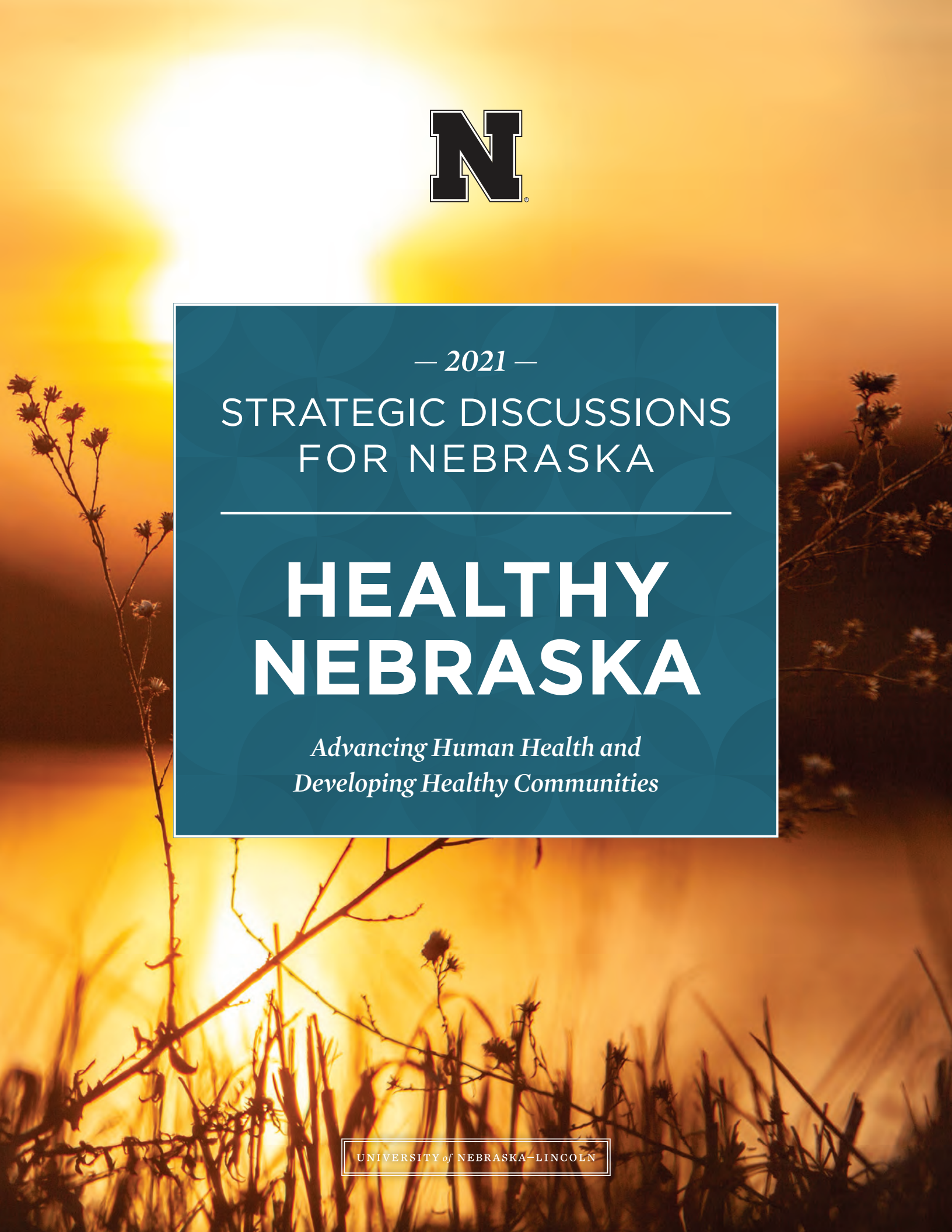


— 2021 —

STRATEGIC DISCUSSIONS FOR NEBRASKA

HEALTHY NEBRASKA

Advancing Human Health and Developing Healthy Communities

UNIVERSITY of NEBRASKA–LINCOLN

> “Every day, IANR is putting together a wickedly complex puzzle, in which each faculty member, researcher, Extension educator, student, staff member, partner and stakeholder is a vitally important piece. As the pieces come together, we see a picture of the world in which IANR is making a meaningful difference in sustainable food, fuel, feed, and fiber production.”

— Michael J. Boehm —

University of Nebraska Vice President for Agriculture and Natural Resources
University of Nebraska–Lincoln Harlan Vice Chancellor,
Institute of Agriculture and Natural Resources

IANR COMMUNITIES OF PRACTICE AND DISCOVERY

In 2011, six IANR communities of practice and discovery were formed as intentional focus areas of strength within IANR, in an effort to propel Nebraska forward. The six communities include:

Computational Sciences – striving to efficiently and effectively analyze and report large sets of high-quality data in ways to be shared with the public.

Science Literacy – encouraging members of society to analyze complex challenges and make science-informed decisions in real-world situations.

Healthy Systems for Agricultural Production and Natural Resources – building on expertise in soil health, water resources, ecology, risk analysis, and plant and animal systems to help Nebraskans develop resilient agricultural production and natural resources systems.

Drivers of Economic Vitality for Nebraska – strengthening Nebraska's entrepreneurial approaches to stimulate economic development and increase the vitality of Nebraska's communities and the quality of life of its people.

Healthy Humans – establishing a research-based understanding to advance human health in relationships to healthy communities by conducting studies from basic biomedical research directed to understand disease, to nutritional foods and strategies that promote physical and mental well-being.

Stress Biology – improving production, health, and well-being for animal, plant, and human systems to better understand how organisms and systems adapt to stressors such as drought, insects, heat, and cold.

In recent years, Strategic Discussions for Nebraska (SDN) has rotated through the IANR communities as a publication theme for highlighting these intentional IANR focus areas.

The goal of SDN is to provide a snapshot of IANR research, teaching, and Extension efforts. In 2021, that snapshot covers research and projects on *Healthy Humans*.

IANR projects on topics related to Healthy Humans might include studying the food we eat and the impact it has on overall health, but these projects also explore the sustainable approaches producers use when growing the food, ideally keeping harmony among animals, crops, water, and climate.

ABOUT STRATEGIC DISCUSSIONS FOR NEBRASKA

Strategic Discussions for Nebraska (SDN) is an annual publication covering research conducted at the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR). The Nebraska Legislature created IANR in 1973 through the enactment of LB149.

SDN shares the IANR story by translating research-based science to be understood by the general audience. SDN has been produced annually since 2008, with each edition focusing on a different overall topic.

This 2021 edition of SDN focuses on the overarching topic of *Healthy Humans*. Specifically, stories highlight current work in the Nebraska Food for Health Center, a multidisciplinary group within the University of Nebraska system focusing to improve human health by linking agriculture and food production to wellness and disease prevention. Primarily, researchers involved with the Nebraska Food for Health Center study microbes living in the human gut.

Stories in SDN 2021 also highlight projects on water quality and health in babies, establishing healthy eating habits for children, research to improve rice, corn, and sorghum crops in an effort to keep the world healthy, and initiatives in research and Nebraska Extension to increase healthcare access within Nebraska communities as well as create more inclusive community environments.

As their senior capstone experience, students in Agricultural and Environmental Sciences Communication (AESC) in the Department of Agricultural Leadership, Education and Communication (ALEC) create content for SDN.

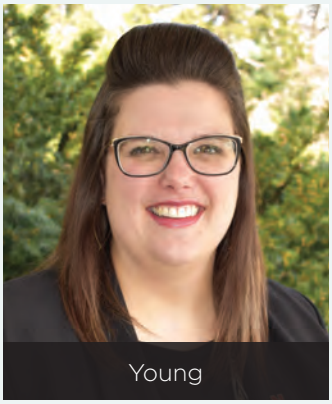
Dr. Taylor Ruth, faculty member in AESC, taught the senior capstone course in Spring 2021. A sincere, special thanks is expressed to Dr. Ruth for taking on this project!

Each year, University Communication provides graphic design and IANR Media offers website design expertise. IANR provides funding, business and liaison services for the production of this publication.

A sincere appreciation is expressed for the original vision and financial support of the Robert and Ardis James Family Foundation, which founded SDN in 2007.

Please visit our website, sdn.unl.edu, to find the complete publication and photo and video promotion.

Thank you for your interest in Strategic Discussions for Nebraska!



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INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR) focuses on people and the food, energy, water, natural resources and communities that sustain them.

IANR scientific innovation in the land-grant mission areas of teaching, research and Extension places Nebraska on the leading edge of food production, environmental stewardship, human nutrition, business development and youth engagement.

IANR comprises the College of Agricultural Sciences and Natural Resources (CASNR), the Agricultural Research Division (ARD), Nebraska Extension, and the ARD and Extension components of three departments in the College of Education and Human Services.

IANR is committed to growing the future of Nebraska's people, businesses and communities.

Strategic Discussions for Nebraska highlights teaching, research, and Extension projects occurring within IANR with the goal of communicating the work to a general audience.

SPECIAL APPRECIATION

Strategic Discussions for Nebraska extends special appreciation for the vision, guidance, support and assistance of the following individuals and organizations:

Ronnie Green,
Chancellor, University of Nebraska–Lincoln [unl.edu/chancellor]

Michael Boehm,
University of Nebraska Vice President for Agriculture and Natural Resources and Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources, University of Nebraska–Lincoln [ianr.unl.edu]

Ron Yoder,
Associate Vice Chancellor, Institute of Agriculture and Natural Resources, University of Nebraska–Lincoln [ianr.unl.edu]

Tiffany Heng-Moss, Dean,
College of Agricultural Sciences and Natural Resources, University of Nebraska–Lincoln [casnr.unl.edu]

University of Nebraska–Lincoln administrators, faculty and staff.
We are fortunate to work with these innovative, forward-looking individuals who are making the world a better place.

Nebraska Extension, led by Dave Varner, Interim Dean and Director.
Nebraska Extension administrators, specialists, educators and faculty members with partial Extension appointments take objective university research to the people of Nebraska and beyond. [extension.unl.edu]

Agricultural Research Division (ARD), led by Archie Clutter, Dean.
The ARD is the major research unit of the Institute of Agriculture and Natural Resources and is the Agricultural Experiment Station. [ard.unl.edu]

Taylor Ruth, Agricultural and Environmental Sciences Communication faculty member,
for teaching the Spring 2021 AESC Senior Capstone course that produces the SDN publication.

Department of Agricultural Leadership, Education and Communication, led by Mark Balschweid, including Christina Franklin and Jennifer Greenlee,
for financial support, organization of technology equipment, supporting student needs, and for championing Strategic Discussions for Nebraska. [alec.unl.edu]

Agricultural and Environmental Sciences Communication academic program, including Taylor Ruth and Heather Akin,
for their outstanding service to students and for valuing Strategic Discussions for Nebraska for its academic importance. [aesc.unl.edu]

IANR Communication, led by Cara Pesek, communications director, and including Natalie Jones, Diane Lewis, and Chandra Spangler,
for continuous support of the publication, editing of final versions, and providing social media coverage of stories. [ianr.unl.edu]

University Communication,
for graphic design, project management, and photography. [ucomm.unl.edu]

Stephanie Severin, University Communication senior design specialist,
for the creative and graphic design of this publication. [sdn.unl.edu]

Craig Chandler, University Communication photographer,
for providing supplemental images in this publication.

Lauren Becwar, University Communication project manager,
for keeping this project moving through to publication.

UNL Print, Copy, Mail and Distribution Services, led by John Yerger, for project management, printing, mailing, distribution and transportation of these publications. [printing.unl.edu]

University of Nebraska–Lincoln IANR Media: [ianrmedia.unl.edu]

Jason Cooper, Coordinator

Mike Kamm, Videography

Tim Svoboda, Web design

Anne Holz, Web strategy

STRATEGIC DISCUSSIONS FOR NEBRASKA
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2021

STRATEGIC DISCUSSIONS FOR NEBRASKA STUDENT WRITERS

Students in the Agricultural and Environmental Sciences Communication program in the Department of Agricultural Leadership, Education and Communication write the stories for the Strategic Discussions for Nebraska publication.

The senior capstone course provides a learning experience similar to those students may encounter in the workplace, emphasizing accurate, clear and objective communication of science-based information.

During the course, students learn about scientific research being conducted at the university and the diverse funding sources required to support that research.

Throughout one semester, the students interview scientists from many disciplines and write stories, take photos, create videos, and design social media content based on those interviews. The stories in this publication were reviewed by the sources and approved for publication.

Mya Donelson

Mya is from Newman Grove, Nebraska, and graduated from UNL in May 2021 with an agricultural and environmental sciences communication major with an emphasis in strategic communication.

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Bailee is from Pleasant Dale, Nebraska, and graduated from UNL in May 2021 with an agricultural and environmental sciences communication major and animal science minor.

BRIEF HISTORY OF THE LAND-GRANT MODEL OF PUBLIC EDUCATION

By Mary Garbacz

The University of Nebraska is one of more than 100 land-grant institutions in the United States and its territories. Although the University of Nebraska–Lincoln was the original campus of the University of Nebraska, the land-grant mission extends to all four campuses of the University of Nebraska system. The land-grant college system was established by the passage of the Morrill Act in 1862.

The Morrill Act of 1862

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

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

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

The University of Nebraska was founded on February 15, 1869, and designated a land-grant institution under the 1862 Morrill Act. The land-grant system formed the framework for the land-grant institutions' missions of teaching, research and Extension.

Hatch Act of 1887

Twenty-five years after the Morrill Act was passed, the Hatch Act of 1887 provided funding for agricultural research programs at state land-grant agricultural experiment stations in the 50 states of the United States, the District of Columbia and the U.S. territories. The Hatch Act established agricultural experiment stations in connection with the land-grant colleges so research could be conducted and applied in practice.

Named for Congressman William Henry Hatch, the Hatch Act established not only experiment stations, but also distribution of information to the people of the United States on subjects connected with agriculture. The Hatch Act also provided an annual payment to each state and territory for the expenses of research, as well as for printing and distributing the results.

Hatch research activities involve a range of options related to agriculture, land use, natural resources, family, human nutrition, community development, forestry and more and can be local, state, regional or national in scope. A further requirement of the Hatch Act of 1887 is that new information is to be extended to the public.

The Morrill Act of 1890

The Morrill Act of 1890 also established funding for land-grant institutions specifically for African-Americans. These institutions are sometimes called "1890 schools." These 16 public institutions, plus one private institution, are among the more than 100 historically black colleges and universities in the United States. The Morrill Act of 1890 also forbade racial discrimination in admissions policies for institutions receiving these federal funds.

Smith-Lever Act of 1914

The Smith-Lever Act of 1914 created a Cooperative Extension Service within each land-grant institution. Cooperative Extension, a partnership between the U.S. Department of Agriculture and agricultural colleges, helps to extend information produced by the research of scientists within each college's experiment station.

Equity in Educational Land-Grant Status Act of 1994

The Equity in Educational Land-Grant Status Act of 1994 provided land-grant status for certain American Indian colleges and institutions, bringing higher education to reservation communities. The act directed the U.S. Secretary of the Treasury to establish a 1994 Institutions Endowment Fund and the U.S. Secretary of Agriculture to make capacity-building grants to these institutions.

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— Michael J. Boehm —

Michael J. Boehm

FIGHTING FOR HEALTHY HUMANS IN A GROWING WORLD:
IANR Intentionally Focuses on a Healthier Tomorrow

Interview with Michael J. Boehm
by Kelli Mashino

The Institute of Agriculture and Natural Resources (IANR) has a mission to sustainably produce food, fuel, feed, and fiber for the growing world in a way that provides a high quality-of-life for those engaged in agriculture. This mission rattles with deeper importance as world population numbers are expected to jump from 7.5 billion to approximately 9 billion by the year 2050.

"Every day, IANR is putting together a wickedly complex puzzle, in which each faculty member, researcher, Extension educator, student, staff member, partner and stakeholder is a vitally important piece," said Michael J. Boehm, University of Nebraska Vice President for Agriculture and Natural Resources and Harlan Vice Chancellor of IANR at the University of Nebraska–Lincoln. "As the pieces come together, we see a picture of the world in which IANR is making a meaningful difference in sustainable food, fuel, feed, and fiber production."

Each year, Strategic Discussions for Nebraska (SDN) provides a snapshot of ways IANR makes a difference by focusing on one specific community area — and in 2021, the community focus is *Healthy Humans*.

"This edition of SDN paints the big picture of a collection of work being done in IANR connecting health to multiple areas," Boehm said.

This edition also serves as a connector to other areas within the University of Nebraska system, Boehm said. For example, researchers in the Food for Health Center are working to harness the gut microbiome and better understand how the food we eat influences the gut microbiome as well as how the gut microbiome breaks down food. This work is a natural bridge to the University of Nebraska Medical Center (UNMC), where researchers are working to understand diseases connected to similar issues.

HEALTHY HUMANS IMPACT

Innovative, world-class research is discussed and highlighted in SDN, Boehm said. Ranging from community health to individual nutrition, to food security, health disparities, and mental well-being, the work showcased in this SDN edition has a critical impact not only on Nebraskans and their overall health, but on the world.

"This chapter in SDN history, and in the story of healthy humans, will be boundary-expanding on many fronts," Boehm said.

The 2021 edition of SDN highlights these projects. For instance, Dipti Dev, associate professor in the Department of Child, Youth and Family Studies, offers a series of on-demand, online modules with short videos to demonstrate science-based strategies for establishing healthy eating patterns with children, in order to prevent health issues later in life.

Virginia Chaidez, associate professor in the Department of Nutrition and Health Sciences, works to achieve health equity and eliminate health disparities in Nebraska through community-based research.

Kaustav Majumder, assistant professor in the Department of Food Science and Technology and researcher in the Nebraska Food for Health Center, investigates how food proteins and peptides impact human health depending on how food is harvested from the field, processed in a food processing facility, and prepared in the kitchen.

Finally, Richard Wilson, professor in the Department of Plant Pathology, studies rice blast, a plant-pathogenetic fungal disease that significantly impacts rice production, with the goal of reducing rice blast developments on the rice plant ultimately ensuring global food security.

"These projects are the next generation of research that will propel Nebraska forward, and that we will continue to build on into the future," Boehm said. "IANR needs all perspectives and all approaches to drive real impacts."

Agriculture is more than cows and plows, as it really does touch and permeate lives in so many ways, Boehm said. The interconnected story of IANR showcased in SDN shows a glimpse of the diversity of research and projects currently underway at the university.

COMMUNITIES OF DISCOVERY AND PRACTICE

IANR is a complex system where focused communities contribute to different efforts, including human health, science literacy, economic vitality, etc., Boehm said.

These communities connect and work together, but also function independently. Having different perspectives to solve current global issues, such as food insecurity and poor water quality, is the essential piece that ensures IANR is doing its best to sustain efforts.

Faculty and staff of IANR conduct extensive research and projects under specific communities, known as the six IANR communities of discovery and practice:

- Computational Sciences
- Drivers of Economic Vitality for Nebraska
- Healthy Humans
- Healthy Systems for Agriculture Production and Natural Resources
- Science Literacy
- Stress Biology

The six communities were established in 2011 after considering faculty and staff engagements with Nebraska citizens and beyond.

"Through these six communities, IANR leaves a positive footprint on the state of Nebraska and, at times, even the world," Boehm said.

Annual performance evaluations and processes allow for faculty, staff and students to share what they have accomplished in the areas of the six communities. Many of those accomplishments unfold in the stories of this publication.

"SDN gives us a snapshot of a broader window about what IANR is doing to make a difference in the six IANR communities of discovery and practice," Boehm said.

For more information on IANR, visit ianr.unl.edu.

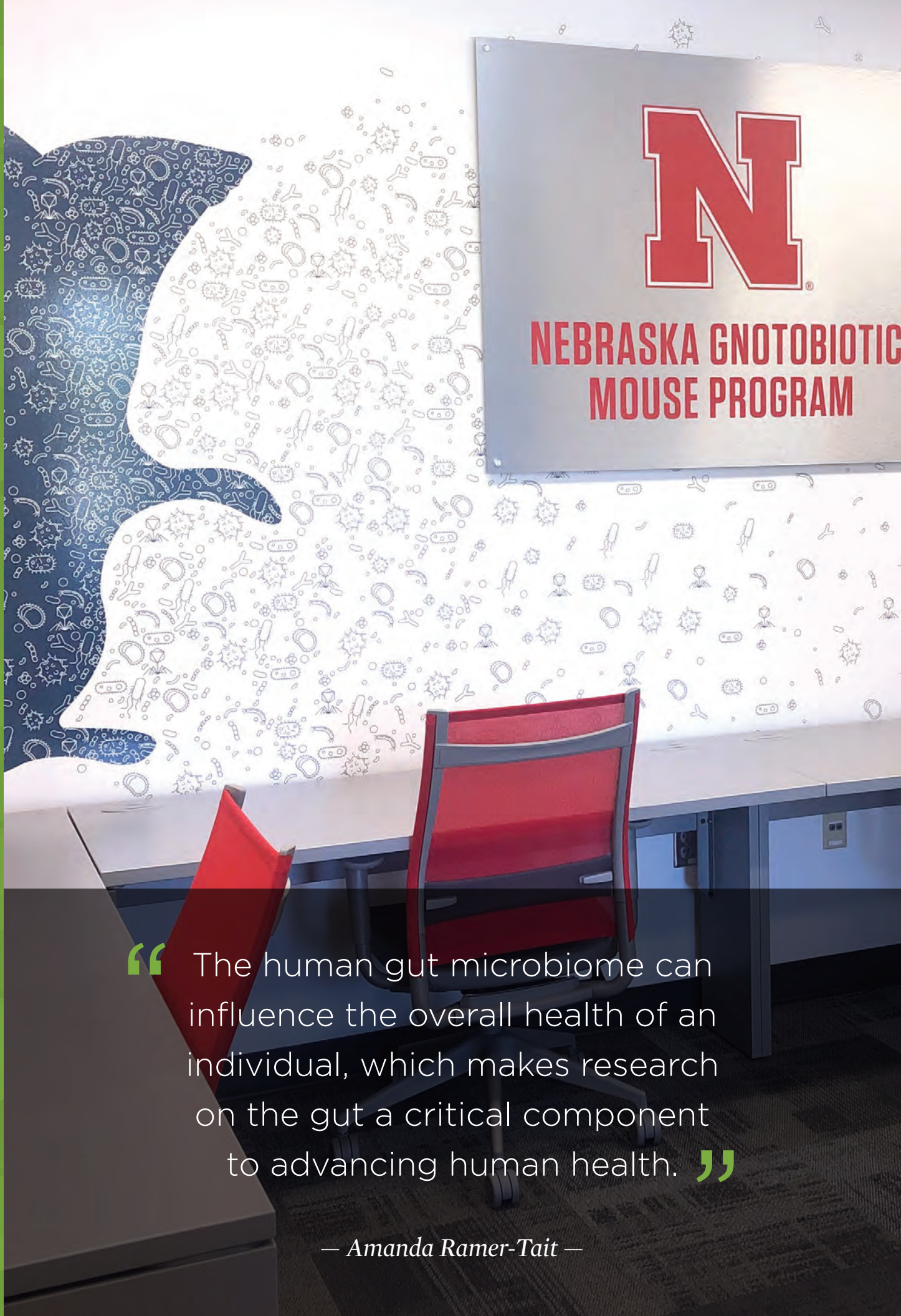
> “SDN gives us a snapshot of a broader window about what IANR is doing to make a difference in the six IANR communities of discovery and practice.”

— Michael J. Boehm —

KEY TAKEAWAYS

1. The Institute of Agriculture and Natural Resources (IANR) has a mission to produce feed, fuel, and fiber for the growing world through research, projects, and Nebraska Extension.
2. Strategic Discussions for Nebraska (SDN) provides a snapshot of ways IANR makes a difference by focusing on one specific community area — and in 2021, the community focus is *Healthy Humans*.
3. Ranging from community health to individual nutrition, to food security, health disparities, and mental well-being, the work showcased in this SDN edition has a critical impact not only on Nebraskans and their overall health, but on the world.
4. SDN gives us a snapshot of a broader window about what IANR is doing to make a difference in the six IANR communities of discovery and practice.

For more information on IANR, visit ianr.unl.edu.



"The human gut microbiome can influence the overall health of an individual, which makes research on the gut a critical component to advancing human health."

— Amanda Ramer-Tait —

Nebraska Food for Health Center

Amanda Ramer-Tait

MIGHTY MICE – THE NEBRASKA GNOTOBIOTIC MOUSE PROGRAM: Germ-Free Mice Help Us Understand the Human Gut

Interview with Amanda Ramer-Tait
by Jessica Rudolph

The human gut — including the microbes that live there — can influence the overall health of an individual. At birth, humans begin acquiring the trillions of bacteria, yeast, viruses, etc., that can ultimately have either a positive or negative effect on their health. Together, this ultra-dense ecosystem is referred to as the gut microbiome, and every person's microbiome is different.

Not only does the microbiome affect a person's gastrointestinal health, it can also influence our cardiovascular and neurological systems, making research on the gut a critical component to advancing human health.

Amanda Ramer-Tait, associate professor in the Department of Food Science and Technology at the University of Nebraska–Lincoln, studies how gut microbes impact human health in the Nebraska Gnotobiotic Mouse Program.

"The word 'gnotobiotic' comes from the Greek words 'gnoto' (known) and 'bios' (life). In a gnotobiotic mouse, we know exactly what microbial life is present in that animal," Ramer-Tait said. "We can control which microbes are living in the gut of a gnotobiotic mouse, making them an excellent model for understanding the complexities of the human microbiome."

THE HUMAN MICROBIOME: OUR PARTNER

Organisms that make up a human gut microbiome are actually there for the purpose of "good."

"These organisms are essential to human health — they help with digestion by breaking down complex carbohydrates as well as synthesize vitamins that humans cannot make," Ramer-Tait said.

The human gut microbiome also is important for training a person's immune system and providing protection against intestinal pathogens.

"Our gut microbes can also provide colonization resistance by crowding out potential pathogens, such as *Clostridioides difficile* — also known as *C. diff*," Ramer-Tait said. "Microbes in the gut are our partners — they are here to help."

Ultimately, gut microbes are considered the "good guys" from the standpoint of helping shape human health.

However, under certain circumstances, Ramer-Tait said microbes can also contribute to diseases. For example, a person may have a genetic predisposition for an inflammatory bowel disease such as Crohn's disease or ulcerative colitis. While gut microbes may not be the initial cause of those issues, they may be catalysts for the disease.

"An important challenge is to determine which of our gut organisms can turn out to be harmful and how they can contribute to starting or worsening disease," Ramer-Tait said.

Ramer-Tait and her team work to understand these challenges, but they also look for solutions. Many microbiome researchers have shown that diet can dramatically alter the gut microbiome, which means it may be possible to one day determine specific diet suggestions for humans with health issues.

MICE HELP UNDERSTAND THE HUMAN GUT

The Nebraska Gnotobiotic Mouse Program is a key resource for studying how gut microbes influence health and disease as well as how diet can shape the human microbiome, Ramer-Tait said.

"A gnotobiotic mouse (one without its own microbes) can become an avatar for a person," Ramer-Tait said. "We can colonize these mice with a specific person's gut microbiome and determine whether a particular dietary intervention can change that microbiome to improve the health of the mouse."

Mice are raised in the lab and born germ-free, meaning they have no bacteria in their bodies. The mice are housed in sterile isolators that look like plastic bubbles and can sometimes be moved to new housing units where researchers conduct studies with specific microbes.

"We are excited that the Nebraska Gnotobiotic Mouse Program is now home to a new facility that can house up to 50 isolators and many other pieces of specialized equipment to study host-microbiome-diet interrelationships," Ramer-Tait said.

In this new facility, scientists can give germ-free mice a select group of microbes to see if they contribute to a chronic, inflammatory disease, such as Crohn's disease or metabolic syndrome. The researchers can also transplant an entire microbiome community into a germ-free mouse to gather information for use with humans later.

DIETARY INTERVENTIONS

Research on germ-free mice is an important intermediate step to eventually finding dietary interventions for humans.

Ramer-Tait said a diet that is rich in fiber and high in fruits and vegetables may alter the microbiome in a positive way. Each person, however, has a different gut microbiome makeup, so results will likely differ from person to person.

For instance, oftentimes people will eat superfoods, such as raspberries, and not see a change in health, Ramer-Tait said. This could be because their particular microbiome cannot assimilate the superfood.

The Nebraska Gnotobiotic Mouse Program also studies resistant starches found in sorghum, raw potatoes, and certain corn varieties to see how gut microbes convert resistant starches into metabolites that bolster immune health. Resistant starches cannot be broken down in the upper gastrointestinal tract, and therefore make it to the colon intact where microbes live. These gut microbes, in turn, find them to be a fantastic fuel source as they break it down and create new molecules that benefit humans.

Ramer-Tait envisions her research will eventually lead to making specific diet recommendations based on an individual's gut microbiome, but that research is not there yet.

"We hope one day that we can use personalized approaches that include knowing a person's unique microbiome profile and giving them a very specific dietary intervention tailored to their gut microbiota," Ramer-Tait said. "We are not quite yet ready to do this, but we work every day to get there."

For more information on Ramer-Tait's work with the Nebraska Food for Health Center, visit foodforhealth.unl.edu/amanda-ramer-tait.

KEY TAKEAWAYS

1. The human gut microbiome can influence the overall health of an individual.
2. A microbiome influences a person's gastrointestinal health, immune system, and sometimes even cardiovascular or neurological systems, making research on the gut a critical component to human health.
3. The Gnotobiotic Mouse Program studies the cause and effect of microbes and disease processes by exposing mice to a human microbiome in various ways.
4. Organisms that make up a human microbiome are actually in the gut for the purpose of "good." However, when their environment is altered, microbes can contribute to diseases.
5. A diet that is rich in fiber and high in fruits and vegetables may alter the microbiome in a positive way.

For more information on Ramer-Tait's work with the Nebraska Food for Health Center, visit foodforhealth.unl.edu/amanda-ramer-tait.

Amanda Ramer-Tait cultures microbes that will be transplanted into germ-free mice.

Jordan Goebel, gnotobiotic research technician, feeds mice that are housed in sterile insulators.

> "We are excited that the Nebraska Gnotobiotic Mouse Program is now home to a new facility that can house up to 50 isolators and many other pieces of specialized equipment to study host-microbiome-diet interrelationships."
>
> *— Amanda Ramer-Tait —*

Heather Rasmussen

GUT-CHECK – KEEPING NEBRASKA "GUT HEALTHY":
A Healthy Gut Foundation Impacts Entire Body System

Interview with Heather Rasmussen
by Abigail Durheim

Gastrointestinal (gut) health can be influenced by one's daily food and dietary choices. This is important because gut health impacts nearly every area of a person's body.

Heather Rasmussen, associate professor in the Department of Nutrition and Health Sciences at the University of Nebraska–Lincoln, explores how dietary patterns, supplement consumption, and various foods impact gut health.

"We identify and define supplements, foods, or dietary patterns that can benefit gastrointestinal health and provide this information to the general public to improve the overall health of individuals," Rasmussen said.

Ultimately, this work advances science in the area of gut health with the goal of providing recommendations to help people make better choices.

"We provide evidence for healthy dietary recommendations," Rasmussen said, "and encourage individuals to eat foods with a variety of beneficial components to help stay disease-free and healthier overall."

CREATING A HEALTHY GUT FOUNDATION

Creating a healthy gut foundation is critical because gut bacteria can influence the entire body system and thus overall health.

"Gut health can be beneficial or detrimental to overall health," Rasmussen said.

Health care providers formerly defined a "healthy gut" as one that is merely "disease free." Now, she says a healthy gut encompasses may other factors.

"A healthy gut is really a combination of many factors, such as the health of microbiota (gut bacteria), the health of the immune system, and whether the gastrointestinal (GI) tract is promoting well-being in the brain," Rasmussen said. "Specific foods, dietary patterns, and sometimes supplements, such as a prebiotic, impact these areas, and we work to identify those that best modify overall gut health."

While every individual has a unique microbiome that processes food differently, establishing healthy dietary patterns creates a foundation for improved overall health.

FOOD CHOICES IMPACT OVERALL HEALTH

Consuming nutritious, healthy foods positions individuals to have better systemic health (overall health of all bodily systems), Rasmussen said. Conversely, there is evidence that poor gut health contributes to heart disease, diabetes, and brain health issues such as Parkinson's Disease and Alzheimer's Disease.

"Consuming a healthy dietary pattern consisting of a variety of foods that contain substances to promote gastrointestinal health is essential to a healthy life," Rasmussen said.

A healthy diet is based on eating fruits, vegetables, whole grains, nuts, beans, and legumes, Rasmussen said. Following a diet including these foods sets the foundation of the gastrointestinal tract. One example of this type of dietary pattern is a Mediterranean diet, and adoption of this pattern could serve as another foundational starting place to improve and change gastrointestinal health.

However, Rasmussen said everyone has a different GI tract, so food impact varies widely from person to person. Most importantly, she suggests starting small and gradually expanding a person's intake, especially supplements, to see how the body reacts. Healthful dietary patterns and certain supplements, such as prebiotics, contain fiber, so gradual introduction would help minimize temporary gastrointestinal side effects.

Rasmussen also said establishing a personal self-awareness of one's GI tract is critical to understanding GI health. Paying attention to changes in the GI tract is important as it helps recognize and identify potential gut health issues needing to be addressed.

SUSTAINABILITY IS THE FUTURE OF GUT HEALTH RESEARCH

What individuals eat impacts much more than their individual bodies. The resources they consume also impact the world around them. Sustainability is key to the future of gut health research, and this is achieved by keeping both individuals and the environment healthy.

"What is good for the gut is good for the environment," Rasmussen said as she explained the value of fruits, vegetables, and legumes for the gut and the environment. "We will continue to work to marry these two areas and offer suggestions for a healthier individual *and* a healthier environment."

Rasmussen said furthering research investigations in this area is critical as the importance of diet and gut health is increasingly recognized among consumers, health care professionals, and researchers. Connections between gut health and disease will be further explored and more concrete evidence of how gastrointestinal health impacts systemic health will be gathered to better inform dietary recommendations.

While the possibilities for gut health research seem endless, Rasmussen is committed to contributing to the body of literature surrounding this topic and helping the next generation of registered dietitians understand the complexities of gut health as she leads the dietetic internship program at the university.

For more information about gastrointestinal health and the research Rasmussen is conducting, please visit cehs.unl.edu/nhs/nhs-faculty-and-staff/ or the university's Food for Health Center at foodforhealth.unl.edu/researchers.

> “Gastrointestinal (gut) health can be influenced by one’s daily food and dietary choices. This is important because gut health impacts nearly every area of a person’s body.”
>
> — *Heather Rasmussen* —

Healthy food options include rice, quinoa, lentils, and whole grains.

KEY TAKEAWAYS

1. Gastrointestinal health can be influenced by the daily actions of individuals and gut health impacts nearly every area of one’s body.
2. The choices we make every day in the food we eat or the dietary choices we make, impacts our overall level of health.
3. Rasmussen encourages individuals to eat foods with a variety of beneficial components to help stay disease-free and healthier overall.
4. Fruits, veggies, nuts, beans, legumes, whole grains, etc. are the foundation of healthy dietary patterns.
5. Sustainability is key to the future of gut health research and this is achieved by keeping both individuals and the environment healthy.

For more information about gastrointestinal health and the research Rasmussen is conducting, visit cehs.unl.edu/nhs/nhs-faculty-and-staff/ or the university’s Food for Health Center at foodforhealth.unl.edu/researchers.

Kaustav Majumder

PROTEINS & PEPTIDES:
Harvesting, Processing, and Cooking Foods to Increase Health Benefits

Interview with Kaustav Majumder
by Taryn Sehnert

Proteins are an essential component of human body development. Proteins can be consumed through fish or meat, or through plant-based foods such as legumes, lentils, peas, chickpeas, etc. If processed and prepared correctly, portions of food proteins can exhibit health benefits beyond the known nutritional value, such as reducing high blood pressure or chronic inflammation.

Food *proteins* can be described as a ball-like structure connected with a chain (with a lot of folding). These structures are broken down into smaller pieces, called *peptides*, after being processed, cooked, and eventually eaten. Peptides with health-beneficial biological activity (such as reducing high blood pressure or chronic inflammation) are known as *bioactive peptides* (BAPs).

Kaustav Majumder, assistant professor in the Department of Food Science and Technology at the University of Nebraska–Lincoln, investigates how food proteins and peptides impact human health depending on how food is harvested from the field, processed in a food processing facility, and prepared in the kitchen.

"Our lab studies how protein-rich foods are grown, processed, and cooked, and how each impacts health after the food is consumed," Majumder said.

The smaller pieces of food proteins (peptides) play a much larger role in the normal functioning of human bodies. For instance, what one puts onto their plates and in their cups affects how their bodies grow and develop.

"Those who drink milk, typically have strong bones," Majumder said. "Similarly, those that eat meat, gain more muscle protein."

Majumder's research focuses on how these peptides are grown, harvested, and prepared to better understand how peptides impact the human body and contribute to overall wellness beyond regular growth and development.

BIOACTIVE PEPTIDES (BAPS)

BAPs are food proteins and peptides that can regulate cardiovascular conditions such as hypertension and atherosclerosis, Majumder said.

The goal of Majumder's work is to either find naturally-occurring BAPs or create BAPs via food processing that can be easily incorporated into food products to prevent the occurrence of cardiovascular diseases.

For example, Majumder said angiotensin-II is a peptide hormone found in the bloodstream that increases blood pressure.

"One way to reduce blood pressure is to find food peptides that can both inhibit the action of the angiotensin-converting enzyme in the blood *and* reduce the amount of angiotensin-II," Majumder said.

While these peptides will not stop cardiovascular events, such as a heart attack, from happening, they have the potential to help prevent an individual from being in that position in the first place.

Additionally, Majumder studies how dietary peptides can aid in reducing chronic inflammatory conditions in vascular cells and fat cells. While current research does not have any effect on reducing body weight at this time, there is potential that these peptides may play a role in preventing obesity-associated cardiometabolic disorders.

EATING MORE FUNCTIONAL FOODS

Incorporating "functional foods" — foods enriched with BAP — into one's diet is the best way to maximize the efficacy of these peptides, Majumder said.

The functional value is influenced by the way food is grown, processed, and prepared before it is bought and consumed.

Majumder said Nebraska is the number one producer of dry edible beans, namely the great northern bean. His work looks at the growing conditions, environment, and impact of fertilization on these specific dry beans. At some point, these conditions influence the occurrence of some peptides and their impact on human health.

"Specifically, we look at the protein *quality* when they are broken down into peptides and the impact on human health," Majumder said.

Further, his team perfects age-old practices in preparing foods, such as fermentation.

"We can use fermentation to make a new peptide-rich food product that lowers blood pressure and reduces chronic inflammation," Majumder said. "Our laboratory not only identifies and optimizes the processes of producing these BAPs, but also explores their role in the human body."

For example, a drink or food made out of fermented dry beans could be one example of a functional food that could potentially have a beneficial effect on human health.

The incorporation of peptide-rich drinks — similar to a yogurt-based drink — is how other countries, such as Japan and Finland, have achieved this idea; however, the creation of such food products has yet to be made and approved in the United States.

For more information on Majumder and the Nebraska Food for Health Center, visit foodforhealth.unl.edu/kaustav-majumder.

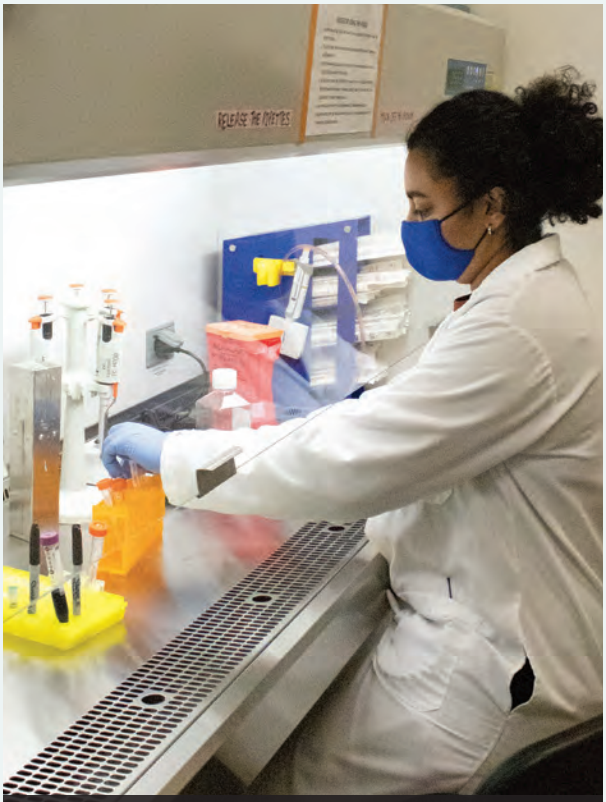
The way that food is prepared in the kitchen changes the basic structure of the item.

KEY TAKEAWAYS

1. Proteins are an essential component of human body development. Proteins can be consumed through fish or meat, or through plant-based foods such as legumes, lentils, peas, chickpeas, etc.
2. If harvested and prepared correctly, food proteins and peptides can not only add nutritional value to one's health, but also boost biological activity, such as reducing blood pressure or chronic inflammation.
3. Food proteins can be described as a ball-like, chain structure (with a lot of folding) found in foods. These structures are broken down into smaller pieces, called peptides, after being harvested, cooked, and eventually eaten.
4. Incorporating "functional foods" — foods that have biological activity above and beyond the known nutritional value — into one's diet is the best way to maximize how the body processes peptides.
5. Refining age-old practices in food preparation, such as fermentation, is being researched to produce more peptide-rich products.

For more information on Majumder and the Nebraska Food for Health Center, visit foodforhealth.unl.edu/kaustav-majumder.

> "If processed and prepared correctly, portions of food proteins can exhibit health benefits beyond the known nutritional value, such as reducing high blood pressure or chronic inflammation."
>
> *— Kaustav Majumder —*



Snigdha Guha, Majumder's research assistant, inspects a sample in the lab on Innovation Campus.

“Early childhood is the formative, developmental period where children can be set on a lifetime path of good health. It is during this critical time that children develop eating behaviors that transition into adolescence and adulthood.”

— Dipti Dev —

Childhood Health Impacts Adult Health

Dipti Dev

A LIFETIME OF HEALTH STARTS IN CHILDHOOD: Promoting Healthy Eating in Children

Interview with Dipti Dev
by Krista Ott

A lifetime of health begins in childhood. The food choices given to children impacts the relationship they have with food as adults.

"Early childhood is the formative, developmental period where children can be set on a lifetime path of good health," said Dipti Dev, associate professor and child health behavior Extension specialist in the Department of Child, Youth and Family Studies at the University of Nebraska–Lincoln. "It is during this critical time that children develop eating behaviors that transition into adolescence and adulthood."

Through Nebraska Extension, Dev works directly with families, teachers, and childcare providers teaching them healthy eating strategies. Specifically, she offers a series of on-demand, online modules with short videos to demonstrate science-based strategies for establishing healthy eating patterns with children, hoping to prevent health issues later in life.

"Healthy eating is important because it is the key modifiable risk factor for preventing obesity and chronic diseases," Dev said.

BEST PRACTICE #1: PROMOTE HEALTHY EATING HABITS YOUNG

Early childhood is the time period where children discover what they like and dislike, according to Dev. Adults can use this to their advantage and lead children to healthy foods and help them make healthy food choices that lower the potential of having health issues later in life.

"Obesity and associated chronic diseases, such as diabetes, cancer, and cardiovascular diseases, can all be modified by improving healthy eating," Dev said. "If these habits are developed at a young age, it can create a lifetime of good health."

Unfortunately, the majority of children in the United States fail to meet dietary recommendations, according to Dev. Therefore, she suggests children should be encouraged to eat more fruits, vegetables, whole grains, and lean meats, and less of foods high in sugar and saturated fats.

From birth to five years of age, children are able to self-regulate their caloric intake or eat when they are hungry and stop eating when they are full.

Adults can support children to actually listen to their internal cues of hunger and fullness. Dev calls this *mindful eating*. Promoting mindful eating cues carry into a child's adult life and help them respond appropriately to their hunger and fullness signals.

When children learn to eat healthy options when they are young, they are more likely to continue doing so into adulthood. Dev said promoting healthy eating habits at a young age is critical to overall adult health.

BEST PRACTICE #2: RESPONSIVE FEEDING

The best way to teach children healthy eating is to practice responsive feeding.

Dev said responsive feeding means being active and attentive to the hunger cues of a child. For instance, if the child acts full, ask them if they are "full," rather than if they are "done." Doing so sparks a response from the child where they determine if they need more food.

Responsive feeding also pays attention to how the food is being presented to the child.

"Responsive feeding can be as simple as changing the way people present the food to the children," Dev said.

For example, if children are taught that dessert is a "reward" only after they eat fruits and vegetables, it causes a dislike and resentment for fruits and vegetables. Instead, treating the foods equally changes the way children view those types of food. Doing so can also take the struggle out of mealtime.

Dev warned that forcing or bribing children to eat specific foods is not usually successful.

"Avoid coercing or pressuring a child to eat and avoid giving them bribes or treats," Dev said. "These are actually counterproductive to encouraging good eating habits."

Instead, following a child's hunger cues and presenting food equally can make mealtime much more enjoyable.

BEST PRACTICE #3: ROLE MODELING AND FOOD EXPOSURE

Being a role model for children and exposing them to various foods also promotes healthy eating habits, according to Dev.

"Children are influenced by adults, especially at a young age, so childcare providers, parents, grandparents, and teachers can all serve as role models for healthy eating," Dev said.

For example, the adult caregiver should try to eat healthy food themselves and have a variety of healthy foods available. They can also use descriptive words such as "crunchy" or "juicy" to create interest in the food for children.

The child may take more interest in food they are exposed to if the adult is also interested, Dev said. The child is also more likely to like these healthy foods and continue to like them into adulthood.

Further, creating exposure can be fun and there is little pressure when children are given different choices.

"Children are naturally curious, and they want to explore," Dev said. "Allowing them to explore new, healthy foods will expose them to different options and find what they like."

Dev said offering healthy food options does not need to be expensive and offers suggestions for budget conscious families.

"Families might consider attending farmers markets or creating a garden in the backyard and growing vegetables," Dev said. "Children will watch and learn these modeled behaviors."

Frozen fruits and vegetables are an inexpensive way to provide healthy foods for children, Dev said. Families can also purchase bags of lentils or beans for soups, burgers, etc. that last quite a long time or purchase only seasonal fruits to keep down costs.

In the future, Dev hopes to improve healthy eating by creating a Community Learning Healthcare System, seamlessly integrating technology and best practices into one system, while considering all stakeholders within the system. She plans for this to be scalable, transferable, and sustainable for use in hospitals, schools, and nursing homes.

For more information about Dev's research of promoting healthy eating among young children or the EAT Family Style Programming, visit cehs.unl.edu/cyaf/dev-research-and-extension-group/.

KEY TAKEAWAYS

1. Promotion of healthy eating at a young age can create a lifetime of healthy eating practices.
2. Healthy eating practices can become a key risk factor for preventing chronic diseases, such as obesity, diabetes, cancer, and cardiovascular diseases.
3. Practicing responsive feeding practices is a great way to promote healthy eating among children.
4. Helping children perform mindful eating can carry into their adult life and help them eat less when they are not truly hungry.
5. Being a role model and creating exposure to healthy food can make children more open to eating healthy foods.

For more information about Dev's research of promoting healthy eating among young children or the EAT Family Style Programming, visit cehs.unl.edu/cyaf/dev-research-and-extension-group/.

> "Obesity and associated chronic diseases, such as diabetes, cancer, and cardiovascular diseases, can all be modified by improving healthy eating. If these habits are developed at a young age, it can create a lifetime of good health."
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> *— Dipti Dev —*

Dipti Dev promotes healthy eating habits by reading to children about radishes.

Martha Rhoades

THE BIRTH OUTCOMES AND WATER (BOW) STUDY:
Understanding Water Quality Impacts on Health in Women and Children

Interview with Martha Rhoades
by Morgan Leefers

Water quality plays a crucial role in public health, but it may be something most people do not consider until it adversely affects them. The Birth Outcomes and Water (BOW) study was created to learn more about water quality and potential negative impacts to women and their children. Specifically, the BOW study evaluates the relationships between harmful birth outcomes and maternal exposure to nitrate and other agrichemicals in drinking water.

Martha Rhoades, research manager in the School of Natural Resources at the University of Nebraska–Lincoln, is the project leader for this study.

"Understanding the relationship between drinking water quality and pregnancy outcomes will help us prevent birth defects and improve quality of life for future generations," Rhoades said.

One in every 33 infants in the United States is born with a birth defect, according to Rhoades. Yet, in the state of Nebraska, two out of every 33 infants born has a birth defect.

The BOW study connects Nebraska researchers with families across the state to find the cause of this increased rate.

DRINKING WATER IMPACTS HEALTH

Drinking water plays a critical role in one's health. Therefore, Rhoades said additional research on water quality is needed.

"The key benefit of water-quality research is to establish if there are connections between environmental factors (protective or otherwise), drinking water quality, and the impact on public health," Rhoades said.

The BOW study takes a deeper look at water quality in Nebraska. Following the model of the National Birth Defects Prevention Study, the BOW project serves as a pilot study for the state as it assesses the feasibility of exploring maternal exposures to chemicals in drinking water and the impact on birth outcomes.

"We do translational science," Rhoades said. "The BOW study does both benchtop science (laboratory science) and population science, or what we consider the epidemiology side," Rhoades said.

Sometimes, contaminants occur in drinking water and can form toxic nitrosated compounds (such as nitrosamines) over time. One important factor within the study is the ability for a water specialist to determine the groundwater age and test for nitrate and nitrosatable compounds.

Using drinking water, blood and saliva testing, along with examining environmental factors and health history, researchers create a more complete picture and determine connections between drinking water quality and human health.

ENVIRONMENTAL FACTORS IMPACTS HEALTH

In additional to examining drinking water quality, the BOW study also examines environmental factors and how they influence risk for birth defects.

Specifically, Rhoades and her team uncover women's health and environmental factors that are related to the health of their children.

"We are interested most in drinking water quality and its impacts on health, but we also have to control for other environmental factors such as lifestyle, smoking, diet, and family history," Rhoades said.

People are interested in how their environment affects all aspects of their lives, Rhoades said. There may be simple things that people can do to prevent birth defects and the BOW study is working to find these answers.

GETTING INVOLVED

Researchers involved with the BOW study work directly with the Nebraska Department of Health & Human Services to reach eligible participants via mailed letter.

Women who are interested in taking part in the study complete a questionnaire and provide samples of saliva, blood, and water for testing.

Women are given incentives throughout the process as they complete the questionnaire and provide each of the samples. Once the initial portion of the study is complete, women are asked to be interviewed to understand the motivators and barriers impacting a decision to participate in the study.

For more information, visit bow.unl.edu.

Rhoades working with a research assistant in the lab.

> “The key benefit of water-quality research is to establish if there are connections between environmental factors (protective or otherwise), drinking water quality, and the impact on public health.”

— Martha Rhoades —

Machine testing samples in Rhoades’ lab.

KEY TAKEAWAYS

1. Water quality plays a crucial role in public health, but it may be something most people do not consider until it adversely affects them.
2. The Birth Outcomes and Water (BOW) study was created to learn more about water quality and potential negative impacts to women and their children.
3. The BOW study evaluates the relationships between harmful birth outcomes and maternal exposure to nitrate and other agrichemicals in drinking water.
4. Understanding the relationship between drinking water quality and pregnancy outcomes will help us prevent birth defects and improve quality of life for future generations.

For more information, visit bow.unl.edu.

“Like humans, plants have DNA. We identify the differences within each plant DNA strain and use this information to determine how they respond to different environments. The goal is to determine how crops can provide the highest yield in any given environment.”

— James Schnable —

Food Security Keeps the World Healthy

Richard Wilson

RICE BLAST THREATENS FOOD SECURITY: Lost Rice Crop Impacts the World

Interview with Richard Wilson
by Mya Donelson

Rice plays a significant role in the food chain for developed and developing countries alike. Rice is referred to as one of the most strategic commodities worldwide, as it offers food security in multiple countries. Rice is also considered a staple food for half of humanity, feeding more than 3.5 billion people globally. However, the rice crop faces a serious threat — rice blast disease.

Richard Wilson, associate professor in the Department of Plant Pathology at the University of Nebraska–Lincoln, studies rice blast, a fungal disease that significantly impacts rice production, with the goal of reducing rice blast development on the rice plant.

More specifically, the fungus attacks the plant and essentially takes all sugars, amino acids, etc. that the plant needs to survive. Doing so also makes photosynthesis less efficient.

Rice blast looks like infected, tear-drop-shaped lesions on the plant where the leaves appear to have been burnt. However, it is fairly undetectable by the plant until it has completely overtaken the crop. Wilson is working to find a solution.

"We are working to create a long term, sustainable means of reducing rice blast to a manageable level, in a cost-effective way for use in the United States and deployed to developing countries as well," Wilson said.

Rice blast can significantly lessen the yield for the rice crop, Wilson said. Given the rising worldwide population and the heavy reliance on rice as a food source, a lower yield is a serious concern to food security.

LOST RICE IMPACTS OVERALL HEALTH

Rice blast disease decreases crop yields, which means less rice harvested worldwide, Wilson said. Further, a limited amount of rice worldwide ultimately increases rice cost. However, many around the globe will not go without rice and will pay more to keep rice in their diet.

"Even with an increased cost of rice, people often will still spend money on rice and not on other foods that they would normally buy," Wilson said. "They will not go without rice, regardless of cost."

Paying more for rice may limit money available for healthier food options, such as fruits and vegetables. While this could be acceptable for adults, Wilson said the impact on children can be long-lasting.

"For children, a lost rice crop can have long-lasting developmental effects due to less access to vitamins from fruits and vegetables," Wilson said. "In this way, there is a whole trickle effect to human health from losing a rice crop. It really is about food security for these parts of the world."

Reducing rice blast disease in rice plants provides a much more secure crop by enabling farmers to grow healthy rice.

"Our goal is to provide a solid foundation for societies by enabling them to grow healthy rice," Wilson said. "We want the options to be affordable for growers and when harvested, the rice to be affordable for consumers."

Specifically, Wilson and his team study ways the rice blast pathogen — the fungus that is killing the plant called *Magnaporthe oryzae* — grows and develops in contact with the host plant. *M. oryzae* does not produce toxins, but rather destroys the plant once it gets into it.

This fungus can also overcome resistance and chemicals very rapidly, causing it to be the most devastating disease of cultivated rice.

RICE ECONOMICS AND SUSTAINABILITY

Rice blast is capable of wiping out an entire field, making the fungus not only a global food security threat, but also a threat to the global economy.

"Rice blast is able to destroy enough rice to feed approximately 70 million people worldwide," Wilson said. "That much rice lost is a significant economic hit to rice producers."

Wilson said that with current practices, rice blast still destroys 10% to 30% of each year's world rice harvests.

In developed countries, like the United States and Japan, the economic hit of rice blast is insured, or farmers can afford to use fungicides to prevent it as much as possible. However, Wilson said in developing countries, the use of most fungicides is not an option, so a complete wipe-out of their harvest because of rice blast is detrimental.

"We want to be able to deploy something into the field that reduces rice blast in a sustainable way — one that works for farmers across the globe," Wilson said.

For more information, follow Wilson on Twitter @WilsonLab.

KEY TAKEAWAYS

1. Rice is considered a staple food for half of humanity, feeding more than 3.5 billion people globally, making it a strategic commodity for food security.
2. Rice blast is a fungal disease threatening rice plants, creating a global food security threat.
3. Rice blast decreases crop yields, which means less rice harvested worldwide, causing an increase in cost for rice worldwide.
4. Wilson and his team study ways rice blast pathogens grow and develop in contact with the host plant as it destroys the plant once it gets into it.
5. Rice blast is able to destroy enough rice to feed approximately 70 million people worldwide.
6. Wilson is working to identify a sustainable means of reducing the rice blast destruction to not only a manageable level, but also in a cost-effective way.

For more information, follow Wilson on Twitter @WilsonLab.

James Schnable

HEALTHY CROPS THRIVING IN DIFFICULT ENVIRONMENTS:
Producing Corn and Sorghum with Less Water, Fertilizer, and Land

Interview with James Schnable
by Brent Lemmer

As the world's population continues to rise, researchers are finding new ways to produce greater yields in corn and sorghum working with less water and fertilizer and lower-quality agricultural land.

James Schnable, associate professor in the Department of Agronomy and Horticulture at the University of Nebraska–Lincoln, determines ways for corn and sorghum to grow and thrive in more difficult environments, in an effort to allow crops to grow on more land while requiring fewer inputs. More difficult environments might include a dry or hot climate that is atypical for the growth of a specific crop.

"Like humans, plants have DNA. We identify the differences within each plant DNA strain and use this information to determine how they respond to different environments," Schnable said. "The goal is to determine how crops can provide the highest yield in any given environment."

Specifically, Schnable and his team study sorghum and corn genomics and genetics and use new sensor, robotics, and computer vision technologies to measure how different varieties of corn and sorghum grow and respond to different environments.

HEALTHY PEOPLE NEED FOOD

Being a healthy human means eating proper nutrients provided through safe and reliable resources within the agricultural sector. Schnable said food needs to be produced regularly to keep people healthy.

"If people do not have enough food, they will not be healthy," Schnable said. "If a person is not able to eat enough calories, none of the rest matters. Once people have enough calories, the next priority is the right balance of nutrients."

FERTILIZER IMPACT ON HEALTH

The use of fertilizer, such as nitrogen, impacts human health as well, Schnable said. For many farmers, after the cost of buying seed itself, nitrogen fertilizer is the second largest cost of production.

Yet, Schnable said one challenge farmers face is that the amount of nitrogen fertilizer a given field will require to reach its maximum yield potential varies from one year to the next.

For example, the cost of being wrong in one direction — applying too much fertilizer — is much smaller than the cost of being wrong in the other — applying too little and missing out on potential yield. As a result, perhaps one third of the total nitrogen fertilizer applied to corn is actually unnecessary, costing farmers money and running off into the water supply. For those living in an agricultural state, too much nitrogen and fertilizer can impact the quality of the water supply. The problem is that without better tools or models, researchers do not know which third of nitrogen fertilizer that is from year to year.

"Too much nitrogen and fertilizer can create excess run off that ends up in water ways and cause poor water quality," Schnable said. "If this happens, water treatment plants are taxed with removing the extra nitrates before they get into the drinking water supply."

GROWING CROPS IN NON-NATIVE LANDS

Despite corn originating in the warmer climates of Central America and sorghum originating in Africa, both crops are now widely grown in the temperate latitudes of North America.

Schnable's lab

Schnable's research explores ways to better adapt these crops to cold weather at the beginning and end of the growing season, guided by the solutions developed by wild relatives of these same crop species, which grow natively in Nebraska, have developed.

"If we can develop varieties of corn or sorghum that can be planted earlier in the spring and grow further into the fall without risk of frost damage, those crops can capture more of the total light that falls on a farmer's field over the course of a whole year," Schnable said. "More light captured by photosynthesis means the potential for more total grain from the same number of acres."

Increasing agricultural productivity in Nebraska and throughout the Midwest is not only good for farmers and the agricultural economy. If more food can be produced from the same amount of plant, it reduces the pressure to bring new acres into production globally. Right now, new agricultural land comes primarily from cutting down the rainforest and increasing acreage in Brazil or Southeast Asia.

INTERESTED IN A CAREER IN AGRONOMY?

Agronomy is a fast-growing industry that has changed drastically in the last 10 years, Schnable said.

"An agronomist, or plant breeder, learns about plant biology and how plants grow," Schnable said. "But they also learn statistics, programming, computer vision, and artificial intelligence."

Those who worked with Schnable have gained such transferable skills where they have not only become plant breeders, but also apply for and get interviewed for jobs at Internet and data science companies.

"The type of research we do in agronomy is becoming more generalizable," Schnable said. "We have better tools for collecting data, so the industry is now more focused on how to analyze the data and use it effectively."

For more information about opportunities in the Department of Agronomy and Horticulture, visit agronomy.unl.edu/schnable.

For more information on Schnable's work, visit schnablelab.org/.

> If we can develop varieties of corn or sorghum that can be planted earlier in the spring and grow further into the fall without risk of frost damage, those crops can capture more of the total light that falls on a farmer's field over the course of a whole year. More light captured by photosynthesis means the potential for more total grain from the same number of acres.

— James Schnable —

Checking maize in the lab.

KEY TAKEAWAYS

1. As the world's population continues to rise, researchers are finding new ways to produce greater yields in corn and sorghum working with less water and fertilizer and lower-quality agricultural land.
2. Schnable determines ways for corn and sorghum to grow and thrive in more difficult environments, in an effort to allow crops to grow on more land while requiring fewer inputs.
3. Schnable and his team study sorghum and corn genomics and genetics and use new sensor, robotics, and computer vision technologies to measure how different varieties of corn and sorghum grow and respond to different environments.
4. One challenge farmers face is that the amount of nitrogen fertilizer a given field will require to reach its maximum yield potential varies from one year to the next and too much fertilizer can impact water supply.
5. If more food can be produced from the same amount of plant, it reduces the pressure to bring new acres into production globally.

For more information on Schnable's work, visit schnablelab.org/.

> “There are multiple factors that prevent people from having opportunities to be the healthiest versions of themselves. We need to break down these barriers so people can be their healthiest selves because many times, it is not an individual choice — there are environmental and systemic factors at play that we have a responsibility to improve.”

— Virginia Chaidez —

Healthy Communities Need Access and Inclusion

Virginia Chaidez

LOCAL HEALTH HEROES – COMMUNITY HEALTH WORKERS IN NEBRASKA:
People Bringing Healthcare to Underprivileged Areas

Interview with Virginia Chaidez
by Rebecca Reagan

Some might call community health workers "local health heroes" because they act as a liaison between community members and the healthcare system.

A community health worker is an umbrella term used to describe a frontline public health worker who provides services ranging from community outreach and education, to social support and patient advocacy, according to Virginia Chaidez, associate professor in the Department of Nutrition and Health Sciences at the University of Nebraska–Lincoln.

These workers live in communities throughout Nebraska and help hard-to-reach groups gain better access to healthcare and health education. Chaidez said most community health workers are in paid positions, but some volunteer their time to the community.

"Community health workers are so passionate about helping people and some are literally volunteering their time," Chaidez said.

Chaidez and her colleagues work to achieve health equity and eliminate health disparities in Nebraska, particularly as there is an anticipated demographic shift reflecting greater diversity throughout the state. They conduct community-based research to identify health disparities and provide appropriate response addressing specific needs.

"Ultimately, we hope our work helps to improve lives, advocate for underprivileged groups, better inform policies, and break down barriers, structures, and systems that prevent people from having equal access to health and healthcare," Chaidez said. "The end goal is to make a real impact now and in the future."

COMMUNITY HEALTH WORKERS IN NEBRASKA

Community health workers are an essential group within Nebraska healthcare. Not only do they conduct outreach that promotes and improves both individual and community health, but they also help facilitate access to services. Chaidez said community health workers build trusting relationships by linking individuals with healthcare systems in the communities they serve.

Unfortunately, in most communities, there are not enough community health workers in the workforce to support the population's needs. Chaidez said there is high demand for increased involvement in Nebraska communities to better serve those in need.

"Community health workers can be anybody — while some have formal education, others have never attended school," Chaidez said. "Many even volunteer their time because they want to help community members improve their health and gain access to resources."

However, clear issues exist that prevent people from pursuing the community health worker career path. As part of her research, Chaidez interviews community health workers to determine what keeps individuals in the field. Most responded with receiving a livable wage, burnout prevention support, and strong leadership as basic requirements.

Fortunately, there has been a shift in dialogue of how to better serve community health workers and keep them as health workers for the long term, especially since most feel passionately about their community work.

"Community health workers do not do their job for the money, they do it because they want to help people," Chaidez said.

VULNERABLE POPULATIONS

Latinx communities tend to experience health disparities and discrimination within the healthcare systems. Chaidez works in conjunction with Nebraska nonprofit health organizations to help improve health among Latinx communities through community health workers.

For Latinx populations, language barriers can prevent people from getting a good job, accessing healthcare, and communicating with healthcare professionals. Many Latinx households are multi-generational, and it is not uncommon for the younger generations to serve in the role of interpreter or translator of written documents. Research suggests this type of ad hoc interpretation can have adverse consequences.

Language barriers are not the only thing holding people back. Racial tensions and inequities show the issues are systemic, and until those societal issues are addressed, there will not be improvements.

Chaidez said it is critical to raise awareness, reiterate, and re-emphasize (with multiple repetitions) that not all people have equal access to healthcare. She said repeated messages will help convey the issue to community stakeholders.

"There are multiple factors that prevent people from having opportunities to be the healthiest versions of themselves," Chaidez said. "We need to break down these barriers so people can be their healthiest selves because many times, it is not an individual choice — there are environmental and systemic factors at play that we have a responsibility to improve."

COMMUNITY NEEDS

Community health workers yearn for additional information and more training opportunities on the best ways to serve community members. Chaidez said there is an incredible amount of knowledge in academia, and it is critical to share that knowledge with communities.

"Community health workers have said they want more training in basic nutrition knowledge because they want to be able to bring that information back to the community," Chaidez said.

Because of this, she works to make her own work accessible to all.

"I make an effort to personally email my published work to particular stakeholders who work to support the community health workforce in the state of Nebraska, and I would be happy to share that information with anyone interested," Chaidez said.

To receive this research or learn more information about Chaidez's research, email her directly at vchaidez2@unl.edu.

KEY TAKEAWAYS

1. A community health worker is a frontline public health worker who provides services ranging from community outreach and education to social support and patient advocacy.
2. These workers live in communities across the state of Nebraska and help hard-to-reach groups gain better access to healthcare and health education.
3. Not all people have equal access to healthcare in the state of Nebraska. Particularly, Latinx communities tend to experience health disparities and discrimination within the healthcare systems.
4. Chaidez and her colleagues conduct research to help improve lives, to advocate for underprivileged groups, to better inform policies, and to break down barriers, structures, and systems that are preventing people from having equal access to healthcare.

To receive this research or learn more information about Chaidez's research, email her directly at vchaidez2@unl.edu.

> "Ultimately, we hope to improve lives, advocate for underprivileged groups, better inform policies, and break down barriers, structures, and systems that prevent people from having equal access to health and healthcare."
>
> *— Virginia Chaidez —*

The Douglas County Health Department is one of many health departments that work with Chaidez to improve community health.

Helen Fagan

RURAL FELLOWS PROGRAM BRINGS INCLUSION EFFORT TO RURAL NEBRASKA:
Healthy Communities Include Diverse Ideas

Interview with Helen Fagan
by Bailee Tucker

As part of Rural Prosperity Nebraska, the Rural Fellows program has connected students and rural communities with opportunities through the University of Nebraska–Lincoln since 2013.

Helen Fagan, assistant professor of practice and coordinator of the Rural Fellows program at the University of Nebraska–Lincoln, pivoted and elevated the Rural Fellows program (originally called Serviceship) in 2018 to be a fellows program focused on creating inclusive envrionments. This program impacts not only the communities as a whole, but individuals as well.

"Through the Rural Fellows program, students and community leaders come together and learn how to work as a team with different backgrounds, experiences, degrees, programs, ages, values, and life beliefs," Fagan said. "We want everyone to feel included and to know what inclusion feels like so they can create that environment in the workplace. In this way, leaders are developed in an inclusive way of thinking and practicing."

Community health is often dependent on available healthcare, a prospering economy, and thriving social interactions, Fagan said. Physical and mental well-being is essential in maintaining good health, and good health comes from a prosperous community. Overall, a healthy human depends on a healthy community. Fagan said this program helps rural communities prosper in these ways.

Rural communities play an essential role in the United States, especially in Nebraska. The Rural Fellows program shows students the value of working in rural America and brings new perspectives to communities.

"The fabric of what makes America great is the rural element," Fagan said. "We cannot live without our rural communities and I hope this program helps keep them healthy and vibrant."

COMMUNITY, WORKFORCE, AND ECONOMIC DEVELOPMENT

Rural Fellows is a unique program that helps rural communities across Nebraska through monumental projects. Each summer, students from different universities around the country spend 10 weeks in a rural Nebraska community where they work and live for the duration of the project.

Communities identify their most pressing needs and students are matched with a community that fits their skills and interests involving economic and business development, entrepreneurship, early childhood development, marketing and promotion, mental health services, or other areas essential to that specific community, Fagan said.

Examples of projects include establishing a marketing and social media presence/plan, creating a website to share mental health resources in the community, and analyzing community strengths, weaknesses, threats, and opportunities in order to develop an action plan.

"Students gain the experience of working alongside community leaders and community leaders get to tap into the intellectual power and capacity of the whole university," Fagan said.

Through this, students gain a deeper understanding of a particular community while creating a meaningful change that affects the overall health of the community. Fagan said each student involved in the program is given the opportunity to get hands-on experience.

"We place students in a rural community where they get resume-building, real-life experience working alongside a community leader and actually develop a project idea from the beginning and often see it come to fruition," Fagan said.

INCLUSIVE LEADERSHIP DEVELOPMENT

The Rural Fellow program's purpose is to also create a sense of inclusivity for communities and students. When a student is made to feel like they belong, and their unique contributions matter, their confidence increases. When community leaders and members take the input of diverse students, that builds their confidence as a community. This confidence aids in developing an inclusive community for all who participate.

"Diversity is our reality because human beings are unique," Fagan said. "Inclusion is our choice to welcome, honor, and celebrate the contributions of people from all walks of life and make them feel like they belong, and the Rural Fellows program wants to create environments where people feel like they belong and their uniqueness matters."

Community leaders, who are also considered Fellows of the program, along with students go through a development program where they learn necessary skills to be successful in becoming an effective team. This training program is led by Fagan, and other team members, where they focus on a transformative approach to inclusive leadership, team building, and community development.

Healthy communities help their members to feel a sense of community and inclusivity. This sense of community and inclusivity has the ability to affect physical and mental well-being, which play a major factor in a community's economy and social interactions.

RURAL FELLOWS HELPS COMMUNITIES

The Rural Fellows program made an average economic impact of $28,000 in participating communities. Whether building homes in Friend, Nebraska, creating behavioral health and priority support services for the inclusion of Native American youth in Chadron, Nebraska, or helping Latinx businesses thrive in Grand Island, Nebraska, the Rural Fellows are changing rural communities for the better.

Fagan discussed how this rewarding program helps people from all backgrounds come together as one.

"We want to grow this program and to support how the community sees themselves and how people from different parts of the world see and experience Nebraska," Fagan said.

For more information about the Rural Fellows program, visit ruralprosperityne.unl.edu/rural-fellows.

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>
> *— Helen Fagan —*

Broken Bow, Nebraska, located in Custer County, where the Nebraska Rural Fellows had the opportunity to serve this county through areas of marketing and workforce development.

KEY TAKEAWAYS

1. The Rural Fellows program has connected students and rural communities with opportunities through the University of Nebraska–Lincoln since 2013.
2. Community health is often dependent on available healthcare, a prospering economy, and thriving social interactions. A healthy human depends on a healthy community and this program helps rural communities prosper in these ways.
3. Students are matched with a community where they complete a project and gain a deeper understanding of the particular community while creating a meaningful change that will affect community health.
4. The Rural Fellow program’s purpose is to also create a sense of inclusivity for communities and students.
5. The Nebraska Rural Fellows was able to make an average economic impact of $28,000 in participating communities.

For more information about the Rural Fellows program, visit ruralprosperityne.unl.edu/rural-fellows.

Jean Ann Fischer

NEBRASKA EXTENSION NUTRITION AND HEALTH PROGRAMS : Directed Programming to Provide Access to Healthcare

Interview with Jean Ann Fischer
by Molly Suhr

Nebraska Extension nutrition and health programs help communities create environments that are supportive of health and well-being.

Jean Ann Fischer, Nebraska Extension Human Sciences Program Leader at the University of Nebraska–Lincoln, oversees Extension programming with Nebraska communities making it easier for individuals to make healthy choices.

"Our programming focuses on developing and implementing strategic plans that have a vision for health and well-being in Nebraska communities," Fischer said. "We build capacity in Extension educators who work across the state, engaged in communities and focused on critical issues that best serve the area."

Fischer also serves as the director of the Nutrition Education Program that helps families facing poverty make healthy choices.

"In the nutrition education program, we are specifically focused on those individuals who are at 185% or less of the poverty level in Nebraska and implement multi-level approaches targeted at barriers keeping them from assessing health needs, whether it is food security or safe, physical activity spaces," Fischer said.

People are influenced by interpersonal and environmental factors, so Fischer said she gears Extension programs toward helping people improve knowledge, skills, behavior, and attitudes toward health.

However, she also acknowledges environmental and societal influences impacting individuals as well. Such as social determinants of health (i.e., conditions in the places where people live, learn, work, and play that affect a wide range of health risks and outcomes) which must be addressed to impact health outcomes.

HEALTHY ADULTS SHAPE COMMUNITIES

Healthy individuals influence the workforce within the community.

"We know that healthier individuals are able to add more to a workforce," Fischer said. "From a workforce standpoint, an individual's health directly impacts organizations, as there is a higher likelihood that the increased burden of chronic disease will negatively impact healthy, productive workers."

Physical and mental health are interrelated and are equally important components of overall health, Fisher said. Mental illness, especially depression, increases the risk for many types of physical health problems and the presence of chronic conditions can increase the risk for poor mental health.

NEBRASKA EXTENSION FOCUS ON COMMUNITY HEALTH

Behavioral health changes and health outcomes are shaped not only by individual decisions and choice, but also by environmental and community factors, Fischer said.

Goals of the Nebraska Extension programming that Fischer builds capacity for include increasing healthcare access, decreasing health disparities, and creating an environment that is supportive of people's well-being, particularly in impoverished and rural communities throughout Nebraska.

"We shape interventions and strategies based on the community engagement and the community identified issues," Fischer said.

Implementing new strategies to maintain healthy lifestyles can also begin at schools within the community as well. Fisher's programs have participated in implementing programs in schools, such as starting a school garden to increase children's exposure to different types of foods.

"One positive benefit of a school garden is understanding the larger spectrum of where food comes from, while seeing the need for that entire food system to work together," Fischer said.

FAMILIES INFLUENCE HEALTH CHOICES

A person's home life should provide them ways to live a healthy lifestyle, Fischer said.

Everyone has different definitions of family and various role models in their life. However, because of the strong influence role models provide, it is crucial that those role models provide positive examples of a healthy lifestyle.

"A caregiver has a role in shaping behaviors and attitudes towards topics like body image and how children view different foods," Fischer said.

Being a caregiver is an important role. When a caregiver, whether that is a parent, a childcare provider, or a teacher, makes healthy choices, it affects both the child and caregiver.

"From existing data collected from school enrichment programs throughout the years, we see positive change, not only in the youth knowledge and behavior, but also in teachers," Fischer said. "Post-survey data shows us that teachers are more aware of their role and how they might be influencing the children to change health behaviors in a positive way."

Fischer's work aligns with the World Health Organization's sustainable development goals around health. Those goals include decreasing chronic diseases, improving food access, creating supportive environments of health and well-being in communities, and supporting positive behavior change for individuals.

For more information on Nebraska Extension's health and nutrition programs visit food.unl.edu.

KEY TAKEAWAYS

1. Nebraska Extension nutrition and health programs create environments that make it easier for individuals to make positive health behavior changes.
2. People are influenced by interpersonal and environmental factors, so Fischer gears Extension programs toward helping people improve knowledge, skills, behavior, and attitudes toward health.
3. Nebraska Extension programming focuses on developing and implementing strategic plans that have a vision for health and well-being in Nebraska communities.
4. Specific goals of the programming include increasing healthcare access, decreasing health disparities, and creating an environment that is supportive of people's well-being, particularly in impoverished and rural communities throughout Nebraska.
5. A person's home life should provide them ways to live a healthy lifestyle.

For more information on Nebraska Extension's health and nutrition programs visit food.unl.edu.

> "One positive benefit of a school garden is understanding the larger spectrum of where food comes from, while seeing the need for that entire food system to work together."
>
> — *Jean Ann Fischer* —

Community garden in Schuyler, Nebraska.

“Nebraska Extension nutrition and health programs focus on developing and implementing strategic plans that have a vision for health and well-being in Nebraska communities.”

— *Jean Ann Fischer* —

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