Welcome home
Architecture students tackle housing crisis

A pandemic battle
Scientists take the lead on COVID-19

The hemp frontier
Research pioneers study a new crop
A different vein

This close-up view of an industrial hemp leaf comes from a Cannabis sativa L. variety that is growing at the John C. Pair Horticultural Center, which is a K-State Research and Extension research center near Wichita.

Hemp is a broadleaf plant often grown and harvested for its fiber and grain. This makes it useful for a variety of potential products, such as food ingredients, fibers, and cattle feed.

While industrial hemp is related to marijuana, hemp is legal to grow because it contains low to no tetrahydrocannabinol, or THC. See page 36 to learn how Kansas State University industrial hemp research is helping farmers across Kansas learn how to grow this new crop.
As African swine fever spreads worldwide, scientists protect U.S. industry

As African swine fever spreads worldwide, scientists protect U.S. industry.

As African swine fever spreads worldwide, scientists protect U.S. industry.
Polytechnic team awarded for innovation, economic engagement

The Kansas State University Applied Aviation Research Center and professional education and outreach team of the K-State Polytechnic campus have received an Innovation and Economic Engagement Award of Excellence.

The K-State award recognizes faculty and staff, centers, institutes and units engaged in work that advances innovation and the economic prosperity of the region and recognizes exemplary economic engagement efforts, generation and usage. This award was announced in 2017 when K-State was named an Innovation and Economic Prosperity University by the Association of Public and Land-grant Universities.

The Applied Aviation Research Center offers professional unmanned aircraft training. This training provides access to the university’s researchers and expands technology knowledge and utilization (innovations) across Kansas. Kurt Carraway, unmanned aircraft systems executive director of the Applied Aviation Research Center and Kirsten Zoller, director of professional education and outreach, lead the team.

“The award winners are leveraging the resources that K-State offers in a unique way to grow the aviation industry,” said Peter K. Dorhout, vice president for research. “Their work equips students with immediately impactful skills through providing accessible, practical learning in a manner in which industry professionals, entrepreneurs and fellow educators can benefit.”

Making water, nutrients go further on the Great Plains

New research from Kansas State University and collaborators is boosting crop yield potential. Kansas State University Agricultural Research Center and collaborators are leading a multiagency team focused on improving water and nitrogen use efficiencies and improving soil health in the semiarid southern Great Plains.

Chuck Rice, a distinguished professor of agronomy in the College of Agriculture, is leading the nearly $10 million five-year research effort, which includes an interdisciplinary team from the U.S. Department of Agriculture Agricultural Research Service, Oklahoma State University and the University of Maryland. The USDA National Institute of Food and Agriculture is funding the work.

The long-term research goal is to sustainably increase the productivity of farms that solely rely on rainfall rather than irrigation in the southern Great Plains by improving the efficient use of water and nitrogen. The research also is striving to reduce soil losses from erosion, conserving water and improving soil health.

“Crop and food animal production in this region lags well below its potential, and 50% or more of the precipitation received by cropland is lost by evaporation from soil or is used by weeds,” Rice said.

The interdisciplinary team includes researchers, educators and extension professionals with expertise in agronomy, crop production, soil science, modeling, economics and sociology.

Lights, camera, action

Kansas State University physicists have taken extremely fast snapshots of light-induced molecular ring-opening reactions — similar to those that help a human body produce vitamin D from sunlight. The research has been published in Nature Chemistry.

“Think of this as stop-motion like a cartoon,” said Daniel Rolles, associate professor of physics in the College of Arts and Sciences and principal investigator for the study. “For each molecule, you start the reaction with a laser pulse, take snapshots of what it looks like as time passes and then put them together. This creates a ‘molecular movie’ that shows how the electronic structure of the molecule changes as a function of how much time passes between when we start and when we stop.”

Shashank Pathak, doctoral student and lead author on the paper, said the idea was to study the dynamics of how a ring opens in a molecule on the time scale of femtoseconds, which is one quadrillionth of a second.

The researchers used a free-electron laser to visualize how these reactions happen by recording electron energy spectra as the atoms in the molecule move apart.

“Think of this as stop-motion like a cartoon,” said Daniel Rolles, associate professor of physics in the College of Arts and Sciences and principal investigator for the study. “For each molecule, you start the reaction with a laser pulse, take snapshots of what it looks like as time passes and then put them together. This creates a ‘molecular movie’ that shows how the electronic structure of the molecule changes as a function of how much time passes between when we start and when we stop.”
Teacher merit pay programs improve student outcomes

Do teacher merit pay programs improve student test scores? According to a Kansas State University College of Education researcher, the answer is yes.

Tuan Nguyen, assistant professor of curriculum and instruction, published “Teacher Merit Pay: A Meta-Analysis” in the American Educational Research Journal, one of the top and most respected journals in education research. His 40 co-authors were Lam Pham, doctoral candidate at Vanderbilt University, and Matt Springer, associate professor of educational policy and leadership at the University of North Carolina at Chapel Hill.

Teacher merit pay, also called performance pay or differential pay, is a system of pay incentives meant to reward teachers with additional salary or a bonus based on performance and evaluation measures.

To determine if merit pay can raise student achievement, Nguyen and his colleagues examined the existing literature on merit pay with a particular focus on rigorous quantitative studies. They found, overall, merit pay programs can modestly raise student achievement, but the effect is strongly correlated with program design features such as opportunity of professional development, more sophisticated teacher evaluation systems, and amount of pay.

“Merit pay can work, but there are important questions of how to fine-tune and experiment with better and more sophisticated teacher evaluation systems and outcomes of how to fine-tune and experiment with better and more sophisticated teacher evaluation systems and leadership at the University of North Carolina at Chapel Hill.” Nguyen said.

Rural water wells show large increase in nitrate levels

Kansas private well owners should test water quality annually, according to a recent Kansas State University study that revealed nitrate levels in shallow wells above U.S. Environment Protection Act standards.

“The changes we measured in the Great Bend Prairie Aquifer appear to be large relative to changes observed in a natural study by the U.S. Geological Survey,” said Matthew Kirk, associate professor of geology in the College of Arts and Sciences and the study’s principal investigator.

The Great Bend Prairie Aquifer, a part of High Plains Aquifer, was the focus of a 40-year comparison study of rural water wells, recently published in the Hydrogeology Journal. Kirk and Alexandria “Allie” Richard Lane, K-State 2018 master’s degree graduate and John Hildebrand and Orrin Feril, both with Big Bend Groundwater Management District No. 7, in geology, published the study along with Donald Whittemore from the Kansas Geological Survey; Randy Stotler from the University of Kansas geology department; and John Kifer from the University of Kansas geological department; and John Hilderbrand and Orrin Ford, both with Big Bend Groundwater Management District No. 7.

“The Great Bend Prairie Aquifer is very vulnerable to contamination and if rural well owners don’t know there is a problem, they obviously can’t do anything about it,” Kirk said. “Municipalities are required to test and provide safe drinking water for city residents, but rural owners don’t have that luxury. But if they don’t take care of it, it could be a bigger issue for the future.”

Collaboration for a safer global breadbasket

A Kansas State University team and collaborators are addressing food supply contamination in Nepal.

Jagger Harvey, director of the K-State Food the Future Innovation Lab for the Reduction of Post-Harvest Loss, funded by the U.S. Agency for International Development, and several collaborating institutions recently finished a two-year project in Nepal.

The study found fungal toxins in several major food crops, including peanuts, corn, soy nuggets and chili peppers. Along with other partners, the Nepal Development Research Institute, the Nepal Academy of Science and Technology, and Helen Keller International led key components of the project, which established national capacity to address mycotoxin contamination in the food system. Jisang Yu, assistant professor of agricultural economics in the K-State College of Agriculture, led agricultural economics efforts.

Twenty-five percent of Nepalese children are below the second percentile for growth on an international scale and a portion of this growth stunting is potentially attributed to naturally occurring mycotoxins in the food supply,” said Harvey, also a research associate professor of plant pathology in the College of Agriculture. “In one region, previous work found 85% of pregnant women tested positive for aflatoxins, a category of mycotoxin.”

To help Nepal plan a mitigation strategy, Harvey invited John Leslie, associate professor of plant pathology in the College of Agriculture, to host a multinational stakeholder workshop using the nominal group technique. Leslie has 30 years of experience leading workshops that use the discussion technique and has helped other developing countries with comparable issues.

According to Harvey, the nominal group technique helps stakeholders become involved in solving problems and helps guide their efforts. It works by empowering people from a variety of backgrounds to formulate relevant local solutions to complex, multifaceted issues.

The goal is to allow individuals to express what they see as a priority to solve the problem,” Leslie said. “It’s very democratic and in the end, you get both an excited and very empowered group and a diverse list of action items for addressing the problem.”

Nepal now has a wet lab for food and food mycotoxin testing and research to support the national planning and mitigation measures to remediate this food safety issue.

Collaboration and communication

Communicating across all entities is key in addressing food security. During the Nepal workshop, Leslie, Morris and Leslie created a framework for communication about food security issues and published it in the December 2019 issue of Frontiers in Sustainable Food Systems.
Carnegie Foundation endorses K-State for community engagement

The Carnegie Foundation has named Kansas State University as one of 119 U.S. colleges and universities to receive the 2020 Carnegie Community Engagement Classification for the university’s commitment to community engagement. K-State is one of 75 institutions to be reclassified by the Carnegie Foundation this year.

This classification honors higher education institutions that demonstrate dedication to collaborate at a local, state, national and global level to share knowledge and information. K-State first received this classification in 2010. A total of 359 institutions now hold the community engagement designation.

“Engagement is in the DNA of Kansas State University,” said Charles Taber, provost and executive vice president. “It has been embraced since our founding as the first operating land-grant university and continues today through our numerous and varied community partnerships.”

The university has more than 50 signature partnerships across its campuses and in numerous communities. The K-State Center for Engagement and Community Development enhances and broadens community partnerships and is responsible for reporting on community engagement for the university.

“I am so proud of K-State’s administration, faculty, staff and students for daily efforts to work in partnership with our community partners to address the significant challenges faced by Kansas and communities worldwide,” said David Procter, former director of the Center for Engagement and Community Development.

---

Microplastics can be harmful to farm crops

A Kansas State University crop physiologist has found that plastic products, which are well known to cause negative impacts on fish and other aquatic animals, also have an adverse effect on land-based organisms, such as farm crops.

That fact should throw caution to such industries as agriculture in which plastic products are part of doing business, said Mary Beth Kirkham, university distinguished professor of agronomy in the College of Agriculture. She specializes in the relationship between soil, plants and water.

In a greenhouse experiment with wheat, Kirkham showed that the presence of tiny particles of plastic in soil caused water to pool up on the surface and the flooded conditions permitted oxygen from getting to a plant’s roots. She also found that plastic serves as a vector, or vehicle, for plant uptake of such toxic materials as cadmium.

“Many plants died in the monthlong experiment,” Kirkham said. “In the plants where cadmium was in the soil with plastic, the wheat kernels had much, much more cadmium than in the plants that grew without plastic in the soil.”

---

A K-State first: Plant pathologist named to National Academy of Sciences

Kansas State University plant pathologist Barbara Valent has earned membership in the prestigious National Academy of Sciences, or NAS. She is the first scientist at K-State to earn the honor for original research conducted while at the university.

As a member, Valent, university distinguished professor in the College of Agriculture, joins a group of scholars who are often sought out to provide independent, objective advice to national leaders on problems where scientific insights are critical. “Being a member of the NAS is not just an honor but also an opportunity to impact scientific issues important for the well-being of the nation and the world,” Valent said.

“My expertise in fungal pathogens of important grain crops allows me to contribute to national and global food security issues including and beyond wheat blast.”

Valent has worked on understanding blast disease, caused by a fungus known to scientists as Magnaporthe oryzae, for more than 40 years. In the last decade, her work has focused on wheat blast, a dangerous new disease in which the fungus is capable of taking out entire wheat fields.

Valent has led a research team that is driving the world’s most comprehensive studies on wheat blast to keep it out of the U.S. Her team has worked in the K-State Biosecurity Research Institute, a biosafety level-3 facility, and the researchers were the first to discover a resistance gene called 2NS for wheat blast disease.

---

About the National Academy of Sciences

The National Academy of Sciences, or NAS, is considered the country’s leading authority on matters related to science and technology. The academy was established by an act of Congress and signed by President Abraham Lincoln in 1863. Today, the academy has 2,405 members in the U.S. and 501 more internationally. Academy members are nominated and then elected in recognition of their distinguished and continuing achievement in original research.

Barbara Valent, university distinguished professor of plant pathology, has spent years studying wheat blast disease.

---

Microplastics can be harmful to farm crops

A Kansas State University crop physiologist has found that plastic products, which are well known to cause negative impacts on fish and other aquatic animals, also have an adverse effect on land-based organisms, such as farm crops.

That fact should throw caution to such industries as agriculture in which plastic products are part of doing business, said Mary Beth Kirkham, university distinguished professor of agronomy in the College of Agriculture. She specializes in the relationship between soil, plants and water.

In a greenhouse experiment with wheat, Kirkham showed that the presence of tiny particles of plastic in soil caused water to pool up on the surface and the flooded conditions permitted oxygen from getting to a plant’s roots. She also found that plastic serves as a vector, or vehicle, for plant uptake of such toxic materials as cadmium.

“Many plants died in the monthlong experiment,” Kirkham said. “In the plants where cadmium was in the soil with plastic, the wheat kernels had much, much more cadmium than in the plants that grew without plastic in the soil.”

---

A K-State first: Plant pathologist named to National Academy of Sciences

Kansas State University plant pathologist Barbara Valent has earned membership in the prestigious National Academy of Sciences, or NAS. She is the first scientist at K-State to earn the honor for original research conducted while at the university.

As a member, Valent, university distinguished professor in the College of Agriculture, joins a group of scholars who are often sought out to provide independent, objective advice to national leaders on problems where scientific insights are critical. “Being a member of the NAS is not just an honor but also an opportunity to impact scientific issues important for the well-being of the nation and the world,” Valent said.

“My expertise in fungal pathogens of important grain crops allows me to contribute to national and global food security issues including and beyond wheat blast.”

Valent has worked on understanding blast disease, caused by a fungus known to scientists as Magnaporthe oryzae, for more than 40 years. In the last decade, her work has focused on wheat blast, a dangerous new disease in which the fungus is capable of taking out entire wheat fields.

Valent has led a research team that is driving the world’s most comprehensive studies on wheat blast to keep it out of the U.S. Her team has worked in the K-State Biosecurity Research Institute, a biosafety level-3 facility, and the researchers were the first to discover a resistance gene called 2NS for wheat blast disease.
Researchers DEVELOP solutions through local watershed study

NASA and a collaborative Kansas State University team are working to understand changes to the Wildcat Creek watershed in Manhattan.

To help anticipate and better understand the phenomena, Aida Farough, teaching assistant professor of geology in the College of Arts and Sciences, proposed a NASA DEVELOP program at K-State.

The program focuses on determining if changes in land use and land cover over the years have affected water runoff along Wildcat Creek. DEVELOP, part of the NASA Applied Sciences Program, supports research projects that address community challenges by applying data collected by NASA earth observatories.

Farough is collaborating with Trisha Moore, associate professor in the Carl and Melinda Helwig Department of Biological and Agricultural Engineering in the Carl R. Ice College of Engineering. Their team includes four student researchers selected competitively from across the U.S.

"Natural disasters are inevitable and we want our community to be more resilient," Farough said. "NASA already has this data. We just need to see what it can tell us."

The team that was hired by DEVELOP at Langley Research Center spent the summer analyzing data remotely. The findings will enable Manhattan-area community development officials to better understand the challenges they face in their community and to make scientifically informed decisions to reduce the risks of future floods.

The researchers have provided results to the project’s partner organizations, which include the city of Manhattan, the Riley County Department of Planning and Development, the Kansas Department of Health and Environment, the Kansas Forest Service and the Riley County Conservation District.

Spiraling and spinning

An analysis of more than 200,000 spiral galaxies has revealed unexpected links between spin directions of galaxies. The structure formed by these links might suggest that the early universe could have been spinning, according to a Kansas State University study.

Lior Shamir, a K-State computational astronomer and computer scientist, presented the findings at the 236th American Astronomical Society meeting in June. The findings are significant because the observations conflict with some previous assumptions about the large-scale structure of the universe.

Since the time of Edwin Hubble, astronomers have believed that the universe is inflating with no particular direction and that the galaxies in it are distributed with no particular cosmological structure. But Shamir’s recent observations of geometrical patterns of more than 200,000 spiral galaxies suggest that the universe could have a defined structure and that the early universe could have been spinning. Patterns in the distribution of these galaxies suggest that spiral galaxies in different parts of the universe, separated by both space and time, are related through the directions toward which they spin, according to the study.

“Data science in astronomy has not just made astronomy research more cost-effective, but it also allows us to observe the universe in a completely different way,” said Shamir, also associate professor of computer science in the Carl R. Ice College of Engineering. “The geometrical pattern exhibited by the distribution of the spiral galaxies is clear, but can only be observed when analyzing a very large number of astronomical objects.”

A new infectious disease research center

The National Institutes of Health has awarded a Kansas State University-led team of veterinary researchers with a prestigious five-year, $11.3 million grant under the Centers of Biomedical Research Excellence, or COBRE, program to establish a new Center on Emerging and Zoonotic Infectious Diseases, or CEZID.

The center includes four primary research projects that bridge areas of excellence in the collective infectious diseases programs involving the colleges of Veterinary Medicine and Arts and Sciences.

“The overarching goal of the CEZID is to advance our overall understanding of emerging and zoonotic infectious diseases based on research performed in the state of Kansas,” said Jürgen A. Richt, Regents distinguished professor at K-State and a Kansas Bioscience Authority eminent scholar.

Richt is the director of the center and Philip Handvogl, professor of diagnostic medicine and pathobiology, serves as associate director. Richt said there are two research core facilities to support the research projects and programs: an Animal Model/Pathology Core and a Molecular and Cellular Biology Core, which offer unique research infrastructure resources at K-State and the state of Kansas. See page 26 to learn more about Richt’s infectious disease research.
Career builders

There’s no question: Kansas State University early career faculty are award winners. 

In fiscal year 2020, K-State led a significant number of early career researchers to receive prestigious awards. The NSF Faculty Early Career Development, or CAREER, Program is one of the most prestigious NSF awards for supporting early career faculty who effectively integrate research and education in the context of the mission of their departments or organizations. The award comes with a federal grant for research and education activities for five consecutive years. The DOE Office of Science Early Career Research Program is designed to build the nation’s scientific workforce by providing support to emerging researchers during crucial early career years when many do their most formative work. This year grants are very competitive and only 147 scientists received the award in 2020. Learn more about the award-winning early career faculty members at K-State.

By the numbers

Number of K-State researchers who have received National Science Foundation CAREER awards since fiscal year 2001 3

Number of K-State researchers who have received U.S. Department of Energy Office of Science Early Career Research Program awards since the program was established in 2010 24

Dong Lin
Assistant professor of industrial and manufacturing systems engineering

Area of study: 3D printing and manufacturing Award: $500,000 NSF CAREER award Project title: “Bio-inspired manufacturing of high-strength, high-roughness metal-graphene composites” Project description: Lin, Don and Linda GlaserKeystone research scholar in the Carl R. Ice College of Engineering, is establishing a bio-inspired manufacturing technology. He is engineering high-strength, high-roughness, 3D metal-graphene composites that can be used for automotive applications, aerospace, electronics packaging and thermal management. “Nature-evolved, damage-tolerant materials such as nacre, bone and wood are both strong and tough because of their hierarchical composite structure,” Lin said. “Unlike bone and wood, which have complex microstructures, nacre, more commonly known as mother of pearl, exhibits superior mechanical properties with a simple composite microstructure.”

Lydia Zeglin
Associate professor of biology

Area of study: Microbial ecology Award: $650,000 NSF CAREER award Project title: “How do microorganisms and grazing mammals interact at local to regional scales to maintain grassland nitrogen cycling processes?” Project description: Zeglin, a microbial ecologist in the College of Arts and Sciences, is researching interactions between the tallgrass prairie’s largest species, which are bison and cattle, and the smallest species, which are soil microbes. The interactions between grazers and soil microbes are important for prairie biodiversity and may affect how soil can remediate nitrogen pollution. Zeglin is testing soil from multiple prairie locations with a return science approach. “Our ultimate goal is to understand the nitrogen cycle in all prairie soils,” Zeglin said. “We are working with The Nature Conservancy, ranchers and students to contribute soil samples from bison- and cattle-grazed areas across the Flint Hills to expand the range of understanding.”

Ryan Hansen
Assistant professor of chemical engineering

Area of study: Biotechnology Award: $550,000 NSF CAREER award Project title: “Understanding bacteria-exceptional proliferation and roles in photodegradable hydrogel materials” Project description: Hansen, Steve Hsu Keystone research scholar in the Tim Taylor Department of Chemical Engineering, is investigating the chemical and physical properties of light-reactive hydrogels. The hydrogels will guide the delivery of therapeutic bacteria to targeted disease sites. “The project is creating new research avenues at the intersection of materials science and microbial biotechnology,” Hansen said. “It uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level.”

Jeff Comer
Keystone research scholar in the Carl R. Ice College of Engineering, is investigating the chemical and physical properties of light-reactive hydrogels. The hydrogels will guide the delivery of therapeutic bacteria to targeted disease sites. “The project is creating new research avenues at the intersection of materials science and microbial biotechnology,” Hansen said. “It uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level.”

Project title: “Programmable assembly of glycine-rich peptides on a graphene surface” Project description: Comer is the first researcher in the College of Veterinary Medicine to receive a CAREER award. He works at the intersection of biology, physics and computer science, and designs programmable molecules that can be programmed to arrange themselves into complex biomedical devices for drug delivery and diagnostic tests. The educational part of the project uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level. “The miniaturization of devices such as computers and cellphones has been so successful that the size of their parts is now similar to the size of molecules and atoms,” Comer said. “The future is building devices atom-for- atom out of individual molecules.”

Lado Samushia
Associate professor of physics

Area of study: Cosmology Award: $750,000 DOE early career award Project title: “Robust dark energy constraints with dark energy spectroscopic survey” Project description: Samushia, a cosmologist in the College of Arts and Sciences, is measuring positions and properties of tens of millions of distant galaxies. His statistical analysis of the distribution of these galaxies and the patterns they make can help us better understand dark energy. “Dark energy is one of the hottest topics in modern cosmology,” Samushia said. “We know that 70% of the universe is made of a mysterious substance that we call dark energy — dark because it does not emit any light — but we don’t really have a good idea of what it is.”

Project title: “Programmable assembly of glycine-rich peptides on a graphene surface” Project description: Comer is the first researcher in the College of Veterinary Medicine to receive a CAREER award. He works at the intersection of biology, physics and computer science, and designs programmable molecules that can be programmed to arrange themselves into complex biomedical devices for drug delivery and diagnostic tests. The educational part of the project uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level. “The miniaturization of devices such as computers and cellphones has been so successful that the size of their parts is now similar to the size of molecules and atoms,” Comer said. “The future is building devices atom-for- atom out of individual molecules.”

Project title: “Programmable assembly of glycine-rich peptides on a graphene surface” Project description: Comer is the first researcher in the College of Veterinary Medicine to receive a CAREER award. He works at the intersection of biology, physics and computer science, and designs programmable molecules that can be programmed to arrange themselves into complex biomedical devices for drug delivery and diagnostic tests. The educational part of the project uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level. “The miniaturization of devices such as computers and cellphones has been so successful that the size of their parts is now similar to the size of molecules and atoms,” Comer said. “The future is building devices atom-for- atom out of individual molecules.”

Project title: “Programmable assembly of glycine-rich peptides on a graphene surface” Project description: Comer is the first researcher in the College of Veterinary Medicine to receive a CAREER award. He works at the intersection of biology, physics and computer science, and designs programmable molecules that can be programmed to arrange themselves into complex biomedical devices for drug delivery and diagnostic tests. The educational part of the project uses state-of-the-art molecular simulation methods to help students understand how medicines work at the molecular level. “The miniaturization of devices such as computers and cellphones has been so successful that the size of their parts is now similar to the size of molecules and atoms,” Comer said. “The future is building devices atom-for- atom out of individual molecules.”
Home. Be it big or small, rented or owned, on the range or in the big city, there’s no place like it.

Finding an affordable home, though, can be a challenge across the U.S. Experts say affordable housing should cost no more than 30% of one’s annual income. But according to 2016 U.S. Census Bureau data, nearly half of Americans earning under $10,000 per year are now overburdened by housing costs and spend more than 30% of their income on housing. And for every home built for under $150,000, more than 18 homes are built for over $300,000.

A graduate architecture studio at Kansas State University wants to change that by designing affordable and energy-efficient homes that improve quality of life. The Net Positive Studio, created and led by Michael Gibson, associate professor of architecture, is a research-based studio for students in their final year of the five-year Master of Architecture program in the College of Architecture, Planning & Design.

WELCOME HOME
ARCHITECTURE STUDENTS USE RESEARCH TO DESIGN AFFORDABLE, SUSTAINABLE HOUSING — BY BETH BOHN

“Welcome home”
Architecture students use research to design affordable, sustainable housing — By Beth Bohn

“Our mission is to research, develop and demonstrate housing models that can support households and communities,” Gibson said. “Through lean construction and thoughtful design, the homes intend to foster the quality of life and well being of residents by freeing up income, minimizing required maintenance, improving social connections and building restorative connections to the outdoors.”

Along with affordability, the studio focuses on designing net-zero energy homes that offset energy use through renewable energy generation, and the students use the latest technology to optimize home construction.

“Homes in the U.S. are responsible for a staggering one-fifth of national energy consumption and use more energy than commercial, institutional and industrial buildings,” Gibson said. “Moreover, the cost of housing and utilities increasingly burdens household budgets with an average utility expenditure that can exceed $2,000 annually for heating fuel and electricity.”

This model shows a proposed home for the Indian Mound neighborhood in Kansas City, Missouri.
Different Places, Same Problem

The studio has put its mission to work with real clients: nonprofit partners who are helping fund homes in the Indian Mound neighborhood in urban Kansas City, the largest city in Missouri with a population just under 500,000, and in rural St. John, a south-central Kansas community with a population just under 1,200.

The 15-member 2018-2019 studio was tasked by the Mattie Rhodes Center, a community service organization in Kansas City, to introduce a new model of affordable, sustainable housing for Indian Mound, while the 14-member 2019-2020 studio is working with Stafford County Economic Development to come up with affordable, appealing rental housing in St. John.

Using research as the foundation for their home designs, Gibson said each class analyzed the number and condition of existing homes in each area. They also looked at average housing costs and median incomes. Despite the difference in populations between Indian Mound and St. John, the students found the same problem in each place: aging housing stocks. In both locations, more homes are coming down than are going up each year, which makes finding an affordable home more difficult.

According to the students’ research, the Indian Mound neighborhood has 3,000-plus homes, but only one new home permit has been issued in the last 22 years.

“Indian Mound is among the historic northeast Kansas City neighborhoods known for diversity and prosperous family life,” Gibson said. “But in the last 20 years, these neighborhoods have suffered from neglect and absentee landlords.”

In their study of St. John, the students found that of the 552 homes currently in the community, 85% were built between 1920-1969 and only 4% were built between 1980-2019.

“Our goal is to expand the availability of affordable housing in the county and in particular, rental housing,” said Carolyn Dunn, executive director of Stafford County Economic Development. “The average median income for St. John/Stafford County is $47,000 a year, which means the cost of new construction can exceed what most people can afford. This is not something that a lot of architecture students can say, that they got to create a house with their own two hands and solve the problems along the way that needed to be solved,” said Jameson Jones, a member of the St. John studio.

Making Their Plans

Just as professional architects do, each class met regularly with its client and with community members to help shape their designs and get feedback before finalizing plans.

what I most enjoyed about the project was getting to work with and present our proposals to the community,” said Christian Carter, a member of the Indian Mound studio. “Some of these diverse northeast Kansas City neighborhoods haven’t seen much growth since the 1950s and Indian Mound wasn’t an exception. It was also really great to hear the stories and how people were hoping to bring change and reinvigorate this neighborhood while keeping the aspect of affordability at the forefront of every decision.”

In Indian Mound, the students chose to build a home on a vacant lot owned by the Mattie Rhodes Center. Their goal was to keep it affordable for the buyer most interested in this neighborhood: a family who has one or two children and may be transitioning from rental housing.

Dunn challenged the St. John studio to come up with a rental home for around $100,000 to be built on a vacant lot owned by Stafford County Economic Development. The average median income for St. John/Stafford County is $47,000 a year, which means the cost of new construction can exceed what most people can afford.

“Some of these diverse northeast Kansas City neighborhoods haven’t seen much growth since the 1950s and Indian Mound wasn’t an exception.”

This is Not Something That A Lot of Architecture Students Can Say, That They Got to Create a House With Their Own Two Hands.

Jameson Jones, member of Net Positive Studio

Above: These renderings show the exterior and interior of a Net Positive Studio home.

Above: Net Positive Studio students discuss and build components for one of the two homes they have designed.

Above: These additional renderings show the interior and exterior of a Net Positive Studio home.

Above: Net Positive Studio students discuss, design and present home plans.
The layout of a Net Positive Studio home shows how the social core takes advantage of space that would be lost to hallways in a typical house, which helps to achieve a compact footprint. Generous windows in the living room offer dainty, natural ventilation, and passive solar heating that will result in the house using approximately 90% of the energy that a comparable new house would use.

The Marime Rhodes Center is working with Coldwell, a general contractor, and Environmental Builders, a nonprofit providing construction training and educational opportunities for women and minorities, on the Indian Mound home. The center also will find the buyer for the home, which is being financed in part with a U.S. Department of Housing and Urban Development grant through the HOME program. The preferred buyer is a household of four making less than 80% of the $42,700 median income for Kansas City. The St. John home will include many of the same features of the Indian Mound home, but the students will use prefabricated, precision-cut panels to save construction time. The solar power system will be comprised of a dozen small, but efficient solar panels that the students said will pay for themselves in about 10 years. While larger than the Indian Mound home, Gibson said the St. John studio succeeded in designing a house that will result in the house using approximately 80% of the energy that a comparable new home would use.

ON BUDGET
The cost of building the initial homes is being kept low because of the volunteer student and faculty time and some donated materials from donors. The St. John home will include many of the same features of the Indian Mound home, but the students will use prefabricated, precision-cut panels to save construction time. The solar power system will be comprised of a dozen small, but efficient solar panels that the students said will pay for themselves in about 10 years. While larger than the Indian Mound home, Gibson said the St. John studio succeeded in designing a house that will result in the house using approximately 80% of the energy that a comparable new home would use.

The center also will find the buyer for the home, which is being financed in part with a U.S. Department of Housing and Urban Development grant through the HOME program. The preferred buyer is a household of four making less than 80% of the $42,700 median income for Kansas City. The St. John home will include many of the same features of the Indian Mound home, but the students will use prefabricated, precision-cut panels to save construction time. The solar power system will be comprised of a dozen small, but efficient solar panels that the students said will pay for themselves in about 10 years. While larger than the Indian Mound home, Gibson said the St. John studio succeeded in designing a house that will result in the house using approximately 80% of the energy that a comparable new home would use.

The students’ final home designs for both locations are energy-efficient, prefabricated homes with three bedrooms and two bathrooms. The Indian Mound home will be 1,071 square feet, while the St. John home will be 1,100 square feet. The foundations for both homes will be insulated so they can better retain heat in the cold months and keep cool when it’s warmer outside. Students shifted the public and private areas in each home to optimize circulation. While the bedrooms are small, the communal areas, including the kitchen and living rooms, are bigger so families have room to spend time together. Mechanical systems in the ceiling run through the middle of the home so they don’t take up valuable space. The students’ final home designs for both locations are energy-efficient, prefabricated homes with three bedrooms and two bathrooms. The Indian Mound home will be 1,071 square feet, while the St. John home will be 1,100 square feet. The foundations for both homes will be insulated so they can better retain heat in the cold months and keep cool when it’s warmer outside. Students shifted the public and private areas in each home to optimize circulation. While the bedrooms are small, the communal areas, including the kitchen and living rooms, are bigger so families have room to spend time together. Mechanical systems in the ceiling run through the middle of the home so they don’t take up valuable space.

“Design in action
The Martie Rhodes Center is working with Coldwell, a general contractor, and Environmental Builders, a nonprofit providing construction training and educational opportunities for women and minorities, on the Indian Mound home. The center also will find the buyer for the home, which is being financed in part with a U.S. Department of Housing and Urban Development grant through the HOME program. The preferred buyer is a household of four making less than 80% of the $42,700 median income for Kansas City. The St. John home will include many of the same features of the Indian Mound home, but the students will use prefabricated, precision-cut panels to save construction time. The solar power system will be comprised of a dozen small, but efficient solar panels that the students said will pay for themselves in about 10 years. While larger than the Indian Mound home, Gibson said the St. John studio succeeded in designing a house that will result in the house using approximately 80% of the energy that a comparable new home would use.

The center also will find the buyer for the home, which is being financed in part with a U.S. Department of Housing and Urban Development grant through the HOME program. The preferred buyer is a household of four making less than 80% of the $42,700 median income for Kansas City. The St. John home will include many of the same features of the Indian Mound home, but the students will use prefabricated, precision-cut panels to save construction time. The solar power system will be comprised of a dozen small, but efficient solar panels that the students said will pay for themselves in about 10 years. While larger than the Indian Mound home, Gibson said the St. John studio succeeded in designing a house that will result in the house using approximately 80% of the energy that a comparable new home would use.

Building Success
The next assignment for the Net Positive Studio is the 2020 Solar Decathlon, a biennial college competition sponsored by the U.S. Department of Energy. K-State was selected in one of 10 schools to design a super-efficient home that demonstrates net-positive technology. A prototype of the home was to be constructed and tested at the National Mall in Washington, D.C., this summer for judging, but the event was canceled because of COVID-19. Gibson said the studio is still competing in the decathlon but under some fluctuating rules and calendar adjustments. While the national recognition is rewarding, Gibson said having the studio mission realized is the best sign of its success.

“These projects have been a reminder of how important houses and housing are to the people who live in them,” Gibson said. “This studio’s efforts in researching and designing housing is matched by the earnestness and dedication the students show in responding to the real people and problems that are behind the headlines in today’s housing crisis. Every time their designs advanced, I felt more strongly that these aren’t just construction projects; these homes will give back a tremendous amount to the people who will live in them.”

Seek more
View a gallery of photos from the Net Positive Studio. Learn more about the studio and how to become a partner.

TINY IS BIG IN NICODEMUS
A research project by Kansas State University College of Architecture, Planning & Design students has provided a tiny solution to a long-hanging problem in Nicodemus, Kansas. Residents of Nicodemus, the only continuously settled African American town west of the Mississippi River and home to numerous homes, have been working to keep their community economically viable since the 1970s. K-State interior architecture & industrial design and landscape architecture students came up with the solution with their fall 2017 studio project: “The Nicodemus Campus of Small Homes.”

Their plans for a tiny community of tiny homes was based on meeting with Nicodemus residents Julia Dillon, Elton Holmes and John E. Bates, director of the Nicodemus Historical Society, and learning about community needs and gaps. The students loved the students’ ideas, said K-State interior architecture student Elton Holmes, which provided short-term residential living for groups, artists-in-residence and other visitors. Construction of a third home, for a retiree, was put on hold because of COVID-19. To raise funds to build the next four tiny homes, the town organized a tiny home giveaway as part of the virtual 142nd Nicodemus Homecoming Emancipation Celebration and the community’s Pioneer Day Festival.

College of Architecture, Planning & Design involvement in Nicodemus has been ongoing for nearly 40 years and has been a focus of La Barbara James Wigfall, associate professor of historic architecture and regional & community planning, with several award-winning projects.

Tiny is big in Nicodemus
A research project by Kansas State University College of Architecture, Planning & Design students has provided a tiny solution to a long-hanging problem in Nicodemus, Kansas. Residents of Nicodemus, the only continuously settled African American town west of the Mississippi River and home to numerous homes, have been working to keep their community economically viable since the 1970s. K-State interior architecture & industrial design and landscape architecture students came up with the solution with their fall 2017 studio project: “The Nicodemus Campus of Small Homes.”

Their plans for a tiny community of tiny homes was based on meeting with Nicodemus residents Julia Dillon, Elton Holmes and John E. Bates, director of the Nicodemus Historical Society, and learning about community needs and gaps. The students loved the students’ ideas, said K-State interior architecture student Elton Holmes, which provided short-term residential living for groups, artists-in-residence and other visitors. Construction of a third home, for a retiree, was put on hold because of COVID-19. To raise funds to build the next four tiny homes, the town organized a tiny home giveaway as part of the virtual 142nd Nicodemus Homecoming Emancipation Celebration and the community’s Pioneer Day Festival.

College of Architecture, Planning & Design involvement in Nicodemus has been ongoing for nearly 40 years and has been a focus of La Barbara James Wigfall, associate professor of historic architecture and regional & community planning, with several award-winning projects.

Tiny is big in Nicodemus
A research project by Kansas State University College of Architecture, Planning & Design students has provided a tiny solution to a long-hanging problem in Nicodemus, Kansas. Residents of Nicodemus, the only continuously settled African American town west of the Mississippi River and home to numerous homes, have been working to keep their community economically viable since the 1970s. K-State interior architecture & industrial design and landscape architecture students came up with the solution with their fall 2017 studio project: “The Nicodemus Campus of Small Homes.”

Their plans for a tiny community of tiny homes was based on meeting with Nicodemus residents Julia Dillon, Elton Holmes and John E. Bates, director of the Nicodemus Historical Society, and learning about community needs and gaps. The students loved the students’ ideas, said K-State interior architecture student Elton Holmes, which provided short-term residential living for groups, artists-in-residence and other visitors. Construction of a third home, for a retiree, was put on hold because of COVID-19. To raise funds to build the next four tiny homes, the town organized a tiny home giveaway as part of the virtual 142nd Nicodemus Homecoming Emancipation Celebration and the community’s Pioneer Day Festival.

College of Architecture, Planning & Design involvement in Nicodemus has been ongoing for nearly 40 years and has been a focus of La Barbara James Wigfall, associate professor of historic architecture and regional & community planning, with several award-winning projects.
It’s been a busy decade for Kansas State University researchers. Since 2010, K-State researchers have tackled global food insecurity and created new research centers and laboratories. They have achieved international recognition and have been at the forefront of the latest scientific developments and creative discovery.

These researchers have continued the university’s land-grant mission to serve communities at home and across the globe—a key piece of the K-State 2025 visionary goal to be a premier, student-centered, public research university by 2025. Read more about 10 of the biggest research achievements of the past 10 years.

**Biosecurity:** The Biosecurity Research Institute, or BRI, opened in 2007, and in 2009, Manhattan was selected as the site for the federal National Bio and Agro-Defense Facility, or NBAF. In the decade that followed, K-State has become “the Silicon Valley for Biodefense,” according to Tom Daschle, former majority leader of the U.S. Senate and member of the Blue Ribbon Study Panel on Biodefense. Scientists across the university have studied H1N1 virus, Zika virus, African swine fever virus, West Nile virus, avian influenza, wheat blast fungus and many other infectious diseases. Many of these projects will jump-start research at NBAF when it becomes operational in the next decade.

The university has continued to maintain numerous biosecurity-related facilities, research collaborations and academic programs, including the BRI, which is a biosafety level-3 facility devoted to comprehensive infectious diseases research and training, the Center of Excellence for Emerging and Zoonotic Animal Diseases, which the U.S. Department of Homeland Security awarded in 2010 at K-State; the National Agricultural Biosecurity Center; and the K-State Plant Disease Diagnostic Lab, among many other organizations and partnerships. See page 26 to learn how researchers are using many of these K-State facilities to study COVID-19.

**K-State Olathe:** The K-State Olathe campus opened in 2011 as a Kansas City-area hub for research on human and animal health, food innovation and sensory analysis.

There have been many successes in its first decade. The 1Data collaboration formed in 2017 by K-State and the University of Missouri-Kansas City and includes multiple projects that use big data to improve human and animal lives. Many startup and brand name companies have scaled up operations and developed or refined new products with the Food Innovation Accelerator. Local and Fortune 500 companies use the Sensory and Consumer Research Center to study food and consumer products and improve them. The Postharvest Physiology Lab helps local and national growers improve their produce and is helping Kansas hemp farmers tap an emerging economic market. See page 36 to learn more about industrial hemp research.

**K-State Polytechnic:** The K-State campus in Salina has evolved in the past decade and built research programs focused on aviation, unmanned aircraft and bulk solids.

The K-State Polytechnic Applied Aviation Research Center is engaged in research that promotes the commercialization of unmanned aircraft. The center has been involved in validating unmanned aircraft standards for the Federal Aviation Administration, exploring unmanned aircraft as tools for inspecting power lines or wind turbines and using unmanned aircraft to map natural resources. The Bulk Solids Innovation Center focuses on testing, storing and transporting bulk solids, which are loose, dry commodities such as pellets, granules, powders, grains and recycled plastics. The center opened in a new facility in 2015 and is the only one of its kind in North America.
Feed the Future Innovation Labs: Beginning in 2013 and over the course of 14 months, K-State was named the winner of four highly competitive grants totaling more than $100 million from the U.S. Agency for International Development, or USAID. The grants established four Feed the Future Innovation Labs: the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet, the Feed the Future Innovation Lab for Applied Wheat Genetics, the Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss and the Feed the Future Innovation Lab for Sustainable Intensification.

The Feed the Future Innovation Labs are global collaborations among universities, industry and nongovernmental organizations. The labs focus on ending world hunger by improving the resilience and production of food crops as well as preventing crop losses in grain-producing countries. The labs address these challenges through a combination of research, education and outreach in target nations.

The Edge Collaboration District: The northern edge of the Manhattan campus was largely undeveloped land in 2010. In the past 10 years, it has become a hub of industry, research and university collaboration. The area became known as the North Campus Corridor, and in 2020 was renamed the Edge Collaboration District, which is a partnership between K-State and the Kansas State University Foundation.

More than a dozen partners and six academic colleges are represented in the Edge Collaboration District, and more are expected. Some of these partners include the city of Manhattan, the K-State Research Park, the K-State Office Park, the Natural Re and Agro-Defense Facility, the Biosecurity Research Institute, the Kansas Department of Agriculture, the College of Veterinary Medicine, the College of Agriculture Grain Science and Industry Complex, the Kansas Wheat Commission and the National Science Foundation I/UCRC Wheat Genetics Resource Center.

CRISPR technology: CRISPR-Cas9 technology was introduced in 2012 and has since revolutionized the scientific world. The 2020 Nobel Prize in Chemistry was awarded to the scientists who developed the gene-editing technology.

K-State researchers have used CRISPR technology to ethically and responsibly combat some of the world’s most devastating animal and plant diseases. College of Agriculture plant pathologists are developing wheat varieties with improved traits, such as having higher yields or being more drought resistant. A biochemistry and molecular biophysicists team in the College of Arts and Sciences is studying gene drives through the model system of yeast. College of Veterinary Medicine researchers have used the technology to fight animal diseases such as African swine fever and porcine reproductive and respiratory syndrome.

Konza Prairie Biological Station: In 2010, the Konza Prairie Biological Station was named one of the Eight Wonders of Kansas Geography by the Kansas Sampler Foundation. It is a 8,400-acre prairie that is also the site of long-term ecological research, from burning and grazing techniques to all aspects of the grassland ecosystem: flowers, soil, water and wildlife.

The Konza Prairie has been a National Science Foundation Long-Term Ecological Research site for more than 45 years and it continued to received funding renewal in 2014 and 2020. The Konza Prairie is jointly owned by K-State and The Nature Conservancy and is managed by the Division of Biology in the College of Arts and Sciences.
The next decade offers many new research developments and opportunities.

**Infectious disease research:** The COVID-19 pandemic has made it even more evident that infectious disease research will continue to play a critical role in the coming years. See page 26 to learn more about how K-State is fighting the coronavirus pandemic.

**Center on Emerging and Zoonotic Infectious Diseases:** In 2020, K-State received its third National Institutes of Health Centers of Biomedical Research Excellence grant. The $11 million in funding established the new Center on Emerging and Zoonotic Infectious Diseases. See page 11 to read more about the new research center.

**3D printing:** 3D printing has dramatically improved, and artists, researchers and scholars continue to use this technology across the university, from the art department in the College of Arts and Sciences to the Carl R. Ice College of Engineering and the College of Architecture, Planning & Design.

**Chapman Center for Rural Studies:** The center’s focus on strengthening rural Kansas communities will play a key role as rural communities evolve in the next decade.

**Health sciences:** The recently renamed College of Health and Human Sciences is setting the stage for new research, education and outreach that promotes the well-being of individuals, families and communities.

**Beach Museum of Art:** The collection at the Marianna Kistler Beach Museum of Art has grown to more than 10,000 objects that highlight Kansas and regional art. The museum will celebrate its 25th anniversary in 2021.

**WHAT’S NEXT?**

**Seek more**
Read more about the decade of K-State research achievements. k-state.edu/seek

---

**Sensory Analysis Center:** The K-State Sensory Analysis Center has investigated sensory analysis and worked with companies across the globe for more than 30 years. In 2015, the center was named the top in the world for sensory analysis research influence by the Journal of Sensory Studies. The Sensory Analysis Center conducts more than 50 studies every year. At the Manhattan and Olathe campuses, faculty, students and panelists conduct consulting, education and consumer research on a variety of products and topics: food, beverages, cosmetics, fabrics, packaging, paints, personal care products and fragrances, as well methodologies and food safety.

**Global Food Systems Initiative:** In the past decade, K-State began the Global Food Systems Initiative to focus on what will become a critical challenge in the coming decades: feeding the rapidly growing world’s population, which will grow to an estimated 9.6 billion people by 2050. The K-State research initiative aims to solve global food challenges through innovation, outreach and workforce development. K-State has been preparing for this challenge for decades, and it is a challenge that harkens back to the university’s land-grant mission when it was founded many decades ago.

**CNAP Center:** In 2017, the National Institutes of Health awarded a nearly $11 million Centers of Biomedical Research Excellence, or COBRE, grant to establish the K-State Cognitive and Neurobiological Approaches to Plasticity Center, or CNAP. It is the largest grant in the history of the psychological sciences department and marks the second time that K-State has received a COBRE grant. The statewide center aims to understand the human brain and how it changes. More than 63 collaborators, including University of Kansas and Wichita State University researchers, are involved with CNAP and are conducting cognitive, behavioral and neurobiological research on topics such as self-control, alcohol abuse, aging, hearing, memory loss and learning.

**Center on Emerging and Zoonotic Infectious Diseases:** In 2020, K-State received its third National Institutes of Health Centers of Biomedical Research Excellence grant. The $11 million in funding established the new Center on Emerging and Zoonotic Infectious Diseases. See page 11 to read more about the new research center.
By now, we all know the key phrases that describe the COVID-19 pandemic. They are familiar snippets we have heard many times during this peculiar period of history. Loss of taste and smell. Cases spreading. Hundreds of thousands of deaths. Staying home. Record unemployment. Economic collapse. No treatment and no vaccine.

At the center of everything is a newly emerged coronavirus called SARS-CoV-2, which causes COVID-19. In its name, CO stands for corona, VI for virus, D for disease and 19 for the year 2019 when it emerged. This highly contagious and difficult-to-treat virus is covered in spikes — similar to the jewels on a crown, or corona — that attach to the cells in our bodies.

There is no denying that the pandemic has affected nearly every aspect of our daily lives. Things look different now. We wear face coverings. We stand 6 feet apart. We practice behaviors to mitigate the spread of the virus.

Kansas State University researchers are helping by battling the pandemic from multiple angles: understanding the virus, exploring vaccine and treatment options, improving COVID-19 tests, 3D-printing test materials and assisting communities.

The solutions during the COVID-19 pandemic come through a multifaceted approach led by the state’s land-grant university.

“As the country’s first operational land-grant university, K-State has always risen to the occasion to help our state and country through difficult times,” said Richard Myers, K-State president. “The current COVID-19 pandemic is no different and our researchers continue to lead the way through important work across disciplines. Together, we will battle this pandemic.”
Seek 2020 k-state.edu/seek

Researchers can safely study SARS-CoV-2, which is the coronavirus that causes COVID-19. The Biosecurity Research Institute in Pat Roberts Hall is a biosafety level-3 facility where the dedicated BRI and institutional staff can safely study infectious diseases that affect plant, animal and human health. Zoometric viruses, which are viruses such as SARS-CoV-2 that spread between animals and humans, are one of the areas of focus at the BRI. Since the beginning of the COVID-19 pandemic, scientists and staff at the BRI have ramped up research on SARS-CoV-2 in an "all hands on deck" approach to fighting a virus that affects all of us. Under the leadership of Director Stephen Higgs, the BRI quickly began new programs related to SARS-CoV-2 and built on existing infectious disease research and training programs.

"This is of the essence when responding to a new biological threat," Higgs said. "I am proud of the work we are doing at K-State to learn as much as we can about SARS-CoV-2 and other dangerous pathogens. Time is of the essence when responding to a new biological threat," Higgs said. "I am proud of the work we are doing at K-State to learn as much as we can about SARS-CoV-2 and other dangerous pathogens. Time is of the essence when responding to a new biological threat," Higgs said. "I am proud of the work we are doing at K-State to learn as much as we can about SARS-CoV-2 and other dangerous pathogens.

Researchers meet with Kansas Gov. Laura Kelly during her visit to learn more about Richt's work with the new Biosecurity Research Institute in Pat Roberts Hall.

A new zoonotic disease

Some of the BRI research focuses on the zoonotic potential of SARS-CoV-2 to pass between animals and humans. Researcher Jürgen A. Richt has completed several coronavirus projects at the BRI. Richt is the Regents distinguished professor in the diagnostic medicine and pathobiology department and director of the Center on Emerging and Zoonotic Infectious Diseases, or CEZID, in the College of Veterinary Medicine. He works on five areas: animal susceptibility and transmission of SARS-CoV-2, virus stability on surfaces, therapeutic treatments, diagnostics and vaccines.

"If you want to determine whether a disease is zoonotic, it is necessary to see whether the virus is transmitted from animal to human," Richt said. "In our studies, we have shown that SARS-CoV-2 is transmitted from cats to humans. This is critical in understanding the role of companion animals in the ecology of SARS-CoV-2 and in understanding potential control strategies.

Richt also serves on an expert panel for the World Health Organization, which has tasked the group with developing COVID-19 clinical models for the evaluation of vaccines and therapeutics.

"We are on the front end of studying whether these drugs, which are very promising in preclinical models, can be used to control COVID-19 patients," Richt said. "We hope that the work we are doing presently will save lives." Richt is now testing these potential antiviral drugs in preclinical models.

Richt's research is supported in part by the National Biosecurity Research Institute in Pat Roberts Hall.

Answering the call

While it has been a K-State research asset for more than 10 years, the Biosecurity Research Institute, or BRI, was created for historic moments like the current global pandemic. The BRI, in Pat Roberts Hall, is a biosafety level-3 facility where researchers can safely study infections that affect plant, animal and human health. Zoometric viruses, which are viruses such as SARS-CoV-2 that spread between animals and humans, are one of the areas of focus at the BRI. Since the beginning of the COVID-19 pandemic, scientists and staff at the BRI have ramped up research on SARS-CoV-2 in an "all hands on deck" approach to fighting a virus that affects all of us. Under the leadership of Director Stephen Higgs, the BRI quickly began new programs related to SARS-CoV-2 and built on existing infectious disease research and training programs.

"Time is of the essence when responding to a new biological threat," Higgs said. "I am proud of the work we are doing at K-State to learn as much as we can about SARS-CoV-2 and other dangerous pathogens. This work is possible because of the unique capabilities of the BRI and the dedicated BRI and institutional staff.

The BRI provides the secure environment, training and infrastructure required for research on SARS-CoV-2. It is adjacent to the federal National Bio and Agro-Defense Facility, or NBAF, which is under construction and will be America's foremost animal disease research facility. NBAF is a biosafety level-3 and biosafety level-4 laboratory that will replace the aging Plum Island Animal Disease Research Center in New York.

Research facilities such as the BRI have brought K-State and the state of Kansas into the national and international spotlight for important biosecurity work during the current pandemic. State leaders recognize the importance of the BRI and the research conducted there. Kansas Gov. Laura Kelly visited the BRI in August to meet with researchers and learn more about their work fighting COVID-19 and other diseases that affect plant, animal and human health.

The Kansas State University Biosecurity Research Institute has a long history of excellence and innovation researching disease spread like what we are currently facing with COVID-19," Gov. Kelly said after the visit.

Richt also serves on an expert panel for the World Health Organization, which has tasked the group with developing COVID-19 clinical models for the evaluation of vaccines and therapeutics. Richt's research is supported in part by the National Biosecurity Research Institute in Pat Roberts Hall.

Researchers met with Kansas Gov. Laura Kelly during her visit to learn more about Richt's work with the new Biosecurity Research Institute in Pat Roberts Hall.

Researchers met with Kansas Gov. Laura Kelly during her visit to learn more about Richt's work with the new Biosecurity Research Institute in Pat Roberts Hall.

Researchers met with Kansas Gov. Laura Kelly during her visit to learn more about Richt's work with the new Biosecurity Research Institute in Pat Roberts Hall.

Researchers met with Kansas Gov. Laura Kelly during her visit to learn more about Richt's work with the new Biosecurity Research Institute in Pat Roberts Hall.
Mosquitoes and the virus

Stephen Higgs led a collaborative study that is the first to confirm that SARS-CoV-2 cannot be transmitted to people by mosquitoes. The study, published in Nature Scientific Reports, found that the virus cannot replicate in three common mosquito species — Aedes aegypti, Aedes albopictus and Culex tritaeniorbis — and, therefore, cannot be transmitted to humans by mosquitoes.

"While the World Health Organization has definitively stated that mosquitoes cannot transmit the virus, our study is the first to provide conclusive data supporting the theory," said Higgs, Peine professor of diagnostic medicine and pathobiology. "This research is a significant step forward in understanding COVID-19 transmission and disease spread.

Antiviral drugs and treatment

One problem during the COVID-19 pandemic is that there are not yet any antiviral drugs for human coronaviruses. Two researchers in the College of Veterinary Medicine, Yunjeong Kim and Kyeong-Ok "KC" Chang, are trying to solve this problem by developing a treatment for COVID-19. They have signed two licensing agreements with Cocrystal Pharma Inc., which is a clinical-stage biotechnology company, and another licensing agreement with Anivive Lifesciences, which develops companion animal and human medicines.

"Virologists Kyeong-Oh "KC" Chang, left, and Yunjeong Kim are developing antiviral drugs for human coronaviruses.

Mosquitoes do not transmit SARS-CoV-2 to people, according to a K-State collaborative study.

Blocking the spike

K-State has signed four COVID-19-related licensing agreements with companies for vaccine candidates and possible antiviral drugs. All the licensing agreements have been coordinated through K-State Innovation Partners.

In one research agreement with clinical-stage biopharmaceutical company Tonix Pharmaceuticals, scientist Waithaka Mwangi is studying a COVID-19 vaccine candidate in the BRI. The research is based on a new vaccine platform that his team developed for bovine parainfluenza 3 virus, known as BPI3V, which is closely related to human parainfluenza 3 virus.

"We are working on developing a COVID-19 vaccine in the best way that we can, said Mwangi, assistant professor of diagnostic medicine and pathobiology.

"Vaccine developments and treatments are the biggest targets in COVID-19 treatment for COVID-19. They have signed two licensing agreements with Cocrystal Pharma Inc., which is a clinical-stage biotechnology company, and another licensing agreement with Anivive Lifesciences, which develops companion animal and human medicines.

"Drs. Chang and Kim have been working on antivirals and inhibitors for SARS and MERS at K-State for a number of years, so discoveries related to coronaviruses and noroviruses are really not surprising," said Peter K. Dorhout, K-State vice president for research. "Some of the discoveries they've made about treating fatal feline coronavirus translate nicely into understanding the current SARS-CoV-2 virus, emphasizing the important, critical connection between basic virology research on animal and human diseases."
Building better tests

Another issue throughout the pandemic has been testing, including shortages of testing supplies and challenges with testing results. Several K-State and community partnerships are helping on both fronts.

By partnering with the BRL, the Kansas State Veterinary Diagnostic Laboratory, or KSVDL, has performed thousands of COVID-19 tests since the pandemic began and has maintained a quick turnaround time. Researchers are performing confirmatory tests for the Kansas Department of Health and Environment, or KDHE, and other state and private laboratories.

Researchers from the Carl R. Ice College of Engineering are 3D-printing testing swabs to use at clinics and hospitals in northeast Kansas, including Onaga, St. Marys, Seneca and Holton. Researchers in the BRL College of Engineering are 3D-printing testing swabs to use at clinics and hospitals in northeast Kansas, including Onaga, St. Marys, Seneca and Holton.

K-State administrators and faculty members involved include Beth Montelone, senior associate vice president for research; Jungkwun Kim, assistant professor and Keystone research scholar in the Mike Wiegers Department of Electrical and Computer Engineering; and Dong Lin, assistant professor of industrial and manufacturing systems engineering and Keystone research scholar.

Both Kim and Lin specialize in research related to 3D printing. Kim specializes in 3D microfabrication and Lin studies 3D printing and manufacturing composites. See page 12 for more about Lin's research.

A state commendation

A K-State and community partnership has received recognition from the Kansas Department of Health and Environment, or KDHE, for collaborative efforts to make COVID-19 testing supplies available.

K-State has teamed up with Community HealthCare System and the Northeast Kansas Healthcare Coalition to successfully fill the supply chain gap of nasopharyngeal swabs for COVID-19 testing in the region. Researchers in the Carl R. Ice College of Engineering are 3D-printing testing swabs to use at clinics and hospitals in northeast Kansas, including Onaga, St. Marys, Seneca and Holton.

K-State administrators and faculty members involved include Beth Montelone, senior associate vice president for research; Jungkwun Kim, assistant professor and Keystone research scholar in the Mike Wiegers Department of Electrical and Computer Engineering; and Dong Lin, assistant professor of industrial and manufacturing systems engineering and Keystone research scholar.

Both Kim and Lin specialize in research related to 3D printing. Kim specializes in 3D microfabrication and Lin studies 3D printing and manufacturing composites. See page 12 for more about Lin's research.

The group was recognized in a virtual ceremony of commendation with KDHE Secretary Lee Norman, M.D.

“One of the key advantages that made us a partner was having the ability to work in a timely manner,” Montelone said. “I want to thank Dr. Kim and Dr. Lin for their contributions in helping solve a problem that we had during the pandemic of COVID-19: a short supply of a particular item, the nasal swabs.”

Norman said, “It really is very illustrative that something like an issue as simple as having the right supplies can really stop the presses. The Northeast Kansas Healthcare Coalition, Community HealthCare System and K-State met this need in a very creative way, which provided these much-needed swabs — not just to KDHE, but to hospitals, clinics, etc.”

K-State has printed and donated more than 7,000 swabs and continues to print more.

“K-State is the land-grant university for the state of Kansas and it’s in our mission to do research and extension for the greater good,” Montelone said. “This is just something K-State has done throughout its history — we are the land-grant university for the state of Kansas and it’s in our mission to do research and extension for the greater good.”

Seek more

Find additional stories, photos and videos that show how K-State researchers are helping to battle the COVID-19 pandemic. k-state.edu/seek
From all angles

The battle against COVID-19 crosses disciplinary boundaries. Kansas State University researchers are tackling all dimensions of the pandemic.

Leading an open source drug discovery research effort

K-State is leading a new research consortium that uses artificial intelligence to find promising drugs for COVID-19 treatments.

A $1 million grant from the U.S. Department of Agriculture is funding the project along with $330,000 from the State of Kansas National Bio and Agro-Defense Facility and $270,000 from industry; Jeanette Thurston, director of the Food Science Institute and co-investigator on the project; Randy Phebus, A. Sally Davis, Valentina Scoglio, and many other collaborators. The project involves College of Veterinary Medicine, College of Arts and Sciences, and many other collaborators.

Above image: Caterina Scoglio, professor of electrical and computer engineering, is modeling the spread of COVID-19.
Building a statewide network of research pioneers on a new crop

By Jason Hackett

Battling torrents of rain, blasts of wind, unrelenting heat and humidity, pestilence and endless tall tales, Kansas State University researchers forge ahead as pioneers in the uncertain frontier of industrial hemp.

Using their decades of experience breeding and growing specialty crops, K-State Research and Extension horticulture and agronomy experts are turning their attention to hemp, or Cannabis sativa L., which is one of the most versatile and useful plants in the world.

Until recently, hemp was off limits in the U.S. because it looks, smells and sometimes can become its close cousin, marijuana. The difference between hemp and marijuana is how much tetrahydrocannabinol, or THC, is present. That's what causes a "high" and keeps marijuana illegal in most states. But industrial hemp can be grown with low to no THC.

The 2014 U.S. Farm Bill opened the door for state agencies and educational institutions to grow hemp for research and, in 2018, the Kansas Legislature passed the Alternative Crop Research Act. Those two steps, along with establishment of ground rules, officially opened a new frontier in Kansas and empowered the Kansas Department of Agriculture, or KDA, as the state’s regulatory agency.
An untamed frontier

Rather than a gold rush, a green rush began as experimental growers and handlers obtained licenses to grow hemp if they presented a formal research plan and followed strict controls. In the first year of licensure, the KDA issued 254 research program licenses.

A primary control for growers was the requirement that if representative sample tests revealed THC concentrations above 0.3%, then the entire crop must be destroyed.

That’s a significant risk for Kansas farmers already facing a yearslong economic storm. But some see a risk worth taking because of the interest in hemp products. Industrial hemp can be grown for a variety of purposes, fiber or both, through dual-purpose production.

“The uses for industrial hemp are almost limited only by the imagination,” said Jason Griffin, director of the John C. Pair Horticultural Center, which is a K-State Research and Extension research center near Wichita.

A newer use for hemp is cannabidiol extract, better known as CBD oil. In recent years, CBD has been touted as a miracle drug by some, but with little to no research backing up those claims.

With so much unverified information, whether it’s CBD product claims or methods for planting, growing and harvesting, the hemp marketplace looks a little like the Wild West. That’s why the K-State research is so important.

“We saw a natural fit for us given our expertise and reputation as a trusted source of properly controlled, unbiased research information,” said Ernie Minton, dean of the K-State College of Agriculture and director of K-State Research and Extension. “Given the diverse climate across the state, we recognized we had the ability to take an initial statewide look at key knowledge gaps relative to how the crop should be grown in Kansas. I think it is natural for us to be leading that effort.”

The call to adventure

When Minton tapped Griffin as the leader of the K-State Research and Extension hemp team in late 2018, he began an adventure into a world with few experts at all. Under Griffin’s leadership, K-State is part of a multistate hemp project funded by the U.S. Department of Agriculture. The Pair Center is the primary K-State site for experimental growth of hemp. Significant test plots also were grown in 2019 at the K-State Research and Extension Center-Olathe in the Kansas City metro area and at the Northwest Research-Extension Center in Colby, which provided a much different view of the plant in the drier, higher elevations of western Kansas.

Attempts to plant test plots outside of Manhattan were rained out twice.

The same fate nearly befell Griffin’s research at the Pair Center, but a second planting survived. The hemp grew fast over the summer and provided new information for growers almost every day. Most of the CBD varieties were grown in high tunnels, which are crop shelters similar to greenhouses, while fiber and grain varieties were grown outside with different variables to track.

“We had a couple of variations that produced very well,” Griffin said. “Kansas producers are very familiar with growing a grain crop, and it looks like we might be able to do this one very well.”

While Griffin saw early promise in the southern part of the state, the other plots also saw first-year success. Cary Rizard, director of the Olatha research center, and Lucas Haag, Northwest area agronomist based in Colby, conducted parallel research in their very different climates.

Rizard focused solely on CBD hemp and saw his high tunnel plants yield 3.5 times more than expected. In the drier climate of western Kansas, Haag conducted agronomic growth trials for fiber, grain and dual-purpose hemp rather than CBD varieties. Their early assessments indicate that hemp may have a role as a rotational crop. Hemp may be an old crop, but it’s new to universities and the rigors of repeatable, peer-reviewed, controlled research.

“There’s so much information online, but how much of it is misinformation?” Rizard said. “It’s not malicious misinformation, it’s just not backed up by replication. We’re trying to get away from the hearsay and get into evidence.”

Haag also mentioned there are plenty of snake oil salespeople blowing into town with only one thing in mind.

“There’s so much money pouring in from the outside,” he said. “In a lot of cases, these are people who don’t have a clue about growing a crop. We’re at ground zero in terms of how to grow this crop. It’s exciting and challenging.”

Left photos: Jason Griffin, director of the John C. Pair Horticultural Center, tends to young hemp plants being prepared for the 2020 growing season.
Spreading the word

Because hemp is new and fraught with both possibility and peril, it’s a topic that has captured the attention of the general public. During the past year, K-State hemp researchers and the KDA hemp team have shared helpful material and turned up for dozens of outreach events across the state.

Industrial hemp is a legal crop that looks and smells exactly like marijuana, so law enforcement officials need to know about the legalities of transporting hemp. K-State and KDA staff have conducted law enforcement field days at the Fair Center and presented to nearly 100 law enforcement personnel from across the state as well as Kansas Department of Wildlife, Parks and Tourism staff.

“It’s helping them to answer the question, ‘What should I be looking for to ensure that someone is conducting activities that they’re legally allowed to conduct?’” said Brecken Hock, KHS industrial hemp specialist.

For many law enforcement personnel, the educational sessions are their first opportunity to learn about the crop with details that pertain to their work. The transportation and carrying of hemp is the main point of intersection between farmers and law enforcement, and Kingman County Sheriff Randy Hill said his staff took proactive steps after attending the information sessions.

“The challenge is making sure everybody has the same understanding so we all enforce the law with consistency,” Hill said. “Everybody was impressed with the training and speakers. They did a good job of explaining why this is going on and how the law is applied.”

K-State hemp researchers and the KDA hemp team have been involved with the educational sessions for the past year.

Griffin organized K-State’s first industrial hemp conference at the K-State Horticultural Center, to conduct pharmacokinetic studies to learn how hemp can be broken down into compounds to be absorbed in cattle. Industrial hemp has potential as an economic feed, which would extend the plant material’s usefulness rather than the plant going back to the field or to a landfill.

Michael Klemmer, assistant professor of beef production medicine, and Hans Coon, department head of veterinary medicine, also are involved in the educational series. One team is studying the potential for industrial hemp seed oil, including protein and carbohydrates.

Cattle feed

Seven K-State and KDA staff have partnered with Jason Griffin, director of the John C. Papp Horticultural Center, to conduct pharmacokinetic studies to learn how hemp can be broken down into compounds to be absorbed in cattle. Industrial hemp has potential as an economic feed, which would extend the plant material’s usefulness rather than the plant going back to the field or to a landfill.

Michael Klemmer, assistant professor of beef production medicine, and Hans Coon, department head of veterinary medicine, also are involved in the educational series. One team is studying the potential for industrial hemp seed oil, including protein and carbohydrates.

By the numbers

Kansas Industrial Hemp Research Program

The 2019 growing season included:

- 254 active licenses
- 190 growers, including 35 processors and 20 distributors
- 5,700 acres licensed
- 2,700 acres planted
- 1,757 acres harvested

Based on applications, the recently concluded 2020 growing season included:

- 297 growers, including 30 processors and 25 distributors

Sources: Kansas Department of Agriculture

Nurturing the growth of hemp

Eleni Pliakoni followed the KDA testing procedures and developed a method to screen for five cannabinoids in hemp.

“We are building a program that could be expanded to many different crops,” Pliakoni said.

In the first year, only 10% of the hemp she tested was above the legal THC concentration over the legal level.

To many law enforcement personnel, the educational sessions are their first opportunity to learn about the crop with details that pertain to their work. The transportation and carrying of hemp is the main point of intersection between farmers and law enforcement, and Kingman County Sheriff Randy Hill said his staff took proactive steps after attending the information sessions.

“The challenge is making sure everybody has the same understanding so we all enforce the law with consistency,” Hill said. “Everybody was impressed with the training and speakers. They did a good job of explaining why this is going on and how the law is applied.”

Griffin organized K-State’s first industrial hemp conference at the K-State Horticultural Center, to conduct pharmacokinetic studies to learn how hemp can be broken down into compounds to be absorbed in cattle. Industrial hemp has potential as an economic feed, which would extend the plant material’s usefulness rather than the plant going back to the field or to a landfill.

Michael Klemmer, assistant professor of beef production medicine, and Hans Coon, department head of veterinary medicine, also are involved in the educational series. One team is studying the potential for industrial hemp seed oil, including protein and carbohydrates.

Cattle feed

Seven K-State and KDA staff have partnered with Jason Griffin, director of the John C. Papp Horticultural Center, to conduct pharmacokinetic studies to learn how hemp can be broken down into compounds to be absorbed in cattle. Industrial hemp has potential as an economic feed, which would extend the plant material’s usefulness rather than the plant going back to the field or to a landfill.

Michael Klemmer, assistant professor of beef production medicine, and Hans Coon, department head of veterinary medicine, also are involved in the educational series. One team is studying the potential for industrial hemp seed oil, including protein and carbohydrates.

By the numbers

Kansas Industrial Hemp Research Program

The 2019 growing season included:

- 254 active licenses
- 190 growers, including 35 processors and 20 distributors
- 5,700 acres licensed
- 2,700 acres planted
- 1,757 acres harvested

Based on applications, the recently concluded 2020 growing season included:

- 297 growers, including 30 processors and 25 distributors

Sources: Kansas Department of Agriculture
Fighting the fever

As African swine fever spreads worldwide, scientists protect U.S. industry

By Pat Melgares
“African swine fever is more like the flow of lava, said Cassie Jones, associate professor of animal sciences and industry in the College of Agriculture.

“Unlike pandemics that are more like a volcano, where there is just one eruption every 10 years, African swine fever is more like the flow of lava, where it is a slow flow of disease, but you can’t stop it.”

CFIA researchers agree: Collaboration is key to fighting African swine fever and minimizing its impact on the industry.

**Safe and effective**

Through industry partnerships, Kansas State University and the U.S. Department of Agriculture’s National Bio and Agro-Defense Facility, which is under construction near Manhattan, Kansas, aim to produce vaccines to fight African swine fever.

Researchers there are testing a bovine adenovirus serotype 6 backbone — developed from human adenovirus serotype 6 — that can amplify a transgene up to 10,000 copies in the infected cell without spreading to healthy cells. This backbone can be adapted to produce vaccines for different viruses, including African swine fever.

Partnership also plays a key role in developing tools to diagnose the disease quickly as well as vaccines.

**Diagnoses and vaccines**

K-State’s work includes developing tools to diagnose the disease quickly as well as vaccines.

“The earlier you diagnose a foreign animal disease, the earlier you can stop it in spread,” he said. “If you can detect the disease 24 hours earlier, how many animals can you save? How much money can you save?”

For African swine fever, Richt’s group has partnered with Silver Lake Research Corp. of Azusa, California, to develop a point-of-care diagnostic test that is the first of its kind in the U.S. The test, called PorCheck, can be used right in the field with a simple drop of blood from a pig.

“Very simple, very fast and very accurate,” Richt said.

The test was tested and tested in China, and it is being validated by the Food and Agriculture Organizations of the United Nations. Many other tests to increase the speed of diagnosis are underway, but we are not yet ready for market, he said.

The test was developed to detect African swine fever virus and is being validated by the Food and Agriculture Organizations of the United Nations. Many other tests to increase the speed of diagnosis are underway, but we are not yet ready for market, he said.

“We don’t know about some of the key things and the bigger things, as African swine fever, could be introduced through feed and feed ingredients. Swine feed often consists of many ingredients, such as amino acids, vitamins, vegetable proteins or grains, to give the pig the nutrition it needs.

“Many of the first parts of our work was to discover if the virus is stable and can survive outside the host, in feed and feed ingredients that have been subjected to fluctuating temperatures, temperature changes and the environment,” Niederwieser said.

“The U.S. exports millions of kilograms of feed ingredients to countries that may have circulating African swine fever disease. These ingredients are incorporated into swine diets, provided to confinement and could potentially serve as a route for the spread of transboundary animal disease.”

One major finding indicated that the African swine fever virus can indeed survive the hot-sun route across oceans, where it could be introduced into feed provided to animals. The bottom line: This virus is stable enough to survive a short transport from Beijing to Des Moines, Iowa.

“Not a big surprise to us, but what we want to know next if it a virus makes its way into a contaminated ingredient, does that get distributed through an entire batch of feed and through the entire feeding environment, or does it need to stay in pockets of contamination?” Jones said. “Knowing that there are some really meaningful implications of whether the entire feed supply chain is contaminated, or if we have a risk area, and how careful we need to be about biosafety and subsequent uses of equipment or trucks.”

Researchers are also working on methods to disinfect and chloroform infected. Niederwieser has conducted a study that indicates that the half-life of African swine fever — or the amount of time it takes for the virus to die by one-half — is between 9.6 and 14.2 days.

“Defining the timeline for how a virus decay naturally in feed allows us to consider storage periods for feed ingredients after they arrive to the U.S. from high-risk countries,” Niederwieser said.

That information also helped researchers establish guidelines for using thermal treatments or antimicrobial chemical treatments, she said.

**Feed and fever**

Niederwieser focuses on ways that foreign animal diseases, such as African swine fever, could be introduced through feed and feed ingredients. Swine feed often consists of many ingredients, such as amino acids, vitamins, vegetable proteins or grains, to give the pig the nutrition it needs.

“One of the first parts of our work was to discover if the virus is stable and can survive outside the host, in feed and feed ingredients that have been subjected to fluctuating temperatures, temperature changes and the environment,” Niederwieser said. “The U.S. exports millions of kilograms of feed ingredients to countries that may have circulating African swine fever disease. These ingredients are incorporated into swine diets, provided to confinement and could potentially serve as a route for the spread of transboundary animal disease.”

“Not a big surprise to us, but what we want to know next if it a virus makes its way into a contaminated ingredient, does that get distributed through an entire batch of feed and through the entire feeding environment, or does it need to stay in pockets of contamination?” Jones said. “Knowing that there are some really meaningful implications of whether the entire feed supply chain is contaminated, or if we have a risk area, and how careful we need to be about biosafety and subsequent uses of equipment or trucks.”

Researchers are also working on methods to disinfect and chloroform infected. Niederwieser has conducted a study that indicates that the half-life of African swine fever — or the amount of time it takes for the virus to die by one-half — is between 9.6 and 14.2 days.

“Defining the timeline for how a virus decay naturally in feed allows us to consider storage periods for feed ingredients after they arrive to the U.S. from high-risk countries,” Niederwieser said.

That information also helped researchers establish guidelines for using thermal treatments or antimicrobial chemical treatments, she said.

**Technologies in the spotlight**

Niederwieser said that 3% of the pigs in that country have been lost, which is one-third of all pigs in the world.

“When you think about the world’s largest pig producer losing that many pigs, it significantly changes the global pork industry because China’s hog herd is so large,” Niederwieser said. “We need to step back and be able to produce,” said Megan Niederwieser, assistant professor of diagnostic medicine and pathology at the College of Veterinary Medicine.

In the U.S. the State Research and Development Institute, or ERU, is the only emergency preparedness response for the highly contagious and deadly African swine fever virus, which is a biosafety level-3 pathogen. A significant amount of work with African swine fever was done at Animal Disease Center in New York. The center will be replaced by the National Bio and Agro-Defense Facility, which is under construction adjacent to the K-State Manhattan campus.

The K-State research, which includes partnerships with other universities, and private industry, aims to answer what is the risk of other transboundary animal diseases. It doesn’t matter whether it’s African swine fever virus, classical swine fever, foot-and-mouth disease, Rift Valley fever virus or others.”

Researchers also are working on methods to disinfect and chloroform infected. Niederwieser has conducted a study that indicates that the half-life of African swine fever — or the amount of time it takes for the virus to die by one-half — is between 9.6 and 14.2 days.

“Defining the timeline for how a virus decay naturally in feed allows us to consider storage periods for feed ingredients after they arrive to the U.S. from high-risk countries,” Niederwieser said.

That information also helped researchers establish guidelines for using thermal treatments or antimicrobial chemical treatments, she said.

**Technologies in the spotlight**

Niederwieser said that 3% of the pigs in that country have been lost, which is one-third of all pigs in the world.

“When you think about the world’s largest pig producer losing that many pigs, it significantly changes the global pork industry because China’s hog herd is so large,” Niederwieser said. “We need to step back and be able to produce,” said Megan Niederwieser, assistant professor of diagnostic medicine and pathology at the College of Veterinary Medicine.

In the U.S. the State Research and Development Institute, or ERU, is the only emergency preparedness response for the highly contagious and deadly African swine fever virus, which is a biosafety level-3 pathogen. A significant amount of work with African swine fever was done at Animal Disease Center in New York. The center will be replaced by the National Bio and Agro-Defense Facility, which is under construction adjacent to the K-State Manhattan campus.

The K-State research, which includes partnerships with other universities, and private industry, aims to answer what is the risk of other transboundary animal diseases. It doesn’t matter whether it’s African swine fever virus, classical swine fever, foot-and-mouth disease, Rift Valley fever virus or others.”

Researchers also are working on methods to disinfect and chloroform infected. Niederwieser has conducted a study that indicates that the half-life of African swine fever — or the amount of time it takes for the virus to die by one-half — is between 9.6 and 14.2 days.

“Defining the timeline for how a virus decay naturally in feed allows us to consider storage periods for feed ingredients after they arrive to the U.S. from high-risk countries,” Niederwieser said.

That information also helped researchers establish guidelines for using thermal treatments or antimicrobial chemical treatments, she said.
Fusarium fun-guy

Plant pathologist creates international connections through fungal identification, education
By Stephanie Jacques

Teach a man how to identify fungi and he’ll have streams for a lifetime. That’s what John Leslie, Kansas State University distinguished professor of plant pathology and director of the Fungal Genetics Stock Center in the College of Agriculture, has been trying to do, as he travels the world.

Leslie’s research focuses on the genus Fusarium, which is a large group of fungi found on most plants. Using genetics, he has identified new species of Fusarium and has evaluated variation within natural populations. One of his early career discoveries helped separate corn and grain sorghum Fusarium so breeders could find plant varieties that withheld the fungus’s damaging effects.

“Breaking Fusarium into separate species has made a difference for the sorghum industry to find a line of resistance,” Leslie said.

There are now more than 100 species of Fusarium. Some of these fungi are harmless; some can destroy crops and result in large economic losses; and some produce mycotoxins, which are natural toxins that can cause a range of chronic illnesses, stillbirths and even death in humans and animals.

“Fusarium is a very important plant pathogen and mycotoxin producer,” Leslie said. “Not everyone in the group is a bad fun-guy; but we focus on the bad guys because of the damage that they do.”

While Leslie’s research with Fusarium has positively affected the agriculture industry, it is his international collaborative ability that promotes true problem-solving. He’s been to South Africa, Afghanistan, Italy, Nepal, Japan, Malaysia, Egypt, Australia, South Korea and many other countries through his work with the Fulbright program and through research projects with the U.S. Agency for International Development, or USAID, and the European Union. He also has led popular fungal identification and remediation workshops.

“We’ve had more than 700 people from over 71 countries attend our Fulbright workshops,” Leslie said. “The ones that we do outside the U.S. are really important. There are people at some of these workshops who would never be able to make it to the U.S.”

Through the Fulbright program, he also established the K-State Australia initiative and the Asia-Oz program, which was mainly recognized by the Institute of International Education for innovative and sustainable partnerships that advance internationalization for K-State.

“The relationships that the university has built through this partnership program allow students and faculty to benefit from enhanced global opportunities and shared research,” Leslie said.

In addition, Leslie has served in multiple K-State leadership roles: He was the plant pathology department head from 2006 to 2016 and was the inaugural director of the USAID Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss. Yet his passion remains for the most important fungi in agriculture.

“I’ve tried to make Fusarium a viable research organism so we can understand what it does and if it’s doing things that we don’t want, we know how to stop it,” Leslie said.
Strategy instruction helps students learn math in a fraction of the time
By Patrice Scott

In 2019, Losinski awarded the Council of Children with Behavioral Disorders' Interventor Award. Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at more than 50 conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

In 2019, Losinski awarded the Council of Children with Behavioral Disorders' Interventor Award. Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

In 2019, Losinski awarded the Council of Children with Behavioral Disorders' Interventor Award. Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

In memoriam
Mickey Losinski was a committed educator, a loving husband and father of five. He passed away while hiking on a trip for his students, his colleagues and his profession.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.

Losinski joined K-State faculty in 2013 and published more than 50 articles in peer-reviewed journals, co-authored four book chapters and presented at national conferences. He serves on the editorial boards of the journal Exceptional Children, Behavioral Disorders, Beyond Behavior, Intervention in School and Community, and the Journal of Disability Policy Studies.
Printmaking is an extensive process and it takes days for Quick to create a piece. She starts in her studio surrounded by black and white images of her past creations. Using a soft ground technique and lithographic crayon made of grease, she draws on a copper plate in the negative, or the reverse of how she wants the finished piece.

The copper acts as a barrier between the plate and the acid, it slowly breaks apart in an acid bath and etches what is exposed. The thicker Quick applies the grease, the longer it takes to fall off when the copper plate is placed in a corrosive acid bath. The combination of time in the bath and thickness of the grease determines the shade and line thickness in the finished print.

“The acid creates channels in the copper plate,” Quick said. “The longer the plate is in the acid, the deeper and wider the channel, which will hold more ink. Less time will create a shallow and narrower channel so it will hold less ink.”

Quick repeats the process to get the desired-channel size. When a plate is finished, Quick applies the ink, which settles in the channels, and she wipes away the excess. She places paper on top and presses the two pieces together.

“Printmaking is where I can present my academic work, which is different than the aesthetic art that most people would see in a store,” Quick said. “Instead of a happy bird, I like to draw my birds tearing each other apart. It’s more emotional than aesthetic.”

In spring 2021, Quick will present her research work as a conference demonstration at the University of Colorado Boulder. The Embracing the Wilds conference is part of the Colorado Month of Printmaking, or Mo’Print.

According to Quick, her art and the printmaking community have helped her cope with trauma. “Printmaking materials and processes can be harmful both to the printmaker and the environment. Scuilla and Bousmann have developed a new printmaking process that is more effective and safe.”

“Hailey is a very talented and driven artist with important work,” said Jason Scuilla, professor of art and Quick’s adviser. “She fearlessly confronts her past experiences with beautiful hand-rendered images of struggle and perseverance. Hailey has excelled in her graduate studies and is an inspiration to our undergraduate students in the art department.”

In 2020, Quick’s printmaking work contributed to a National Endowment for the Arts research project, led by Jason Scuilla, professor of art, and Stefan Bousmann, former university distinguished professor of chemistry.

“Printmaking materials and processes can be harmful both to the printmaker and the environment. Scuilla and Bousmann have developed a new printmaking process that is more effective and safe,” said Scuilla.

Quick is working on a few pieces using this new method, which will be part of a portfolio to show other printmakers the safer alternative to the traditional acid bath.

In 2020, Quick was invited to present her research as part of a new major research project, led by Jason Scuilla, professor of art, and Stefan Bousmann, a professor of chemistry. Their research focuses on developing and refining electrochemical etching processes and green biosolvents to empower artists to create prints in a more effective and safe manner. They change the way prints are made while maintaining equal or greater quality.

Quick is working on a few pieces using this new method, which will be part of a portfolio to show other printmakers the safer alternative to the traditional acid bath.
Jagger Harvey is the director of the Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss, which is one of four Kansas State University laboratories that are funded by the U.S. Agency for International Development, or USAID. Harvey is also a research associate professor of plant pathology in the College of Agriculture and he explains in fewer than 100 words what mycotoxins are and why they are a big problem for crops.

Mycotoxins are naturally occurring fungal toxins that form on many crops, foods and feeds, including wheat, sorghum and corn. Mycotoxin-producing fungi pervade the soil and environment globally, with over a quarter of the world’s food supply contaminated. Exposure can lead to cancer or death and has been associated with stunting children’s development; livestock are also affected. Mycotoxins have serious economic impacts, such as potentially costing U.S. corn production billions of dollars in a bad season. Many pre- and post-harvest factors contribute to mycotoxin contamination, including temperature, rainfall and improper drying and storage; research is producing a range of effective interventions.

See pages 7 and 47 to learn more about K-State research related to mycotoxins.

**See The Past**

The 1910 Gas Engine Institute occurred at Kansas State Agricultural College in late December of that year. The event was part of a weeklong state institute for farmers and was organized by what is now known as K-State Research and Extension. E. B. McCormick, dean of机械 arts, organized the engine institute to provide training on the fabrication, operation and care of oil and gasoline engines. Several manufacturers provided lectures and demonstrations, such as the Rumely tractor demonstration in this photo. In the 1920s, the institutes for farmers were replaced by K-State Research and Extension county agents and county fair organizations. See page 36 to learn how Kansas State University continues to provide valuable training and knowledge for farmers across the state through research of new crops such as industrial hemp.

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

True innovation during a global pandemic takes teamwork. Kansas State University has a long history of diverse collaborations — from fighting infectious diseases to forming the newly merged K-State Innovation Partners. This tradition extends to interdisciplinary work such as designing sustainable homes and studying new crops that support Kansas farmers.

The K-State land-grant mission will continue in the decades to come as a student-centered, public research university that tackles the challenges our world faces.

Tomorrow's solutions come from today's collaborations. Read this issue of Seek to learn more.

Seek more
Learn how K-State research is innovating tomorrow.
k-state.edu/seek
k-state.edu/influence-tomorrow