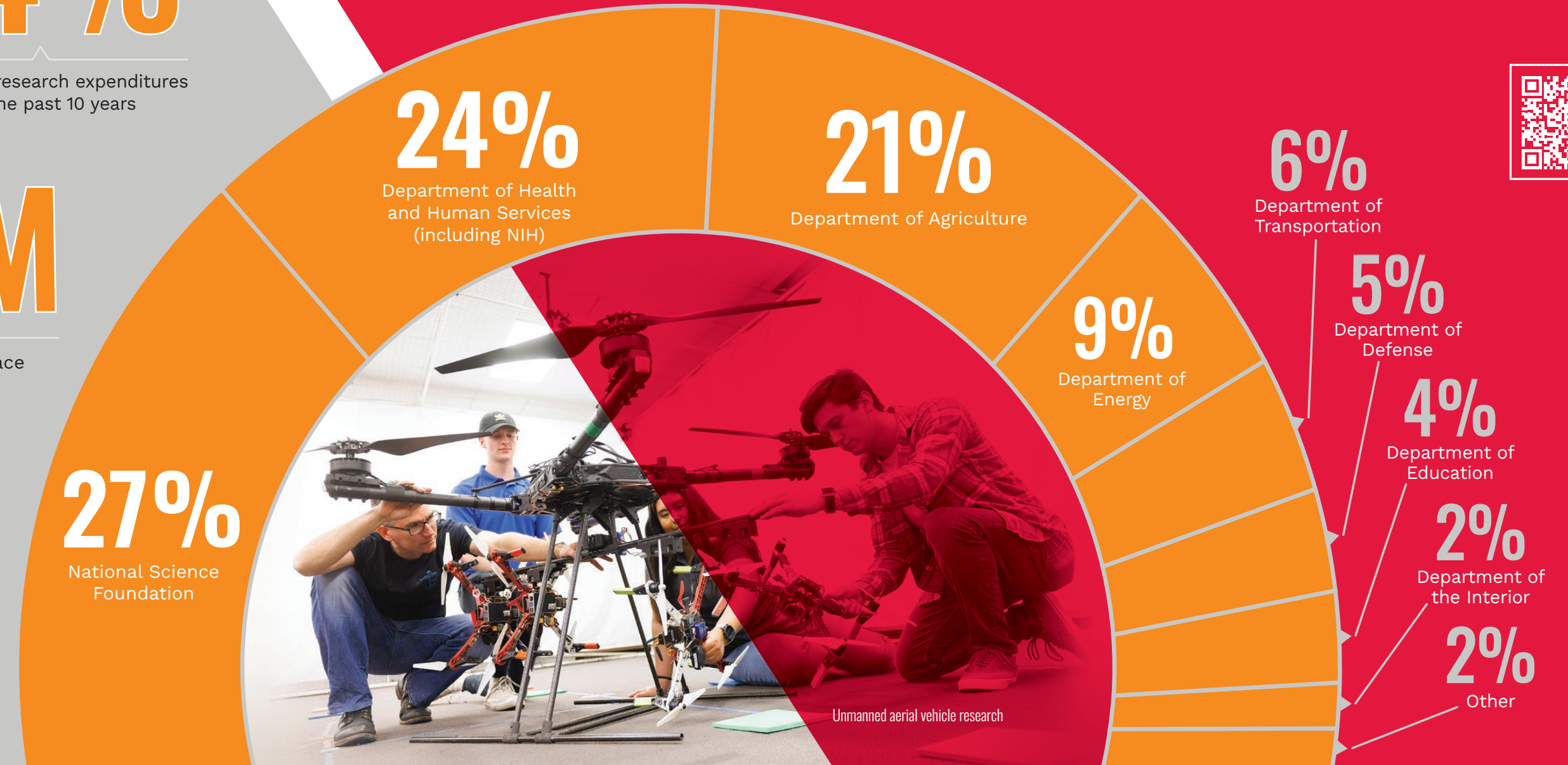
 **1.5M**

Square feet of space
for research

 **\$19.8M**

Industry-sponsored research expenditures,
FY 2022

FY 2022 Federal research expenditures by agency



ECONOMIC IMPACT

We are driving economic growth.

In fiscal year 2023, Nebraska made strides in supporting faculty innovators, and creating new opportunities for students to gain real-world industry experience and work with emerging technologies. Strong university-industry partnerships foster an environment in which faculty members are encouraged to innovate and companies can leverage their research expertise.



Full stories are available at research.unl.edu/annualreport/2023/#economicdevelopment.

Leading robotics innovation

The Heartland Robotics Cluster positions the state of Nebraska as a leading research and development spot for robotics and automation. The cluster is expected to be a critical resource for the state's robust, technology-driven agricultural and manufacturing sectors, and offer expanded opportunities for undergraduate engineering education at UNL and community colleges.

The \$25 million initiative was launched in September 2022. The state's proposal was one of 21 applications selected to receive funding through the U.S. Department of Commerce Economic Development Administration's Build Back Better Regional Challenge.

Invest Nebraska manages the cluster. Funding is being used to develop robotics R&D space in UNL's College of Engineering and to support new courses. At Nebraska Innovation Campus, the university is expanding the robotics makerspace at Nebraska Innovation Studio, and The Combine business incubator will increase technical assistance for ag-tech startups. Plans are underway for an automation demo space and programming for Nebraska manufacturers.

Other partners include the Nebraska Manufacturing Extension Partnership, Metropolitan Community College and Northeast Community College, with the goal of increasing capabilities and educational opportunities in rural and urban areas.



Full story: research.unl.edu/annualreport/2023/robotics

Right: Isaac Regier and William Johnston of Nebraska Innovation Studio peer through a thermoplastic piece created with a 3D printer suitable for prototyping and industrial purposes.

Driving entrepreneurship through collaboration

The University of Nebraska-Lincoln joined a National Science Foundation hub aimed at moving university research into the real world. The Great Lakes Innovation Corps Hub, formed in 2021, reimagines the lab-to-marketplace pipeline and equips technical leaders with skills, networking opportunities and an entrepreneurial mindset.

Including Nebraska, the collaboration has 16 universities in nine states and is one of 10 regional hubs across the country. Membership enables Husker entrepreneurs to access a range of training opportunities that build on the university's existing startup ecosystem, particularly the Nebraska Introduction to Customer Discovery program.

N-ICD is led by NUtech Ventures, the university's technology commercialization affiliate, and to date has drawn more than 180 participants and propelled three Husker teams to the National Science Foundation's I-Corps program.

Full story: research.unl.edu/annualreport/2023/hub



NSF I-CORPS HUB
GREAT LAKES REGION

ECONOMIC IMPACT

Expanding graduate education, job opportunities for students

Nebraska is part of the National GEM Consortium, a partnership between universities and industry that helps students who have been underrepresented in graduate education pursue advanced degrees and fill jobs in engineering and science.

The consortium is focused on covering tuition and expenses for students who might not otherwise be able to afford graduate education. Industry sponsors often provide funding for GEM fellows who, in many cases, go on to work for their sponsors after graduation.

For UNL, being a GEM member is another means of bolstering STEM education opportunities and preparing graduate students for their eventual careers. UNL Graduate Studies is also working to build a GEM alumni community for additional support.

UNL's first GEM Fellow is Vanessa Whitmore, a graduate student in food science and technology who is working at Cargill. Whitmore hopes to launch a career in legal or regulatory compliance in the food industry.

Graduate Studies and NUtech Ventures, the university's technology commercialization affiliate, are partners in the effort.

Full story: research.unl.edu/annualreport/2023/gem



Vanessa Whitmore

ECONOMIC DEVELOPMENT AT A GLANCE

\$5.7M

Licensing income in FY 2023

No. 78

University of Nebraska ranking among the top 100 academic institutions receiving U.S. patents; ranked for the sixth consecutive year

101

Student internships funded by NIC

58

Diverse public- and private-sector partners at Nebraska Innovation Campus

An Ecosystem of Innovation

- Nebraska Innovation Campus
- NUtech Ventures
- UNL Industry Relations
- Nebraska Center for Entrepreneurship
- Engler Agribusiness Entrepreneurship Program
- Invest Nebraska
- NMotion startup accelerator
- Nebraska Department of Economic Development
- Industry partners
- The Combine

GRAND CHALLENGES



Year Two Summary

The University of Nebraska–Lincoln has committed \$40 million over four years toward strategic, goal-based solutions in seven thematic areas. The aim is to leverage Nebraska’s expertise and strengths to solve some of society’s greatest challenges. \$20 million has been invested so far using funds specifically earmarked for research.



CATALYST AWARDS

Bold and catalytic, representing significant new research, scholarly and creative activity.

\$2,992,096

 AVERAGE AMOUNT OF CATALYST AWARDS

PLANNING GRANTS

Ideation and team building, used for developing project ideas around one or more themes.

\$128,112

 AVERAGE AMOUNT OF A PLANNING GRANT

\$10M

INVESTMENTS MADE IN SECOND YEAR

11

FUNDED PROJECTS IN 2023:
3 CATALYST AWARDS
8 PLANNING GRANTS

≈ 130

FACULTY AND STAFF INVOLVED IN PROJECTS FUNDED DURING YEAR TWO

9

ALL UNL COLLEGES ARE PARTICIPATING IN AT LEAST ONE FUNDED PROJECT

HIGHLIGHTS

Accolades

As part of its strategic plan, the University of Nebraska-Lincoln set a goal to increase the number of faculty receiving external honors and awards by 10% annually on a three-year rolling average.

The following list includes selected major awards and accomplishments from fiscal year 2023. More about these accomplishments is available at research.unl.edu/annualreport/2023.

Oleh Khalimonchuk, Susan J. Rosowski Professor of Biochemistry
Fellow, American Association for the Advancement of Science

Richard Wilson, professor of plant pathology
Fellow, American Association for the Advancement of Science

Ronald Faller, Willa Cather Research Professor of Civil and Environmental Engineering
Fellow, National Academy of Inventors

Martha Mamo, John E. Weaver Professor of Agronomy and Horticulture
Fellow, American Society of Agronomy

Nathan Conner, professor of agricultural leadership, education and communication
Fulbright U.S. Scholar Award

Jody Koenig Kellas, Willa Cather Professor of Communication Studies
Bernard J. Brommel Award for Outstanding Scholarship or Distinguished Service in Family Communication, National Communication Association

Casey Kelly, professor of communication studies
Franklyn S. Haiman Award for Distinguished Scholarship in Freedom of Expression, National Communication Association

Yiqi Yang, Charles Bessey Professor of Textiles, Merchandising and Fashion Design
Olney Medal for Outstanding Achievement in Textile Science, American Association of Textile Chemists and Colorists

Wei Qiao, Clyde Hyde Professor of Electrical and Computer Engineering
Senior Member, National Academy of Inventors

Andrea Basche, associate professor of agronomy and horticulture
Early Career Award, American Society of Agronomy

Aziza Cyamani, assistant professor of architecture
Young Educator Award, Industrial Designers Society of America

Full story: research.unl.edu/annualreport/2023/accolades



HIGHLIGHTS

Investing in Nebraska's future

Positioning Nebraska for the future – in research, student learning and outreach – is at the heart of several current and recently completed capital improvements. These major projects expand the university's capabilities in engineering, animal agriculture and journalism and mass communications.



Kiewit Hall

Kiewit Hall, the new center for undergraduate engineering education, is scheduled to open in January 2024, part of a transformation of College of Engineering facilities to expand the college's educational and research capabilities. It's the largest facilities project in university history.



Full story: research.unl.edu/annualreport/2023/infrastructure



Feedlot Innovation Center

Near Mead, Nebraska, the Klosterman Feedlot Innovation Center, expected to be complete in late 2023, will expand research, teaching and extension offerings in a commercial-scale feedlot. The complex will include cattle comfort and research buildings, open lots and an animal handling facility.



Meier Television Studio

At Andersen Hall, the new Don and Lorena Meier Studio gives College of Journalism and Mass Communications students access to professional-level television and video production resources, including three sets and a production studio.

More about these infrastructure projects and Nebraska's expanded capabilities is available in the online edition.



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ECONOMIC DEVELOPMENT**

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