Priorities for preparation
Training the next generation to fight pathogens

Minding the mind
How scientists study our changing brains

Automation in the field
Agriculture’s modern-day workhorses
Studying stripes

The zebrafish is more than a 2-inch minnow found in freshwater throughout South Asia and in aquariums worldwide. It’s also a model species for studying the human brain.

Thomas Mueller, research assistant professor in the Kansas State University Division of Biology, and his team study neural circuits and behavior in zebrafish. Their work helps scientists better understand how the similar human brain works.

Mueller’s research is part of the K-State Cognitive and Neurobiological Approaches to Plasticity Center, or CNAP, which includes an interdisciplinary team focused on neuroscience research and the changing brain. See page 23 to learn more about Mueller’s research and CNAP.
Seek is Kansas State University’s flagship research magazine and invites readers to “See” K-State’s research, scholarly and creative activities, and discoveries. Seek is produced by the Office of the Vice President for Research and the Division of Communications and Marketing.

Priorities for preparation
Training the next generation to fight animal, plant pathogens

Minding the mind
How scientists study our changing brains

Automation in the field
Robots, drones are becoming agriculture’s modern-day workhorses

Thank you for taking time to peruse our fall 2019 edition of Seek. We recently closed out our fiscal year 2019, and I am excited to share that we had another record year of grant proposal submissions, awards and contracts, and total funds awarded to support the research enterprise in the future. As a result, Kansas State University continues to advance its programs and impact. New funding also supports students in their studies through research stipends and our faculty and staff with salary support.

This issue of Seek features a cover story on page 20 about the new multi-institutional, interdisciplinary Cognitive and Neurobiological Approaches to Plasticity Center, or CNAP. The center focuses on brain plasticity, which involves the brain forming memories and learning new information. A $10.6 million Center of Biomedical Research Excellence, or COBRE, grant funds CNAP, and it is only the second COBRE grant that K-State has ever received. The center provides a platform for the center and Kansas State faculty members and the research they are conducting. Along with fundamental research, the grant also focuses on helping early career faculty and involves collaborators at Wichita State University and the University of Kansas Medical Center.

You may have heard of precision agriculture, another K-State strength, and big data applications to agriculture. This issue includes a story on page 28 that takes a closer look at cutting-edge technology in agriculture and shows how K-State research is developing innovative ways to help producers and their families in our state and around the world.

Building on the themes of agriculture and research that improve Kansas communities, we feature a story on page 14 about a five-year, $2.9 million National Science Foundation Research Traineeship Program grant that is helping graduate students strengthen rural communities by addressing water, food and energy challenges in western Kansas. This interdisciplinary project involves engineering, agricultural economics and sociology, among others, and engages the Southwest Research-Extension Center in Garden City.

We have received a number of requests for updates about infectious disease research at the Biosafety Research Institute, or BRI, at Pat Roberts Hall and how it supports the National Bio and Agro-defense Facility, or NBAF. This issue features a story on page 10 about how BRI faculty and staff are training undergraduate and graduate students while engaging in cutting-edge research that will help keep our food supply safe and secure and grow the future workforce for biosecurity and biosafety.

This issue highlights how the university engages with Kansas communities by working with K-State Research and Extension. From growing the future workforce to strengthening rural communities, our collaborative research programs reach beyond our campus. These partnerships enable us to fulfill our land-grant mission to serve the students and the people of Kansas, the nation and the world. We invite you to turn the page and learn more.

Peter K. Dorhout, Vice President for Research

This page and learn more.

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This page and learn more.
A partnership between Fort Riley and Kansas State University is paving the way for continued archaeological site surveys on the military installation.

Fort Riley Garrison Commander Col. Stephen Shrader and K-State Vice President for Research Peter Dorhout recently signed the first intergovernmental support agreement between the two agencies. During the five-year agreement, K-State archaeologists will evaluate and analyze Fort Riley property never surveyed before as directed by Fort Riley’s cultural resources archaeologist.

Site work began in June under the direction of Lauren Ritterbush, professor of sociology, anthropology and social work in the College of Arts and Sciences. Any artifacts the team discovers will help to better understand the past.

“The ancestors of today’s Native peoples, who called this region home more than 14,000 years ago, did not recognize land tenure as we do today. Evidence of their past lives as recorded in archaeological sites must be understanded in a regional scale undefined by modern political boundaries,” Ritterbush said. “This intergovernmental agreement facilitates collaboration between the archaeology faculty and students at K-State and Fort Riley to gain a more complete picture of these peoples before the establishment of Fort Riley, Manhattan and K-State.”

Easing tough conversations in rural communities

Discourse in any town can be difficult at times. Some towns struggle to keep local businesses, while other towns experience demographic shifts in the population. These issues can lead to challenging conversations.

A Kansas State University researcher wants to help and is using historical data to find ways to engage rural Kansas communities in respectful dialogue.

Timothy J. Shaffer, assistant professor of communication studies in the College of Arts and Sciences, is studying how community discussions during the New Deal era were facilitated by Cooperative Extension educators and other community leaders in person and over the radio so that people could better understand the complex challenges they faced. The topics considered during the 1930s and ’40s in rural America resonate with today’s concerns.

“They discussed things like taxes and soil conservation,” Shaffer said. “They talked about imports and exports, which is also a hot topic right now.”

Shaffer’s research aims to help organize and convene people for these types of interactions.

He is collaborating with K-State Research and Extension on one possible solution: the master community facilitator program. This program equips volunteers with the skills to lead productive conversations in their communities, which allows change to come from within the specific group.

“People in local communities don’t need to only rely on people who are based in Manhattan or larger cities,” Shaffer said. “They are empowered to be agents of change within their own communities.”

New Ebola transmission model predicts recent cases

A new risk assessment model for the transmission of Ebola accurately predicted its spread into the Republic of Uganda, according to the Kansas State University researchers who developed it.

Caterina Scoglio, professor, and Mahbubul Raud, doctoral student, both in the Mike Wiegers Department of Electrical and Computer Engineering in the Carl R. Ice College of Engineering; Musa Sekamatte and Issa Makumbi at the Uganda Ministry of Health; and Felix Ocom with the World Health Organization in Uganda, recently published the paper “Risk assessment of Ebola virus disease spreading in Uganda using a multilayer temporal network” in bioRxiv.

The paper describes a new model to better predict how diseases like Ebola spread. The model combines data of people’s constant contacts, such as family members and co-workers, with their temporary contacts, such as people in a market or encountered during travel. According to Scoglio, the model should be used as a risk assessment tool to prepare and distribute resources to mitigate risk, but it also has been accurate thus far regarding the movement of Ebola from the Democratic Republic of Congo into Uganda.

“This is a very new type of model,” said Scoglio, also the Paslay professor of electrical and computer engineering. “Since we consider movement data in addition to constant contacts, we see that not only the districts directly bordering Congo at risk but that the districts on the path to some important Ugandan destinations also are at risk.”

This series of maps depicts the risk of Ebola spreading as transmission increases within 23 districts in southern Uganda.

Caterina Scoglio

This electron microscopic image shows the 1976 isolate of Ebola virus. (Photo credit: CDC/Frederick Murphy)
Big data collaboration brings
big advancements to human,
animal health

Researchers at Kansas State University and the University of Missouri-Kansas City are turning big data about human and animal health into a means of saving lives and improving the quality of life for people and their pets.

The collaboration, called 1Data, cleans and standardizes preclinical human and animal health data. Researchers around the world can use the data to rapidly develop and test new therapeutics, drugs and medical technologies for people and companion animals.

With the 1Data platform and its information, researchers can analyze and compare data across animal species or even look at how the genetic information from a specific animal compares to a human. This could help scientists easily identify similarities in diseases that affect people and pets, such as cancers, chronic mitral valve disease and other illnesses.

“The 1Data platform, researchers have access to a more diverse dataset to aid them in their pursuit of medical advances,” said Gerald Wyckoff, director of 1Data and professor of molecular biology and biochemistry at K-State Olathe and the University of Missouri-Kansas City.

Wyckoff leads 1Data with Majid Jaberi-Douraki, associate professor of mathematics with the K-State Institute of Computational Comparative Medicine, and Jim Riviere, professor emeritus with the K-State College of Veterinary Medicine. Multiple graduate students and postdoctoral researchers at both universities are involved.

Data also can be plugged into human and animal computational models, making it possible for researchers to see what drugs are likely to fail during clinical testing and at what phase, thereby saving time and money.

The 1Data team recently signed agreements with the animal health companies Aratana Therapeutics and Elanco Animal Health, which provided historic data from their clinical studies on dogs and cats. Other private companies also are completing data-sharing agreements.

Several projects use the data in various ways:

• One project involves orphan diseases, which are rare diseases that affect fewer than 200,000 people nationwide, according to the U.S. Food and Drug Administration. Researchers are looking at approved therapies for these diseases and testing them against animal models generated on the 1Data platform.

• A beta version of DrugAssist, a platform for precision and individualized medicine, computes demographic information about patients with either breast cancer or Type 2 diabetes. The platform helps physicians tailor therapeutic drug for patients. A similar platform for veterinarians is being developed.

• Another project uses health data collected by wearable devices on veterans with PTSD, or post-traumatic stress disorder, and their service animals. The goal is to find how frequently and effectively the service animals are at interventions.

Two researchers receive prestigious NSF CAREER awards

The National Science Foundation is honoring two Kansas State University researchers with one of the foundation’s most prestigious awards for early career faculty members.

Ryan Rafferty, assistant professor of chemistry in the College of Arts and Sciences, and Yi Zheng, assistant professor of grain science and industry in the College of Agriculture, have each received the NSF Faculty Early Career Development Award, or CAREER award.

CAREER awards are five-year grants for early career faculty who have the potential to serve as academic role models in research and education and lead advances in the mission of their departments or organizations.

Rafferty is using the CAREER award to develop both scientific and educational tools to address complex biological barriers, such as separating the brain from the bloodstream of mammals and those of gram-negative bacteria. Future applications of the research include intelligent drug design and antibiotic development.

Zheng’s CAREER project focuses on biomanufacturing. He is developing and testing the properties of a novel thermoresponsive polymer material that will facilitate both microalgae cell harvesting and intracellular product recovery, which is a relatively inexpensive and environmentally-friendly technology. The material and approach could potentially influence the entire field of biomanufacturing.
K-State establishes Rural Railroad Safety Center

A more than $2.5 million grant from the U.S. Department of Transportation’s Federal Railroad Administration has established the Rural Railroad Safety Center at Kansas State University. Eric Finkelman, Hall and Mary Sagle professor of civil engineering in the Carl R. Ice College of Engineering, is leading the project. His collaborators are civil engineering faculty members Robert Petersen, professor and Mark H. and Margaret H. Hulings chair; and Christopher Jones and Stacey Kohutki, both associate professors.

“By the end of the three-year grant period, it is our goal to have evolved into a vibrant center for industry-relevant railroad research," Finkelman said. “Additional educational and outreach programs will be in place to train and develop a diverse workforce for the railroad industry and our research outcomes will help ensure the future of the rail industry is as safe and efficient as possible.”

Partner institutions include the University of Nebraska, Lincoln; the University of Florida; Pennsylvania State University, Altoona; and California State University, Chico.

Developing new antibiotics

A Kansas State University biochemist is leading a collaborative project that is exploring new means of treating infections with antibiotics.

Michal Zolkiewski, professor and head of the biochemistry and molecular biophysics department in the College of Arts and Sciences, has been awarded a nearly $2 million grant from the National Institutes of Health to develop new antibiotics. Zolkiewski will lead a team of investigators that includes University of Kansas researchers.

“Decades of global antibiotic misuse and overuse along with a lack of commercial incentives to develop new drugs have brought us to a point where antimicrobial resistance is a major threat to human health,” Zolkiewski said.

According to the Infectious Diseases Society of America, at least 2 million Americans each year develop infections from antibiotic-resistant pathogens, and about 25,000 of them result in death.

“The development of novel antimicrobial strategies and the discovery of new antimicrobials are highly relevant to global public health,” Zolkiewski said. “We aim to develop a new paradigm of antimicrobial therapy to future generations do not face an existential threat of dying from common infections.”

Top: A bus tour gives GASL participants the opportunity to tour the Kansas Flint Hills and tallgrass prairie. Middle: Conference participants tour farms and learn about production facilities. Bottom: Fritz Schneider, GASL chair, speaks at the September meeting at K-State.
Priorities for preparation
Priorities for preparation
Training the next generation to fight animal, plant pathogens

By Stephanie Jacques

“Within 12 years of the virus emerging in the country of Georgia, African swine fever has spread throughout most of Eastern Europe and across the entire continent of Asia into China, Vietnam and Cambodia,” said Daniel Madden, who researches the virus as a Kansas State University master’s student in veterinary biomedical sciences in the College of Veterinary Medicine. “It is very likely that future outbreaks will occur in areas that have never seen this disease before and we must be prepared.”

African swine fever virus and clinical swine fever virus, another concerning disease, have not shown up in any U.S. swine populations yet. To keep it that way, Kansas State University is running the next generation of biocontainment and biobiosecurity scientists, like Madden, while also conducting research to contain the most threatening agents to the world’s food supply, including swine fever viruses and many other pathogens.

The K-State Bioscience Research Institute, or BRI, houses several multidisciplinary research programs on pathogens that affect animals, plants and insects as well as food safety and security. The institute has 14 biosafety labs in addition to 10,000 square feet of educational and training space.

“Other facility can do all that we do in one spot when it comes to plants, animals and insect work,” said John Henneman, BRI director of biocontainment operations. “We are unique and are working with agents that are not allowed in other nonfederal labs.”

In addition to swine fever viruses, the BRI also has research projects that are fighting wheat blast, a fungal disease that threatens wheat harvests; Japanese encephalitis virus, which lives in pigs and is transmitted to humans by mosquitoes; Rift Valley fever virus, a mosquito-borne virus that infects cattle, sheep and goats as well as humans; highly pathogenic avian influenza, which has been detected in more than 50 countries in Africa, Asia, Europe and the Middle East; and foodborne pathogens such as Shiga toxin-producing E. coli.

“As a land-grant university, K-State is using the research we do in the lab to train students and improve current practices. In the simulated BSL-3 training lab, which is one of only a few in the nation, students and researchers learn how to properly handle, decontaminate and dispose of high-consequence agents, how to safely enter and exit a containment lab, how to work in a BSL-3 lab; and what to do in an emergency while in the lab,” Henneman said.

“The BRI is a great facility to help K-State students,” Johnson said. “We’ve had graduate students, undergraduate students,起步博士 and postdoctoral researchers train and gain experience at the BRI. There are very few places they can get this kind of research experience.”

According to Johnson, many of the students doing work at the BRI later have their eyes on careers at the National Bio and Agro-defense Facility, or NBAF, which is under construction adjacent to the Manhattan campus. It will replace the aging Plum Island Animal Disease Center in New York and be the first biosafety level 4, or BSL-4, facility with the capability to handle livestock as part of its research. The proximity to K-State and research partnerships will help students make important career connections.

“The training to work in the BRI enabled me to conduct my research on African swine fever virus,” Madden said. “Work in a BSL-3 setting requires careful planning and a significant amount of attention to detail. Materials must be handled in very specific ways to maximize safety, and meticulous records and inventories must be maintained for everything I do.”

Sizzling bacon, smoky pulled pork, mouthwatering barbecue ribs and even the holiday ham could disappear from meals of African swine fever virus ever made its way to the U.S. While the disease does not affect human health, it is nearly 100% fatal to pigs in less than two weeks and could cause billions of dollars in economic damage for U.S. producers. An outbreak would have lasting effects on the pork industry.

“The only way to combat the most threatening agents to the world’s food supply, including swine fever viruses and many other pathogens, is widespread,” said Julie Johnson, BRI biosafety officer and assistant vice president for research compliance. “If we don’t have those things in place, we are valuable to the U.S. pork industry. Pigs can be the first biosafety level 4, or BSL-4, facility with the capability to handle livestock as part of its research. The proximity to K-State and research partnerships will help students make important career connections.”

“Training to work in the BRI enabled me to conduct my research on African swine fever virus,” Madden said. “Work in a BSL-3 setting requires careful planning and a significant amount of attention to detail. Materials must be handled in very specific ways to maximize safety, and meticulous records and inventories must be maintained for everything I do.”

Daniel Madden, master’s student in veterinary biomedical sciences, uses personal protective equipment while he practices working with samples in a biosafety cabinet, an important piece of critical safety equipment.
Sustaining hands-on training

In the last 10 years, more than 400 people have been trained at the BRI to work in bioscience, including more than 25 postdoctoral researchers, more than 80 graduate students and more than 200 undergraduate students. They must complete about 50 hours of training, including online classes, tutorials and hands-on work in the training lab, followed by both written and practical exams. The training lab portion includes emergency response practice and mimic a real working lab.

New researchers learn how to properly dress in personal protective equipment, which includes gloves that are taped to protective sleeves; and many other steps to ensure safety said Cheryl Doert, associate professor in animal science.

‘Tyde Johnson and her team do a fantastic job training people to work in those kinds of labs,’ Doert said. ‘They do all of that in the training lab before they ever enter a containment lab.’

K-State leader Nancy Jaax, College of Veterinary Medicine alumna and inventor of the pathogen detector, said the college’s training lab allows students and researchers to practice procedures with mock samples before they enter a lab with actual infectious agents.

‘The training lab was Nancy Jaax’s idea,’ Johnson said. ‘Nancy sensed that we needed hands-on training to be effective.’

Nancy Jaax became a well-known, confident and capable leader in the field of infectious disease research. Jaax is one of the few researchers in the world who can work with BSL-4 organisms safely.

‘The BSL-4 agriculture research space is designed as a box within a box, from fresh inoculated media to a suite of emulsiﬁed droplets and disposable gloves, gowns, gloves, face masks and a powered air-purifying respirator,’ Johnson said.

After extensive training, there are numerous steps to enter a biosafety level-3, or BSL-3, lab. In the entry process, experts must remove all personal items, including jewelry, and change into containment-level clothing and shoes. They said Tyde uses or other lab-permitted personal protective equipment, such as a powered air-purifying respirator and double gloves, to enter a biosafety level-3 lab. He puts on a Tyvek suit, double gloves, lab-dedicated clothing and a powered air-purifying respirator.

Above: In the safety of the training lab, Daniel Madden, master’s student in veterinary biomedical sciences, follows each step required to enter a biosafety level-3 lab. He puts on a Tyvek suit, double gloves, lab-dedicated clothing and a powered air-purifying respirator.

Barrier to human error

Working with economically devastating pathogens requires a very strong education in the concepts of safety and security, which is integrated throughout the BRI. Like in any lab, the BRI has layers of security, from the outside gates and the technological firewall to the security cameras and 24/7 video recording.

‘All the training and guidelines that are put in place are because people are human,’ Johnson said. ‘The facility has layers of safety and the way it is designed offers multiple backups.’

Even the air movement in the building has extensive backup systems. Researchers work inside a biosafety cabinet, which has no air pressure so air does not come from the outside. It prevents any aerosols in the air from getting out of the cabinet, which also has high-efficiency particulate air, or HEPA, filtration. As a backup, the laboratory mail has the same setup with negative air pressure and HEPA filters to keep the air moving in one area, according to Johnson.

All of those protocols in the BSL-3 and BSL-4 labs give students hands-on experience, help them build their research and secure their future in battling diseases and securing the nation’s food supply.

‘The training I received here has been invaluable to me,’ Madden said. ‘It gave me the knowledge and the lab experience to work with various types of agents only in biosafety cabinets, which have negative air pressure and HEPA filters to clean the air many times in an hour, according to Johnson.

‘The building’s heightened cybersecurity provides unique personal access. Each researcher can be issued a personal badge and given a unique personalized access. Each researcher can easily go to the bioscience lab and see experimental lab space. The building’s heightened cybersecurity provides unique personal access. Each researcher can easily go to the bioscience lab and see experimental lab space. The building’s heightened cybersecurity provides unique personal access. Each researcher can easily go to the bioscience lab and see experimental lab space. The building’s heightened cybersecurity provides unique personal access. Each researcher can easily go to the bioscience lab and see experimental lab space.'
Some say great minds think alike, but bringing a diverse group of people together with different backgrounds, educational experiences and interests can result in even better solutions to big problems.

This is the idea behind a new Kansas State University effort that’s connecting researchers with a range of expertise to graduate students and communities in western Kansas. Together, they are addressing water shortages that threaten the agricultural economy, the lifeblood of those communities.

The five-year project is made possible by a $2.9 million National Science Foundation Research Traineeship, or NSF NRT, Program grant, which is the first ever awarded in Kansas. As part of the project, researchers in engineering, agricultural economics, sociology and communications are training 50 graduate students who are addressing such challenges as the declining Ogallala Aquifer and the implications for agriculture and affected communities.

Melanie Derby, associate professor in the Alan Levin Department of Mechanical and Nuclear Engineering, leads the project, which is in its first year. Her collaborators come from the Carl R. Ice College of Engineering, the College of Arts and Sciences, the College of Agriculture and K-State Research and Extension.

“Our aim is to create sustainable rural communities in western Kansas and beyond,” said Derby, also the Hal and Mary Siegele professor of engineering. “Our research focuses on engineering new technologies, such as water conservation, natural fertilizers with microbes, and reactors that transform animal waste into power. We are using economics and sociology to figure out how to create these technologies in a way that people will use them.”

The word interdisciplinary is used a lot in reference to the project. The researchers are creating interdisciplinary graduate classes in which the students conduct interdisciplinary research.

“Interdisciplinary is the idea that mechanical engineers, like me, can learn a lot from other engineers, sociologists and economists,” Derby said. “By working together, we can come up with better solutions than on our own.”

Piece by piece, drop by drop

A range of perspectives helps rural Kansas communities address water shortages

By Mary Lou Peter
‘A reason for optimism’

Next summer, the first cohort of 17 graduate students plus Manhattan-based faculty will spend time in southwest Kansas, where they’ll get a firsthand view of the water-related challenges that communities face. They will work with Jonathan Aguilar, associate professor of biological and agricultural engineering and K-State Research and Extension specialist who is based at the Southwest Research and Extension Center in Garden City. Aguilar is involved in programs that help farmers with water conservation and efficient use of available water.

As co-principal investigator on the project, Aguilar encourages the students’ data collection activity, arranges interactions with farmers, community leaders and other stakeholders; and plans other activities that provide a close look at the situation.

“This is particularly important since at least a third of Kansas’ agricultural revenue comes from the southwest Kansas area where the Ogallala Aquifer is found,” he said.

Matt Sanderson, co-principal investigator and the Randall C. Hill distinguished professor of sociology, anthropology and social work, said his role is to better understand barriers and opportunities for water conservation from a social science perspective.

“Much time and effort has been devoted to solving groundwater depletion in western Kansas and the Ogallala Aquifer more broadly,” he said. “The ability to bring together a new generation of top graduate students from across the sciences to work collaboratively and holistically on this problem is a reason for optimism.

“Water conservation in semiarid, groundwater-based communities is a systemic issue that requires moving graduate students from across their disciplines so that they have the time and space to develop a more inclusive perspective that can grasp the social, economic and technical aspects of the problem, all in relation to each other.”

“This sort of thinking, called systems thinking, requires meaningful conversations between people from different fields, so that the group moves forward as a whole,” Sanderson said. “These skills are becoming more important in academia and industry.”

Solutions to declining water

Other co-principal investigators on the project are Prathap Parameswaran, assistant professor of civil engineering, and Stacy Hutchinson, professor of biological and agricultural engineering and associate dean for research and graduate programs.

As part of the effort, Hutchinson, Parameswaran and their graduate students are working at the interface of environmental and water resources engineering.

“As environmental engineers, we work to develop new water treatment technologies that allow us to recover nutrients and clean water from different water streams. These technologies improve our access to usable water while assisting with food production,” Hutchinson said. “As water resource engineers, I look to understand the amount and use potential of different water resources, including natural riparian ecosystems, recovered water and groundwater systems.”

Hutchinson is working with Emily Nottingham, master’s student in biological and agricultural engineering, to study fertilizer and modeled data to assess soil moisture.

“Surface soils are a huge storage reservoir for water,” Hutchinson said. “Traditionally, we have studied inputs of water into the soil, such as rainfall and irrigation, and outputs from the soil, such as evapotranspiration and plant water use. Using new data sources, we are tracking the actual amount of water stored in the soil and looking to better understand long-term trends and potential impacts from climate change.

By developing a better understanding of available water storage in the soil profile, the team can help develop plans for managing a declining water source and assisting with climate change mitigation and adaptation,” Hutchinson said.

For another engineering perspective, Yeili ‘Zoe’ Hu, doctoral student in civil engineering, recently completed a study on declining groundwater storage in Kansas as part of the High Plains Aquifer, which includes the Ogallala Aquifer, in relation to irrigation applied. She is starting a new study that uses dynamic network modeling to understand how weather, transportation and crop diseases affect corn, cotton products and, ultimately, consumers.

Supporting vibrant communities

Gates Flock, associate professor of agricultural education, leads the project’s educational programming for graduate students who are pursuing master’s or doctoral degrees. As the project moves forward, the doctoral students serve as mentors for the next group of master’s students. These students also are trained to work with agricultural teachers, legislators and the general public to inform them about the research to conserve the Ogallala Aquifer and other water sources.

“We’re a land-grant institution and we have to solve problems in the state,” Flock said. “We’re doing the research and we have the extension and educational piece. Tax dollars that go toward supporting K-State are going back into supporting Kansans.”

Bringing people together from different disciplines is key to addressing issues such as irrigation efficiency. Aguilar said. He noted how engineering can only improve efficiency up to 100%, and most irrigation systems in use are already in the 80% to 95% efficiency range.

“The rest of the gains that a farmer could get would have to come from things like improved genetics, better nutrient and water management, improved agronomic practices, shifting to crops that need less water, managing input costs and better crop marketing,” Aguilar said. “An interdisciplinary team is needed to make this possible.”

Aguilar isn’t alone; other researchers agree in the team approach.

“When we go to solve these problems, hopefully we’re not missing solutions because we have a broader view of the situation,” Flock said.

“If sustaining vibrant, resilient communities is a key goal for citizens in western Kansas, then they should know the state’s land-grant institution is working hard, with the support of the National Science Foundation, to develop new approaches for solving the challenges of water conservation,” Sanderson said. 

What students are saying

The National Science Foundation Research Training, or NSF-NRT, Program is the first of its kind in Kansas. The project helps current graduate students to find interdisciplinary solutions to problems throughout the state. Read what some of the students involved in the program are saying.

“A seminar recently introduced me to interdisciplinary thinking and research. It disoriented me, but it was also a powerful experience. It brought me to realize that people from different backgrounds together can solve difficult problems.” — Jordan Moreva, doctoral student in mechanical engineering

“I believe to meet the demands of global scale in this fast-paced world, interdisciplinary research plays a crucial role.” — Nicholas Faith, doctoral student in chemical engineering

“These experiences will provide me with field knowledge as well as skills necessary to work in an interdisciplinary workplace. Our findings will provide additional information on the feedback loop of water resources and land use policies that are currently in place.” — Yeili ‘Zoe’ Hu, doctoral student in civil engineering

About the Ogallala Aquifer

The Ogallala Aquifer is a vast underground reservoir that underlies about 133 million acres under parts of Colorado, Nebraska, Kansas, South Dakota, Texas, Oklahoma, New Mexico, Arkansas, North Dakota, Illinois and Wisconsin. In part of the High Plains Aquifer, the Ogallala Aquifer is found beneath parts of Colorado, Kansas and Texas. The Ogallala Aquifer is the most abundant source of water in the region, but it is depleting faster than it is replenishing.

# Seek more
Read more about the Ogallala Aquifer: k-state.edu/seek
We can see plasticity in the world around us. It might look like this: A student studying for a test. An adult adjusting to a hearing aid. A driver trying to remember where the car is parked. A zebrafish memorizing a place with tasty food. A rat learning self-control.

Plasticity is how the brain changes with experience, learning or age. It can be a positive change, such as a child learning the alphabet or an adult choosing a salad instead of a sandwich. But plasticity also can have a negative side, such as a person struggling with alcohol abuse or suffering from a degenerative disease.

“Plasticity can be good and it can be bad, but both are important and that’s why we need research on both sides of the coin,” said Kimberly Kirkpatrick, Kansas State University distinguished professor of psychological sciences. “It’s important to understand why the brain changes because it can help with disease treatment or countermeasures.”

Plasticity is the research focus of the Kansas State University Cognitive and Neurobiological Approaches to Plasticity Center, or CNAP.

CNAP is a statewide effort led by K-State to help us understand our changing brains and improve our quality of life. While the center is housed in the K-State psychological sciences department, it involves interdisciplinary researchers from the College of Arts and Sciences, the Carl R. Ice College of Engineering and the College of Veterinary Medicine. CNAP also includes collaborators at the University of Kansas and Wichita State University.

The National Institutes of Health recognizes the importance of neuroscience research and, in 2017, funded CNAP with a prestigious $10.6 million Centers of Biomedical Research Excellence, or COBRE, grant. This is the largest grant in the history of the psychological sciences department and is only the second time the university has received a COBRE grant. Now early in its third year, the center continues to develop and grow.

“Plasticity is the glue that fits it all together,” Kirkpatrick said. “Everything relates to brain processes, brain health and plasticity in terms of changes that happen in the brain over time or with experience.”

In addition to supporting research, the grant also has funded laboratory upgrades, including a surgery unit, a new histology laboratory and other equipment. The renovations total more than 2,100 square feet in Bluemont Hall and the upgrades have led to new research possibilities.

“These significant improvements in our infrastructure have opened the door to people performing techniques they couldn’t do before,” Kirkpatrick said. “It is even more important, and now we can recruit top-of-the-line faculty, graduate students and foundational researchers.”
Kirkpatrick is studying behavior in rats and humans to understand how self-control affects the brain. Through time-based interventions, Kirkpatrick’s team has found that one can plan to wait for a larger treat rather than have a smaller treat immediately. Now the team is doing similar behavioral work with humans through computer games, activities and smartphone apps that help people practice self-control.

Through diet-related research, Kirkpatrick has found rats that eat high-fat and high-sugar diets are more likely to engage in impulsive behavior. Through her work with rodents, she has found that rats raised in an enriched environment with toys and social interaction have lower drug and alcohol intake as adults. Kirkpatrick also has found that rats raised in an enriched environment are very sensitive to the taste of alcohol and sugar water.

“We know that the early rearing environment causes brain changes, but it’s really novel that it also may be altering taste,” Cain said. “That may have implications for alcohol use in adulthood as well.”

By looking at images of the brain, Cain can better understand how the structure of the brain, specifically parts of the naris themselves, can affect alcohol use in adulthood. Her work also applies to humans.

“Our research shows that any kind of enrichment provided during childhood is protective against drug and alcohol use in adulthood, and that’s a result of plasticity changes,” Cain said. “Early life enrichment is really important.”

Comparing the brain
One of the best model systems for studying the human brain is a small, 2-inch minnow: the zebrafish. That’s one of the best model species for understanding the human brain.

“Just like humans, our pets have emotions,” Mueller said. “But my research shows that the neurocircuits and the amygdala of the zebrafish are not only very complex, but also stunningly similar to that of the mammalian brain, much more similar, in fact, than previously imagined.”

Mueller’s research group is now using a CNAP pilot grant and part of a $1.3 million Human Frontier Research Foundation grant for an international collaboration to better understand how spatial and associative learning are organized in zebrafish and other fish.
Imaging the brain

But important functional and anatomical brain research is only as good as the images you can capture. In fact, CNAP has fostered collaboration in new imaging technologies. As part of the center’s mission, Mueller and Cain are working with Stefan Bossmann, university distinguished professor of chemistry. Bossmann’s team specializes in state-of-the-art imaging of neurons using a National Science Foundation-funded instrument called an fMRI, which analyzes chemical compounds in the brain.

The partnership also involves Punit Prakash, the Paul L. Spainhour professor in the Mike Wiegers Department of Electrical and Computer Engineering, who is creating better ways to evaluate the images and data.

Bossmann uses a 600-megahertz MRI to capture incredibly detailed images — around 100 micrometers in resolution — of the zebrafish and rodent brains to show what parts of the brain are activated in specific situations. The technique is called diffusion tensor imaging, or DTI, and measures signals between neurons. This preliminary DTI image has different colors to show the different directions that fluid flows within the tissue. (Image credit: Tej B. Shrestha and Macy Payne)

Training the brain

As our brains process sights and sounds, CNAP scientists use EEG to study neural activity as it is happening. With EEG, short for electroencephalography, participants wear a special cap with noninvasive electrodes that detect electrical activity in the brain. Matthew Womanski, assistant professor of psychological sciences, and Aleksandra Zakrzewski, research assistant professor of psychological sciences, are developing new EEG facilities to study how our brains process what we see and what we hear.

Womanski studies auditory learning and his work aims to train people to hear fine details in sound. For his projects, participants wear an EEG cap while they are in a sound booth listening to sounds through earphones. The EEG provides a measurement of how the brain reacts to sound before and after training exercises, as well as the extent to which individuals put effort into listening.

“We’re measuring their ability to hear details in sound over the course of training,” Womanski said. “We want to know what types of training are most effective for changing the brain and improving listening performance. These procedures can then be used to train listening skills with hearing aids or cochlear implants.”

Zakrzewski’s research focuses on metacognition, which is how we think about our own thinking. Her work can help people who are struggling with addiction or who might have poor cognitive ability and not know they are struggling.

“Metacognition is really useful for how we might monitor our judgments and control our behavior,” said Zakrzewski, who also leads the EEG facility. “I’m interested in metacognitive accuracy, or how well we know when we’re right or wrong.”

Zakrzewski has participants make confidence ratings during perceptual or memory tasks and uses EEG imaging techniques to capture metacognition in the brain. She is building training programs to help people improve their metacognitive abilities so they can change or adjust their behaviors.

Left: EEG, short for electroencephalography, shows neural activity as it is happening. Participants wear a special cap with noninvasive electrodes that detect electrical activity in the brain.

Below: Matthew Womanski, assistant professor of psychological sciences, and Aleksandra Zakrzewski, research assistant professor of psychological sciences, study how our brains process what we see and what we hear.
The brain

Research at the Kansas State University Cognitive and Neurobiological Approaches to Plasticity Center, or CNAP, addresses many regions of the brain. CNAP involves more than 63 collaborators working on a variety of projects in these brain regions.

Informing the brain

The research generated from the large amounts of EEG data and high-resolution images of the brain requires a lot of computer power. Enter Beocat, the high-performance computing cluster at K-State. Beocat is the most powerful supercomputer in Kansas and is 4,000 times more powerful than the average laptop.

"Research is becoming dominated by big data and interdisciplinary teams, and CNAP is a model for this type of interaction," said Dan Andresen, professor of computer science and director of the Institute for Computational Research. "You can have the best ideas and the best researchers, but they aren’t going to get their research done unless they have an environment that can handle it."

Beocat’s large processing capacity already has made a difference for CNAP research: Data analysis that used to take days can now be done in hours. Researchers can easily crunch numbers and transfer data to collaborators.

K-State computer scientists are developing new analytic methods for the massive amounts of data and images that CNAP researchers collect. Data analysis that used to take days can now be done in hours.

"It is a great experience for these computer science students because they are taken out of their engineering bubble and get interdisciplinary real-world experience," Andresen said. "Science is becoming more digitized and more data dependent. That’s where we come in."

Seek more

Learn more about CNAP with additional photos and graphics. Listen to a new K-State Global Food Systems podcast, “Something to Chew On,” which features an episode on CNAP research.

Cerebellum
This region is key to cognitive flexibility in autism spectrum disorders, which is a focus of CNAP research.

Hippocampus
CNAP researchers are studying how environmental enrichment and alcohol exposure affect learning and memory processes in this region.

Dorsal striatum
Several CNAP projects focus on fine motor control in Parkinson’s disease as well as interval timing in attention deficit hyperactivity disorder, known as ADHD, and diet-induced impulsivity.

Prefrontal cortex
This key brain region is the focus of many CNAP projects that examine memory decline, self-control, drug abuse, decision-making, post-traumatic stress disorder, cognitive flexibility and the role of experience and knowledge in aging.

Anterior cingulate cortex
CNAP researchers are examining deficiencies in reward expectancy in post-traumatic stress disorder.

Corpus callosum
CNAP researchers are examining how environmental enrichment and acoclit exposure affect the communication between brain hemispheres.

Nucleus accumbens
CNAP researchers study emotional processing and fear learning, which can be impaired in post-traumatic stress disorder.

Insular cortex
This area is involved in awareness of internal bodily sensations, and a CNAP project focuses on how it relates to regulating eating.

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Visual cortex
CNAP researchers are studying visual perceptual learning to develop strategies to help older adults maintain driving skills.

Substantia nigra pars compacta
CNAP researchers are examining how Parkinson’s disease affects fine motor control.

Amygdala
CNAP researchers are examining how environmental enrichment and alcohol exposure affect learning and memory processes in this region.

Insular cortex
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Right: Beocat is the high-performance computing cluster at K-State and is the most powerful supercomputer in Kansas. Below: Dan Andresen, professor of computer science, right, and his team are developing new analytic methods for the massive amounts of data and images that CNAP researchers collect.

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K-State寻求

了解更多关于CNAP的额外照片和图形。收听K-State Global Food Systems播客的新一集“Something to Chew On”，其中包含关于CNAP研究的一集。

Cerebellum
这个区域是自闭症谱系障碍认知灵活性的关键，这是CNAP研究的一个重点。

Hippocampus
CNAP研究人员正在研究环境丰富和酒精暴露对学习和记忆过程的影响。

Dorsal striatum
几个CNAP项目关注帕金森病中精细运动控制问题，以及注意力缺陷多动障碍（ADHD）和饮食诱导冲动性。

Prefrontal cortex
这个大脑区域是许多CNAP项目研究记忆衰退、自我控制、药物滥用、决策制定、创伤后应激障碍、认知灵活性以及经验和知识作用的焦点。

Anterior cingulate cortex
CNAP研究人员正在研究奖赏期望的不足在创伤后应激障碍中的作用。

Corpus callosum
CNAP研究人员正在研究环境丰富和酒精暴露如何影响大脑半球之间的交流。

Nucleus accumbens
CNAP研究人员正在研究情绪处理和恐惧学习，这些功能可能在创伤后应激障碍中受损。

Insular cortex
此区域涉及对内部身体感觉的意识，并且一个CNAP项目关注如何与调节进食相关。

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AUTOMATION IN THE FIELD

Robots, drones are becoming agriculture's modern-day workhorses
By Pat Melgares
of corn, and then immediately treating images of infected plants, such as this row tractors will be capable of taking infrared detect diseases and pests on plants. The tractors that can move through a field and Page 31, bottom: K-State is studying and casing for motorized wheelchairs. 

part of a test on the K-State Agronomy programs may do some of the work and give farmers a glimpse at agriculture of the not-too-

seeking to study the use of robots to detect and defeat insects in crop fields. The nation’s farmers spray nearly $15 billion worth of chemicals annually, yet still lose 37 percent of their crop yields to pest damage, according to the USDA.

Large robots, some the size of farm mowers and others the size of bed frames, are capable of more conventional farming work, such as pulling disc drills for wheat, scouting fields and planting fields. Flippo’s team is building a second category of ground robots that is slightly bigger than the rovers. These are the robots designed for monitoring larger areas of a field, such as sloped hills, where a larger tractor can’t go safely.

There are different categories that we are building,” Flippo said. “The first is the rover category. This would be like a microwave-size robot. Their purpose is to get out and start a field, which is important because while humans can scout really well, nobody wants to walk around a field all day.”

When entomologists go out to look for pests in a field, they may look at two or three spots and make a judgment about the whole field. Rovers can cover the entire field, perhaps even working through the night, and provide data on pests.

“We are trying to make robots much more adaptive and have the sensing capability to do things differently,” Flippo said. “For example, if a robot detects a pest, it can change its location and run between rows to find other areas with pests.”

Therein lies an opportunity for universities like K-State, which in recent years has built considerable momentum toward incorporating technology on America’s farms.

Seek Fall 2019 k-state.edu/seek

Above: A small robotic tractor, measuring about 2 feet tall, enters a row of corn as part of a test on the K-State Agronomy North farm.

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Sharda said spraying from below the crop canopy helps to contain more of the chemical where it’s needed and reduce spray drift. Ultimately, that means less chemicals used and less cost to the farmer.

Eye in the sky

Sharda also is leading a project to use unmanned aircraft, best known as drones, to scout crop fields for water stress. The four-year project is helping farmers schedule irrigation more efficiently because they better understand field areas that are more stressed than others.

The researchers have mounted thermal infrared cameras to the drones, which fly several hundred feet above the field. The cameras measure canopy temperature throughout the field and send volumes of information to a computer on the ground that formats the data into a model to give the farmer irrigation guidance.

Eventually, Sharda said this system could be combined with information from the ground robots to give farmers an even clearer picture of their crops’ water needs.

K-State also is developing drone technology to detect insect pressure in crop fields.

“K-State is really good at getting seed in the ground fast, but maybe this is the time to rethink it. What does it really take to get those seeds in the ground?” Flippo said. “Just think if we could have a bunch of small robots going out to do that work. They just go out, cover the entire field and get the work done.”

Shrinking workforce

Statistics on farm labor indicate that the industry may need help. A 2013 report by the USDA-funded National Agricultural and Rural Development Policy Center indicates that agriculture is vulnerable to “labor supply shocks, which could increase costs and threaten the ability of some farmers to harvest labor-intensive crops.”

The report also noted that 35% of people employed on farms perform an estimated 60% of the work. The reality for U.S. agriculture is that it may be faced with a shrinking workforce, but newer technology can help.

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Measuring smoke

Kansas State University researchers are aiming high — 1,200 feet in the air, to be exact — to understand how smoke affects air quality when landowners conduct prescribed burns on the state’s prairie.

A research team is flying unmanned aircraft into the heart of the fire to determine what pollutants are contained in the plume of smoke, which can travel for hundreds of miles.

“The two pollutants of concern are ozone precursors, which chemically react with the moisture and sunlight to form ozone, and PM2.5, which consists of tiny particulates of soot that cross the membranes in the lungs,” said Carol Baldwin, a K-State Research and Extension associate in Agriculture, Natural Resources and Community Vitality.

Baldwin has teamed with the Applied Aviation Research Center at the Kansas State University Polytechnic Campus to fly unmanned aircraft, or drones, through the tips of the smoke plume — 1,200 feet in the air — and measure pollutants.

The researchers use three drones that are armed with a sophisticated set of sensors and hover through the plume of smoke to send information back to computers on the ground. The researchers have conducted the tests during four prescribed burns.

Travis Balthazor, flight operations manager, said the project is especially complicated because the crew has to manage communication for three drones flying simultaneously into a smoke plume, near fire and at high altitudes.

“‘It’s a new way of sampling safely,’ Baldwin said. ‘No one has to be that close to the fire. It is collecting relevant data from the plume as it leaves the fire, rather than from a sensor that is 12 feet off the ground on a tower.’”

The project helps to support the Kansas Flint Hills Smoke Management Plan, which was developed by the Kansas Department of Health and Environment and other stakeholders to minimize the effects of smoke from prescribed burning on large population areas.

K-State Polytechnic researchers are assisting on a project that uses unmanned aircraft, or drones, to measure pollutants from prescribed fires in Kansas.

K-State students work at the Kansas River Valley Experiment Field near Topeka and fly drones nearly 400 feet over corn fields to detect water and insect stress.

The drones being used to detect water and insect stress are packed with sensors, cameras and other modern technology.
Connecting night and day

Engineers help families monitor children’s sleep quality

By Jennifer Tidball

A Kansas State University engineering team is developing smart beds to understand a child’s sleep.

The research team from the Carl R. Ice College of Engineering has created a collection of bed sensors and support software to help monitor the health and sleep quality of children with special needs. By comparing nighttime sleep data to daytime behavioral data, these engineers are helping Kansas parents and caregivers develop personalized care for children with special needs.

“We want to help improve the quality of care for these children,” said Steve Warren, project leader, professor and Robert and Becca Riesberger Cornerstone Teaching Scholar in the Mike Waege Department of Electrical and Computer Engineering. “Our goal is to use technology to monitor nighttime well-being and understand how a child’s sleep quality affects their daytime well-being, including their behavior and ability to learn.”

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For the project, the K-State team partnered with Heartspring, a Wichita-based nonprofit organization that has a residential and day school program. Heartspring serves students who often have multiple diagnoses, including autism spectrum disorders, cerebral palsy, speech and language impairments, and other developmental disabilities.

Charles Carlson, teaching assistant professor of electrical and computer engineering, sets up a smart bed for several Heartspring group homes. Each smart bed supports film sensors under the mattress and load sensors under the bedposts. The sensors are hidden and unobtrusive, so they do not disrupt a child’s sleep. Every night, these sensors gather health and sleep quality data, including heart rate, breathing rate, movement, center of position on the bed, sleep cycles and how often a child gets in and out of bed.

The team also has worked with Heartspring paraeducators to record instances of child behavior during the day, such as aggressive behavior or tantrums.

Once they have gathered the nighttime and daytime data, researchers, like Bala Natarajan, the Clair N. Palmer and Sara M. Palmer professor of electrical engineering, work on algorithms to correlate these data sets.

Beyond monitoring sleep quality, the smart beds and sensors have the potential to help in other important areas, such as predicting nighttime seizures. The smart beds also may make it easier for caregivers and parents to monitor a child’s health and safety at night in a way that doesn’t require checking on them every 15 minutes or sleeping in the same room.

“One aspect is that these systems can be installed or even set up in someone’s home,” said David Thompson, assistant professor of electrical and computer engineering. “We can help parents and families.”

Other researchers on the team include Charles Carlson, teaching assistant professor of electrical and computer engineering; as well as Alaleh Alivar and Ahmad Suliman, both 2019 doctoral graduates in electrical engineering.

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Other researchers on the team include Charles Carlson, teaching assistant professor of electrical and computer engineering; as well as Alaleh Alivar and Ahmad Suliman, both 2019 doctoral graduates in electrical engineering.

“It was an amazing opportunity to work on this project that has so much potential to positively impact the lives of the children at Heartspring,” Carlson said. The research began years ago as senior engineering design projects led by Warren; Punit Prakash, the Paul L. Spainhour professor of electrical engineering; and other university engineering faculty members. Past student projects have developed customized devices and software, such as smartphone tools and apps to help paraeducators, wearable sensors for children’s shoes and clothing, and educational games.

The K-State engineers have used the funding to develop working smart beds for several Heartspring group homes. Each smart bed supports film sensors under the mattress and load sensors under the bedposts. The sensors are hidden and unobtrusive, so they do not disrupt a child’s sleep. Every night, these sensors gather health and sleep quality data, including heart rate, breathing rate, movement, center of position on the bed, sleep cycles and how often a child gets in and out of bed.

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Fishing for answers

Why fish and their habitats lure biologist

By Beth Bohn

Keeping fish from being out of water is what drives Keith Gido in his award-winning research to protect native fish species and preserve natural waterways.

The Kansas State University distinguished professor of biology leads the Fish Ecology Lab, where the focus is on the conservation of native species in the western and central U.S. Gido and his team in the College of Arts and Sciences study fish ecology, invasive species effects and fish assemblage structure.

In this work, Gido has contributed significant findings to his field with more than 120 peer-reviewed publications. His undergraduate and graduate student mentees work for state and federal natural resource agencies, academic institutions and private consulting firms. He has received notable honors, including the 2015 Fisheries Excellence Award from the North Central Division of the American Fisheries Society and the 2013 Donald Triplett Research Excellence Award from the Southeastern Association of Naturalists.

He recently earned the highest faculty ranking of university distinguished professor from K-State for excellence in research and teaching.

Gido said his love of the outdoors, particularly activities associated with water, such as fishing, boating and cutting, drew him to his field.

“A primary motivating factor for my research is to provide science aiding in fish conservation and the preservation of the natural waterways where they live,” Gido said.

That motivation is seen in his latest projects. With funding from the National Park Service, Gido and his team are evaluating how large predatory fish that escape from ponds during flooding affect the diversity of native fish species in streams.

“We are measuring the rate at which the large predators escape from ponds and then testing how they change the behavior of fish using an experimental stream facility,” Gido said.

A second study evaluates offering fish passages across barriers such as dams that block migration. The most of the work is funded through the U.S. Bureau of Reclamation and is taking place on the San Juan River in New Mexico and Utah.

“We implant fish with radio transmitters and move them above the barriers,” Gido said.

“We then track their movements and quantify if they move back downstream or stay above the barrier. A final project is testing how a highly abundant fish and bottom feeder, the gizzard shad, stay above the barrier. The project is being done with the Kansas Department of Wildlife, Parks and Tourism. With a career devoted to preserving fish species, it’s no surprise Gido isn’t hooked on just one species.

“There are more than 25,000 species of fish on Earth,” Gido said. “Rather than have a favorite, I enjoy the diversity of species and amazing adaptations they all have to survive.

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I decided to go back to school to get an economics degree from the University of California at Davis came to K-State after earning a Master of Business Administration program.

Jessica Davis is an award-winning student in the Master of Business Administration program. By Beth Bohn

It hasn’t taken Master of Business Administration student Jessica Davis long to earn accolades for her research, classroom work and teamwork.

Since starting the Kansas State University MBA program in spring 2018, Davis has helped develop a sales forecasting model that a national restaurant chain is using, presented her research at a national conference, and was on a two-placing team at the 2019 Big 12 MBA Case Competition.

Davis came to K-State after earning a bachelor’s degree in economics from the University of California at Davis came to K-State after earning a Master of Business Administration program.

When it comes to producing scholars in undergraduate research, Kansas State University goes for the gold. The two K-State 2019 Barry M. Goldwater scholarship recipients reflect the commitment that the university is making to provide an inclusive environment that welcomes and encourages outstanding diverse scholars in STEM, which stands for science, technology, engineering and math.

“Preparing these scholars through research involved working on teams,” said Peter Drobits, vice president for research. “Diverse teams will almost always develop the most creative and successful solutions to critical problems that confront them during their research.”

The Goldwater scholarship is a prestigious national undergraduate scholarship for students interested in research careers in engineering, mathematics or the natural sciences. Awards receive up to $7,500 annually for college-related expenses.

Read more about the K-State scholars from the College of Arts and Sciences and the Carl R. Ice College of Engineering.

STM stars

Three Goldwater scholars pursue research careers

By Taylor Provine

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Industrial hemp

Jason Griffin is the director of the John C. Pair Horticultural Center, which is a K-State Research and Extension research center near Wichita. Griffin explains, in under 100 words, what industrial hemp is and why Kansas State University is studying it.

Industrial hemp is not marijuana, but it is the legal and nonintoxicating version of cannabis. It can be harvested for its valuable stem fibers that can be used in many products, from clothing to building materials. The seed, or grain, can be pressed for oil or used in numerous culinary endeavors. Some industrial hemp varieties produce elevated concentrations of oils called cannabidiol, or CBD, oil. This oil is extracted and used in various, popular CBD products. We are researching industrial hemp to provide farmers with science-based recommendations for production of this exciting new crop.

Automation of the past

Agriculture is always advancing, from new methods to new machinery. In this 1926 photo from K-State Research and Extension, a horse-driven agricultural seed drill cuts rows and inserts alfalfa seed in the same pass. The seed drill was a development that saved time and reduced seed waste. See page 28 to learn how Kansas State University has continued to improve agricultural practices from workhorses to modern technology, including robots and drones.

Photo courtesy of the Richard L. D. and Marjorie J. Morse Department of Special Collections.
Food for tomorrow

We all need to eat. As the country’s first operational land-grant university, Kansas State University has been feeding the world for more than 150 years and continues this important work through the Global Food Systems Initiative.

Research at K-State is ensuring that we all have food for tomorrow, from developing precision agriculture to training the next generation of scientists at the Biosecurity Research Institute. Read this issue of Seek to learn more.

Seek more

Learn how K-State research is influencing tomorrow.

k-state.edu/seek
k-state.edu/influence-tomorrow