The Silicon Valley of biodefense
K-State at forefront of biodefense

Home of the range
Preserving the tallgrass prairie

The buzz behind the bite
Scientists fight infectious disease challenge: the mosquito
This Powercat — made of 3-D printed graphene aerogel — is so lightweight that it can rest on the petals of a flower without bending them. The 3-D printed graphene aerogel weighs 0.5 milligrams per cubic centimeter, which makes it the lightest material created in the U.S.

Dong Lin, Kansas State University assistant professor of industrial and manufacturing systems engineering, co-developed the 3-D printed graphene aerogel with researchers at the State University of New York at Buffalo. The material has important qualities — such as low density and good conductivity — and Lin continues studying the 3-D printed graphene aerogel to understand how it can improve energy harvesting or even create flexible batteries.
The Silicon Valley of biodefense

K-State cements status at the forefront of biodefense

Home of the range

Biological station works to preserve tallgrass prairie

The buzz behind the bite

Scientists fight an infectious disease of biodefense

The Past

Research on Sustainable Intensification. Clearly we are learning what the past has to teach us while also creating future economic success.

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40 | Explain It
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Read about our university’s contributions to the world of food security.

The buzz behind the bite

Scientists fight an infectious disease

Antimicrobial resistance is also a growing and deadly problem. K-State research is fighting this threat to both animal agriculture systems and human health through the efforts of experts who are testing the antimicrobial properties of common minerals in animal food, finding the genetic basis of resistance, and ensuring that veterinarians and producers understand the best management practices that can protect the industry from disease outbreaks.

Search forSeek contributors

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Researchers race to stay ahead of disease-causing microbes

What did you think about when the bison on the cover of this magazine caught your eye? Heritage? The majesty of nature? How about singing around a campfire under a star-filled prairie sky on a cool spring evening — yes, I’m an Eagle Scout.

I thought of all of those things, but I also thought of security.

As you’ll read in these pages, the Blue Ribbon Study Panel on Biodefense visited Kansas State University earlier this year for a series of discussions about agrodefense. We were proud to host the group, and we’re eager to showcase the work that demonstrates why K-State is worthy of the subtitle panel member and former majority leader of the U.S. Sen. Tom Daschle offered during his introduction: the “Silicon Valley for biodefense.”

The Silicon Valley of biodefense is crucial to national security. But defending security requires that we take unflinching looks at both our past and our future. Take note of a K-State author’s study of American poetry during World War I as we commemorate the centennial of U.S. entry into that grim chapter of world history along with projects in our Chapman Center for Rural Studies that engage our students in discovering their histories.

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A NATIONAL LEADER: K-STATE CEMENTS STATUS AT THE FOREFRONT OF BIODEFENSE

WHAT SILICON VALLEY IS TO TECHNOLOGY, KANSAS STATE UNIVERSITY IS TO BIODEFENSE

That’s how a member of the Blue Ribbon Study Panel on Biodefense has described the university and its national leadership in animal health, biosciences and food safety research. The panel visited K-State’s Manhattan campus in late January 2017 for a series of discussions titled “Agrodefense: Challenges and Solutions.” Panel members and staff learned about better ways — many taking place at K-State — to protect the country’s food supply and fight bioterrorism.

“They’ve done a great job in being proactive in making sure that this becomes an area of focus,” said Tom Daschle, former Senate majority leader and panel member; Kenneth Wainstein, former homeland security adviser to President George W. Bush and panel member; and Ellen Garbe, co-director.

“The Blue Ribbon Study Panel has been a catalyst for making sure that these issues are at the forefront of what K-State is doing,” said Ellen Carlin, co-director.

“A member of the Blue Ribbon Study Panel on Biodefense has described the university and its national leadership in animal health, biosciences and food safety research. The panel visited K-State’s Manhattan campus in late January 2017 for a series of discussions titled “Agrodefense: Challenges and Solutions.” Panel members and staff learned about better ways — many taking place at K-State — to protect the country’s food supply and fight bioterrorism.

Content from the Blue Ribbon Study Panel on Biodefense.

WHAT PEOPLE ARE SAYING ABOUT K-STATE AND BIODEFENSE

“Collaboration requires a catalyst. Collaboration requires leadership. I believe that K-State is in a very good position to be that catalyst, to be that leader and to create opportunities for better dialogue and engagement with others as we consider the national challenges we face. That’s going to take a real effort and I think K-State is well-positioned to do just that.”

— Tom Daschle, former majority leader of the U.S. Senate

“As agriculture is elevated in terms of recognition and importance, it will be important for K-State to play a key role in setting the direction and public policy approach that it is necessary to get the job done right.”

— Tom Daschle, former majority leader of the U.S. Senate

“Kansas is agriculture. Agriculture is Kansas. Kansans have proven themselves in leading and preventing potential outbreaks.”


“Zoonotic diseases are going to require physicians, veterinarians and researchers to work together. I see my role is to push these people together. Use incredible opportunity with SKAP to work with those people and further the collaboration.”


“Providing an attack is going to be knowledge-based. We need to know everything possible about the pathogens and the potential perpetrators. Know the agent. Know the potential. Know the system. Know the potential perpetrators that we may have. Know everything.”


“There cannot simply be research to protect our nation’s food supply, but rather it must be a collaborative and holistic effort that includes surveillance, detection, diagnostic, treatment and prevention. We must be able to share information in a timely manner to save lives.”

— Tammy Beckum, dean of Kansas State University’s College of Veterinary Medicine

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— Tammy Beckum, dean of Kansas State University’s College of Veterinary Medicine

Kansas State University President Richard Myers speaks to the Blue Ribbon Study Panel on Biodefense in late January 2017. With Myers, from left, are Asha George, co-director; Tom Daschle, former Senate majority leader and panel member; Kenneth Wainstein, former homeland security adviser to President George W. Bush and panel member; and Ellen Garbe, co-director.

An aerial view of Kansas State University’s Manhattan campus, which has been dubbed the “Silicon Valley of biodefense” for its research to protect the country’s food supply and fight bioterrorism.
ON THE FRONT LINE OF BIODEFENSE
Kansas State University has a long history in biosecurity—a history that accelerated in 1999 with the publication of “Homeland Defense, Food Safety, Security, and Emergency Preparedness Program.” The 100-page document—informally called “The Big Purple Book”—outlined the university’s research programs in three major infectious disease components: plant pathology, animal health and food processing.

As the “Silicon Valley for biosecurity,” the university maintains numerous facilities, research collaborations and academic programs devoted to agrodefense and biodefense. Here are just a few:

• The Biosecurity Research Institute, or BRI, at Pat Roberts Hall is a biosafety level-3 facility that addresses threats to plant, animal, and human health and food communication through infectious disease and pathogen research. The institute is jump-starting research on National Bio and Agro-defense facility diseases, including Japanese encephalitis virus, Rift Valley Fever, classical swine fever and African swine fever.

• The College of Veterinary Medicine has research strengths in animal health infectious diseases, comparative virological science and food safety and security.

• The College of Agriculture conducts research in agricultural and horticultural crops, livestock, natural resources and the environment:
  - The National Agricultural Biosecurity Center, or NABC, stems biosecurity research with federal, state and local agencies to provide a response to emerging agricultural threats.
  - The U.S. Department of Homeland Security’s Center of Excellence for Emerging Zoonotic and Animal Diseases, or CEEZAD, develops countermeasures for emerging high-priority animal diseases that can spread to humans. It’s based in the College of Veterinary Medicine.
  - The Food Animal Residuals Avoidance Database, or FARAD, housed by the College of Veterinary Medicine, is a risk-management program that provides science-based expertise to help protect against swine waste chemical residues, such as drugs, dioxins, pentachlorophenol and antibiotics, that might be found in products derived from food animals.

• The Kansas State Plant Disease Diagnostic Lab, part of the Great Plains Diagnostic Network, provides information on disease identification and management, and processes more than 1,000 samples from Kansas each year. The samples help K-State keep a pulse on what plant diseases are active around the state.

• The U.S. Department of Homeland Security’s National Bio and Agro-defense Facility, or NBFF, will be a biosafety level-4 laboratory and the country’s foremost animal disease research facility. It is under construction adjacent to the Manhattan campus and will replace the aging Plum Island Animal Disease Center in New York.

• The Kansas Department of Agriculture, the first state department of agriculture in the nation, is devoted to the total support of agriculture in Kansas. Among the department’s priority objectives is developing strategic partnerships with K-State, as well as other potential partners, to better serve Kansas and the agricultural industry. Access to the university’s main campus was one of the reasons the agency relocated its main offices to Manhattan.

• The U.S. Department of Agriculture’s Center for Grain and Animal Health Research has facilities in Manhattan, the Arthropod-Borne Animal Diseases Research Unit, the Great Plains and Structure Research Unit and the Hard Winter Wheat and Genetics Research Unit.

IN THE LAB
Kansas State University is home to a wide variety of biosecurity-related research funded by government agencies and industry. Here’s a look at some of these projects:

• At the Biosecurity Research Institute, researchers have studied mosquitoes to understand how they become infected with Zika virus. University scientists were part of a multinational team that recently developed a promising new Zika virus vaccine. They also are investigating an emerging type of Japanese encephalitis virus and conducting the first U.S. studies since the 1940s. Find out more about this work on pages 18-23.

• Researchers are taking mobile applications to the field to improve food safety and economic welfare through a $2.5 million project funded by the National Science Foundation’s Foundation Research to Enable Agriculture Development, or BREAD, Program. The team is creating mobile phones and tablets and applications that enable farmers and scientists around the world to develop better plant varieties.

• The Center of Excellence for Emerging Zoonotic and Animal Diseases, or CEEZAD, is using a $2.3 million federal grant from the Defense Threat Reduction Agency in the U.S. Department of Defense, through a collaboration with the commercial firm NewLink Genetics, to study a newly developed livestock vaccine that could protect humans from the Ebola virus. A $100,000 matching contribution from the state of Kansas, the National Bio and Agro-defense Facility, or NBFF, Transition Funds brings the total project funding to $2.4 million.

• The Center of Excellence for Vector-Borne Diseases received $200,000 from the state of Kansas through its NBFF Transition Funds to study the tick-transmitted pathogens Borrelia burgdorferi (causes Lyme disease), which is deadly to cattle, sheep and goats. The researchers are working on a vaccine against the disease.

• Wheat blast fungal disease research, led by Barbara Velas, university distinguished professor of plant pathology, and Jim Stack, professor of plant pathology, continues at K-State’s Biosecurity Research Institute. The 2016 discovery of wheat blast in Bangladesh, the first time the fungus has occurred outside of South America, emphasizes this pathogen’s threat to crop production.

• Wiping Zheng, professor of microbiology, is working on vaccines for E. coli diarrhea using a five-year, $2.1 million grant from the National Institutes of Health.

• The National Agricultural Biosecurity Center is developing a database to help agricultural emergency management coordinators combat animal disease outbreaks and other emergencies. The database is ICABA, which stands for Identifying Contaminants Acting from Agricultural Responses. The project is supported by the U.S. Department of Homeland Security’s Office of Health Affairs, Food, Agriculture and Veterinary Defense Branch through the Food Protection and Defense Institute at the University of Minnesota.

• Five grants from the Kansas Health Information Center are helping the College of Veterinary Medicine and the Kansas State Veterinary Diagnostic Laboratory develop reliable swine pathogen diagnostic tests.

• T.G. Nagaraja, university distinguished professor of diagnostic medicine and pathology, and Ragavendra Achanta, assistant professor of clinical sciences, are studying if copper and zinc, two common minerals, as animal feed additives can provide disease protection to animals. Learn more about this work and other work K-State is combing antimicrobial resistance on pages 24-27.

• Barbara Drisko, who is with the U.S. Department of Agriculture’s Arthropod-Borne Animal Diseases Research Unit and K-State as an adjunct faculty member in diagnostic medicine and pathology, is leading research on the disease threat of zoonoses. Blue tongue virus, a pest from Northern Europe to sheep breeds in the United States.

• Jieren Ruhl and his CEEZAD team are developing a vaccine for African swine fever virus in collaboration with researchers at Iowa State University and Centro y Instituto de Biologia Molecular Severo-Ochoa in Madrid, Spain. Ruhl is a Regents professor of veterinary medicine and a Kansas Bioscience Authority eminent scholar.

• Julie Shi, professor of anatomy and physiology, is developing a novel vaccine, KNB-2, that differentiates pigs selected with clinical onsite fever viruses from those that are vaccinated with KNB-2.

• Scott McVicker, an adjunct faculty member in diagnostic medicine and pathology, and the USDA’s Arthropod-Borne Animal Diseases Research Unit are studying mosquito-transmitted flaviviruses that threaten both human and livestock populations in North America.

• Steven Echols, professor of mechanical engineering, and Chris Storatius, Carolina-Raine distinguished professor of physics, are improving the science and engineering systems for biosecurity buildings like K-State’s Biosecurity Research Institute. The team has been studying the science of detecting nanosized holes in the HEPA filters. Echols’ team and has been documenting the state-of-the-art atomic systems for the National Bio and Agro-defense Facility.
AMERICAN BISON GRAZE ON GRASS THAT CAN grow taller than most people, rainbows of wildflowers dance in the breeze on the limestone-studded terrain, and new life rejuvenates the charcoaled hills in spring. This mosaic landscape is the Kansas Flint Hills, home to the nation’s most diminished ecosystem.

The tallgrass prairie today is about 4 to 5 percent of its original glory. Most of its former range — from Canada to Texas and from Kansas east to Indiana — is now cropland, urban development or woodland. The largest remaining expanse of native prairie is in the Flint Hills of Kansas and Oklahoma because the rocky land made it difficult for settlers to plow.

“We all like to eat, and we eat a lot of food, so those former grasslands are important for our cropland,” said John Briggs, director of Konza Prairie Biological Station, an 8,600-acre native tallgrass prairie research station on the northern edge of the remaining tract of Kansas prairie. “On the other hand, the intact tallgrass prairie here is some of the most productive grassland in the world and supports the multibillion-dollar cattle industry in Kansas.”

Researchers at Konza Prairie, jointly owned by Kansas State University and The Nature Conservancy, have been fostering long-term ecological research, education and prairie conservation for more than 45 years. Konza’s decades of data give ecologists and land managers an understanding of multiple influences on the rich ecosystem and provide an indication of how the prairie ecosystem works in a controlled environment with minimal human influence.

“Konza is an important reference site and is very unique in that the long-term research gives us the opportunity to see changes over many years,” said Brian Obermeyer, Kansas landscape programs manager for The Nature Conservancy. “A lot of things you can’t tease out in a two- or three-year study. It takes a long time to really understand how the prairie ticks and it may take decades to get conclusive data.”

Konza Prairie’s ecological research is as diverse and extensive as the prairie itself, with more than 150 active research programs collaborating and coinciding on the landscape. Managed by Kansas State University’s Division of Biology, the site has produced historical data on climate and rainfall patterns, cattle and bison effects on prairie diversity, the value of prairie fires to control threatening tree invasions, plant, insect, bird and mammal populations, nitrogen cycling, soil carbon, and the quality and quantity of tallgrass-filtered water.

“Konza’s research and the advancement of ecological theory can help people understand why we need grasslands, the danger of losing them and techniques to conserve and even restore them,” said Briggs, who also is a professor of biology.

Blazing and grazing a path

Konza Prairie — where dry grass is intentionally set on fire — is home to a herd of 250 to 300 American bison and 215 cow/calf pairs of cattle. Konza data demonstrate that both fire and grazing are important...
Counting shrubs for 30 years in annually burned, four-year burned and 20-year burned watersheds

Researchers at Konza have hard numbers that show that the tallgrass prairie has a tipping point in the absence of fire. Konza Prairie’s research units — called watersheds because their boundaries are set by how the rainfall and water flows down them — are burned at different frequencies. In the annually burned watershed, the amount of shrubs and tree is minimized — plants are counted every five years — but in the absence of fire, shrubs expand into the prairie landscape and trees may have a better opportunity to become established.

The three watersheds below — an annually burned watershed on top, a watershed burned once every four years in the middle and a watershed burned once every 20 years at the bottom — show the increase in woody plants like yellow across 30 years of counting plants.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>30</td>
</tr>
<tr>
<td>1986</td>
<td>9</td>
</tr>
<tr>
<td>1996</td>
<td>1</td>
</tr>
<tr>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
</tr>
</tbody>
</table>

Researchers further defined the relationship between fire and grazers for prairie health by using tracking collars on the bison. The records indicate that the bison follow fire to the watersheds with the newest and most nutritious grass.

Grass of the tallgrass prairie that can reach heights of 6 to 8 feet with a root system nearly twice that size — can overshadow the flowering plants and reduce plant diversity.

“Fire and grazing work together to open up the canopy and expose short wildflowers to key insects, which increases plant diversity,” Joern said. “The more plant species you have on a prairie, the more animal diversity there will be, including more pollinators.

Ecological diversity varies with plants, which affect diversity at all levels.”

A nearly 20-year collection of grasshoppers on ungrazed prairie compared with a 10-year collection of grasshoppers on grazed prairie indicated that moderately grazed watersheds have 32 percent more arthropods, with some areas reaching as much as 50 percent more insects. According to Joern, the increase in insects will increase the animals that prey on them.

“Bison and cattle are attracted to areas that have been recently burned,” Briggs said. “That’s where the young birds are born and are raised. If they have restricted grassland sites, you are not going to get the birds reproducing at the rates they used to and this is a cause for concern.”

Researchers further defined the relationship between fire and grazers for prairie health by using tracking collars on the bison. The records indicate that the bison follow fire to the watersheds with the newest and most nutritious grass.

“Bison and cattle are attracted to areas that have been recently burned,” Briggs said. A professor of biology who studies grassland ecology and the interaction of insect and plant communities.

Some of Konza’s watersheds host bison as a historical reference for how native grazers influence prairie ecology. Other watersheds host cattle, the most common grazer of today’s prairie. Ungrazed watersheds provide comparison to both grazers and native conditions at many prairie preserves in the region.

“If land managers put one kind of grazier — cattle, bison or even mowing — in an annually burned site, it increases plant diversity because cattle and bison eat the dominant grasses, which allows the subdominant plants called forbs, or flowering plants, to increase,” Briggs said.

“If not controlled for grazing, the towering tallgrass — like big bluestem, the iconic tallgrass prairie management and influence prairie ecology. Konza is divided into more than 50 research units called watersheds, each with a different experimental approach.

Each watershed has an assigned burning season — winter, fall, summer or the traditional spring burning — and a fire frequency in one-year, two-year, four-year or 20-year burning regimens in grazed and ungrazed prairie watersheds.

“The key to effectively managing the prairie is the interaction of fire and grazing — not just one versus the other,” said Tony Joern, university distinguished professor of biology who studies grass-prairie preserves in the region.

“The grassland is a nursery,” Briggs said. “That’s where the young birds are born and are raised. If they have restricted grassland sites, you are not going to get the birds reproducing at the rates they used to and this is a cause for concern.”

Researchers further defined the relationship between fire and grazers for prairie health by using tracking collars on the bison. The records indicate that the bison follow fire to the watersheds with the newest and most nutritious grass.

“Bison and cattle are attracted to areas that have been recently burned,” Briggs said.
Joern said, “If you have an area that has led very little grazing and then you burn it, the grazers basically spend the entire time there. The area that they grazed the summer before are left mostly untouched and build up fuel for the next burn.”

Joern said that the fire-grazing interaction moves around in space and time on the prairie to create a cycle. The consequence of that cycle is effectively managed only over many years.

“Konza shows that long-term research is essential,” Joern said. “Historically, researchers thought burning every four years would keep woody vegetation under control. Based on the accumulation of data of Konza’s wildfires, we are seeing that probably no longer the case. We’re thinking burning at least every three years is the most effective to managing that cycle.”

According to John Blair, director of Konza Prairie’s Long-Term Ecological Research program, which is funded by the National Science Foundation, long-term studies are critical in determining fire frequencies.

“According to Konza Prairie’s patch burn study is a long-term study to determine how burning a third of the prairie every year will affect the ecological and performance and cattle performance, such as weight gain and fertility. Two patch burn watersheds were established, each divided into three sections, with one section burned every year. Cattle have free roam of the entire area.”

In 2011, 2012 and 2013, when drought conditions were pretty severe and we destocked our annually burned pastures, we didn’t have to do anything in the patch burn pastures,” Olson said. “There was a significant amount of residual forage in the unburned areas that was sort of drought insurance that we didn’t have to do anything in the annually burned pastures.”

Conciding with the cattle performance research on the patch burn watersheds, Walter Dodds, professor of animal sciences and industry who is collaborating with Joern for the study. “In a normal moisture year, cattle spend about 75 to 85 percent of their time on the patch that has been burned that particular year.”

The amount of time cattle spend on the burned section is why Olson’s yearly cattle productivity research, since 2010, have not shown performance differences between cattle in the patch burned areas versus the annually burned controls. Olson has noticed one difference between the two areas.

“Farmers are able to convert the nutrients that have been stored in the ground soil over hundreds of thousands of years to crops that feed us,” Briggs said. “It’s good soil for growth, but as the need to feed more people increases and demand for animal products continues, our ability to feed the world will be challenged.”

Briggs said that the U.S. Department of Agriculture’s Conservation Reserve Program, which provides financial incentives for farmers to convert less productive cropland back to prairie for 10-15 years, has helped conservation efforts, but the ecosystem may not return to its original state.
belowground unplowed condition for 100 years. “To the casual observer, a restored prairie looks pretty but if you really dive into the details, the diversity is missing, especially in the soil,” Briggs said. “You get a lot of really tall grasses that dominate the prairie like a 300-hundred-pound gorilla to keep everything out of the field. There are a lot of plants missing, especially the flowering and non-grasses — the ones that provide all of the coloring in the springtime.”

Konza researchers are involved in multiple projects that evaluate the ecological and human factors that affect prairie restoration success, such as manipulating soil resources by adding rocks under the soil to mimic the hilly terrain of the Flint Hills or adding sawdust and table sugar as sources of carbon to increase soil microbe populations and reduce nitrogen availability. A few of the projects measure changes in restored prairies over time as part of Konza’s Long Term Ecological Research program, one of the NSF’s original six funded long-term programs in the nation.

According to Blair, a common problem in prairie restoration is that even if a variety of plants is planted initially, diversity decreases over time. Blair and his colleagues started the first prairie restoration study, called the environmental heterogeneity hypothesis project, on Konza in 1998. It is based on a theory that increasing heterogeneity of soil resources will help increase plant diversity in restored prairie. “It builds on the data collected from Konza that suggests that soil nitrogen availability and soil depth, or water availability, are some of the key factors that influence diversity in native grasslands,” Blair said. “We want to know if we can use this information to steer recovery of prairie.”

The restoration projects are just a few of Konza’s programs and projects that are designed to help further ecological theory and improve grassland management in the tallgrass prairie ecosystem and around the globe. Briggs said educating the next generation is important to achieving that goal. “Education is a major component of Konza’s mission, particularly since we are a research university,” Briggs said. “Training and hands-on experiences for undergraduates and graduate students are essential for the future. We have taken on the additional task of education from K-32 to the general public, and we hope that all of those aspects lead to appreciation and understanding of tallgrass prairie to assure that this endangered ecosystem is protected.”

The 1,000-1,800 pound American bison is a large, hardy animal with a well-deserved reputation for resilience. A bison’s large muscled head and thick coat give it an extra layer of warmth in the bitter winter wind of the Kansas Flint Hills. When it snows, they use their head to plow the snow to get to the grass underneath.
THE BUZZ
BEHIND
THE BITE

How scientists tackle infectious diseases and the mosquitoes that spread them

By Jennifer Tidball
Virulence of Viruses

Researchers Scott Huang knows firsthand the effects of infectious diseases. Huang is from Taiwan, where Japanese encephalitis virus and dengue viruses are endemic pathogens.

“Once these viruses are introduced, there is no way to get rid of them because they can be persistent in mosquitoes or susceptible hosts,” said Huang, a university research scientist and professor of diagnostic virology and pathology. “These viruses can infect humans and animals without showing symptoms, which makes them some of the hardest targets to control.”

That’s part of what motivates Huang to study mosquito-transmitted viruses. At the Biosecurity Research Institute, a biosafety level-3 facility where scientists can safely study animal and human infectious diseases, Huang, Vanlandingham and Huang collaboratively are studying Zika virus, Japanese encephalitis virus, yellow fever virus and Cache Valley virus with researchers from institutions in the U.S. and the U.K.

The university scientists were part of a multi-institutional team that recently developed a possible new Zika virus vaccine and published the results in Nature. The immunogenic vaccine potentially could protect against the virus with one dose and could become a tool to prevent future outbreaks, Huang said.

The Biosecurity Research Institute team played an important role during the Zika virus public health emergency in 2016. The institute has facilities needed to study mosquitoes and understand how they become infected with Zika virus.

Through a research project with Ross University, along with researchers from the National Institutes of Health, the scientists are providing skills and expertise for further studies with Zika virus and similar viruses.

But the university work extends to other emerging viruses as well. Huang, Vanlandingham and Huang are performing several studies funded by the National Bio and Agro-defense Facility Transition Fund and the Bone Health Information Center — on an emerging type of Japanese encephalitis virus. Their studies are the first U.S. studies of Japanese encephalitis virus since the 1940s, and the researchers also are doing the first studies with the Cache Valley virus that is present in North America.

Japanese encephalitis virus is found primarily in pigs and birds in Asia, but it can transmit to humans and cause severe inflammation, or encephalitis, of the brain. The Japanese encephalitis virus research at the Biosecurity Research Institute is especially important. A new, emerging type killed 14 people in China in 2014. Older strains of Japanese encephalitis virus commonly are circulating in Asia and infect an estimated 67,800 people per year. Although many people in Asia are vaccinated, the virus is not very effective because it is made for the older strain, researchers said.

“As the virus continues to circulate, the threat still remains,” Huang said. “The new strain is just as bad as the old strain. If a strain is going to be introduced to the U.S., it’s going to be this new strain and the U.S. is not prepared for a potential outbreak.”

Through U.S. Department of Agriculture funding and collaboration with the Arthropod-Borne Animal Diseases Research Unit in Manhattan, the researchers are determining if North American mosquitoes could transmit Japanese encephalitis virus and how the U.S. could prevent an outbreak.

The team has published results in Vector-Borne and Zoonotic Diseases and PLoS Neglected Tropical Diseases. The Japanese encephalitis virus work in a transition project that will jump-start research at the National Bio and Agro-defense Facility, or NBABFR, the U.S. Department of Homeland Security’s newest animal disease research facility that is being built adjacent to the university’s Manhattan campus. Huang, Vanlandingham and Huang’s research on Cache Valley virus aims to increase knowledge of the virus’s transmission cycles. The virus is an important agricultural pathogen that primarily affects sheep and is widespread in North America.

With no approved vaccine or treatment, Cache Valley virus’s biggest human public health concern is its potential to cause neurotropic disease, which can lead to permanent nerve damage, Huang said. The Biosecurity Research Institute works to identify potential carriers that could transmit Cache Valley virus. The USDA-funded project is a collaborative effort with U.K. researchers.

Back to the Biological Basics

One way to fight mosquito-borne diseases like malaria, yellow fever or dengue fever is to make the insect it’s own vector. Ross University biogeologist Kristin Michel has a specific target in mind: the mosquito immune system.

Michel, associate professor of biology, and Ben Bryant, research assistant professor of biology, are studying Anopheles gambiae, the mosquito species that is the main transmitter of malaria in sub-Saharan Africa. Their goal is to identify ways to eliminate pathogens and parasites in the mosquito before it can transmit them to humans.

Michel and Bryant approach their work like a puzzle. Figure out what molecules are in the immune system, how they function and what immune responses they control. Then determine how these pieces fit together to contribute to the mosquitoes’ immunity as a whole and how they relate to the pathogens.

Their NIH- and USDA-funded research has determined the key role of promoters and their effect on controlling hemocyte immunity as well as the role of hemocytes in cellular immunity.

Michel’s team recently showed that in the first 24 hours after a mosquito eats a pathogen, the hemocytes — or blood cells — increase in a mosquito’s immune system as it prepares to fight any pathogen the blood.

“Imagine if every single time you eat a meal, all your white blood cells said ‘Yes, we need to be a massive infection or inflammation response, and mount a defense,’” Michel said. “That would take a lot of blood.”

Bryant now is using NIH funding to develop a gene therapy-type approach to turn off specific genes in specific tissues in Anopheles gambiae.
2017 Spring - Seek - Anatomical gambier mosquitoes: Anopheles gambiae mosquitoes.

GOING WITH THE GUT

Only a few dozen of the more than 3,000 species of mosquitoes in the world can transmit viruses. To understand why, two biology professors — Rollie Clem and Lorena Passarelli — are investigating the insects’ intestines.

It turns out that the gut and the surrounding structure — called the basal lamina — are a mosquito’s key defenses against viruses. Through NIH funding, Clem and Passarelli have studied the basal lamina and its network of proteins to understand how it can act as a barrier against viruses and how that barrier is disrupted during a blood meal.

When a mosquito bites a host, any viruses in the blood travel through the mosquito digestive system to the gut. Sometimes viruses are able to escape the gut, infect the salivary glands and shed in the saliva when the mosquito bites another host. Yet other times, viruses are not able to leave the gut and the mosquito does not spread the virus. The biologists want to know how the virus can escape the gut and travel into the main body.

“Malaria is a global problem,” Michel said. “People agree that the control strategies while minimizing side effects for the insect.

“By understanding detoxification mechanisms, we will be able to select some of the most devastating disease-spreading insects in the world.”

“Many of these diseases are in other countries, but certainly are threatening to come into the U.S.” Clem said. “With changing climates, these mosquitoes are expanding their range farther and farther north. There is a lot of public awareness about the importance of these diseases and our research could help the millions of people affected by these viruses every year.”

INVESTIGATING INSECT CONTROL

Of course, a key way to keep mosquito-borne diseases under control is to control the insects that spread them.

That’s where Kun Yan Zhu, professor of entomology, fits in. His work with chitin, a major chemical component of a mosquito’s exoskeleton shield. When insects are not able to produce chitin, they can become more susceptible to insecticides.

“The exoskeleton is the first defense line for mosquitoes and other insects,” Zhu said. “Chitin biosynthesis is an important target for insect control. We are trying to understand chitin biosynthetic pathways and develop new techniques to prevent chitin production using chemical and genetic approaches.”

Zhu and his team recently patented a form of nanoparticle insect control that uses a gene, called chitinase, to prevent mosquitoes and insects from producing chitin.

“Insect control that targets chitin biosynthesis is safe and low risk to affect humans because we do not produce chitin,” Zhu said.

Zhu’s research also is attacking another major problem in mosquito control: insect resistance to insecticides. Over time, mosquitoes can become resistant to insecticides, which have to be replaced with newer versions.

To help control this, Zhu’s team has developed a technique that uses a genetic chain reaction to prevent mosquitoes and insects from reproducing.

Using USDA and other funding, his team is investigating a family of genes that uses a genetic chain reaction to prevent mosquitoes and insects from reproducing.

“By understanding detoxification mechanisms, we will be able to selectively use insecticides that may be able to control resistant insects, including mosquitoes,” Zhu said. “This is an important strategy to control the most devastating disease-spreading insects in the world.”

A CLOSER LOOK AT MOSQUITO-BORNE DISEASES

JAPANESE ENCEPHALITIS VIRUS

Japanese encephalitis virus is Asia’s leading cause of pediatric viral encephalitis, or severe inflammation of the brain. While most humans recover, severe cases are fatal.

The virus is linked to birth defects, including microcephaly.

ZIKV VIRUS

Zika virus detections have occurred since the 1940s, but an epidemic spread through the Americas in 2015-2016. Many births with microcephaly were identified, but the virus is linked to birth defects, including microcephaly.

CHIKUNGUNYA VIRUS

Chikungunya fever first appeared in the 1950s, but the first transmission in the Americas occurred in 2013 in Caribbean islands. Chikungunya virus can be lethal, but can cause fever, muscle pain, headaches and severe joint pain in humans.

YELLOW FEVER VIRUS

Yellow fever virus can produce devastating outbreaks in tropical regions. Most infected people only have mild illness, but severe cases can cause liver disease and bleeding. Fatality rates vary from 20 to 50 percent of severe cases.

MALARIAS

Malaria is a serious and potentially fatal disease found in warmer regions. It can cause fever, chills, and flu-like symptoms. Young children and pregnant women are most vulnerable.

“Two weeks ago, we learned that the team is using Maz, a video that shows a closer look at the exoskeleton of a mosquito. Learn more about these diseases at b-state.edu/mosquitoes.
NEARLY 90 YEARS AGO, SCOTTISH SCIENTIST ALEXANDER FLEMING DISCOVERED penicillin, heralding the dawn of antibiotics to fight infections and protect humans from emerging diseases. History indicates that the use of penicillin likely saved the lives of many wounded soldiers during World War II, in addition to countless others suffering from previously untreatable ailments. But disease-causing microbes have survived since the beginning of time largely because of their ability to adapt. In fact, it wasn’t long after Fleming discovered penicillin that he realized that microbes had already become resistant to the medicine.

In a world of bacteria, fungi, viruses and parasites, science can never rest. Kansas State University researchers involved with antimicrobial resistance, or AMR, are ramping up efforts to tackle the growing and deadly problem. “In the mid-1980s, we were so bold as to say the era of infectious disease is behind us, that we’ve conquered infectious disease,” said Mike Apley, the Frick professor of production medicine and clinical pharmacology in K-State’s College of Veterinary Medicine. “Bacteria aren’t smart, but there are billions and billions of them and they have mutations — and some of those mutations select for resistance to antibiotics,” he said.

MICROBES ‘ADAPT AND SURVIVE’

That’s the essence of antimicrobial resistance, which threatens human and animal health as the wave of resistant bacteria grows while the world’s production of new antibiotics and the effectiveness of existing antibiotics diminish. An antibiotic will kill most microbes for which it’s designed, but the surviving microbes develop resistance, ultimately making the antibiotic ineffective to future strains of the disease. “AMR is a natural phenomenon,” said Brian Lubbers, director of the Clinical Microbiological Laboratory in the Kansas State University Veterinary Diagnostic Laboratory. “Bacteria are responding to a pressure from the environment — antibiotics. The bacteria try to adapt and survive just like any species.”

“The concern for the future is if we get an infection in the hospital, we may not be able to deal with it,” said Apley, who was appointed in 2015 to the Presidential Advisory Council on Combating Antibiotic Resistant Bacteria. “That would be catastrophic in a lot of different ways.” According to a 2013 report from the U.S. Centers for Disease Control, a little more than 2 million human illnesses are caused annually by bacteria and fungi that are resistant to some classes of antibiotics. The CDC reports that 23,000 of these illnesses result in death.
Antimicrobial Resistance (AMR) occurs when a microorganism becomes resistant to an antimicrobial drug that was originally effective for treatments of infections.

One way Kansas State University is tackling antimicrobial resistance is through the development of pigs resistant to porcine reproductive and respiratory syndrome, or PRRS, a deadly swine disease. PRRS-resistant pigs were developed by a K-State scientist and colleagues at another university.

The CDC also reports that illnesses and deaths attributed to antimicrobial resistance cost American $20 billion in additional health care spending, and $35 billion in lost human productivity.

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Showcasing K-State in KC

On May 17, Kansas State University is opening its doors to businesses in the Kansas City metro area.

The 2017 Research Showcase at the K-State Olathe campus highlights the wide breadth of research expertise, resources and capabilities at the university that are available to public and private corporate partners.

The 2017 Research Showcase at the K-State Olathe campus highlights the wide breadth of research expertise, resources and capabilities at the Kansas City metro area.

Greater Kansas City is home to more than 240 life sciences companies with more than 50,000 employees. The region also is part of the Animal Health Corridor — a nexus for animal health research and development with more than 300 animal health companies located from Manhattan, Kansas, to Columbia, Missouri.

For more information on the 2017 Research Showcase at the K-State Olathe campus, please visit https://researchshowcase.ksu.edu.

Patented success: Easier way to make graphene

Forget catalysts and expensive machinery — a Kansas State University team of physicists has discovered a way to mass-produce graphene with three ingredients: hydrocarbon gas, oxygen and a spark plug.

Their method is simple: Fill a chamber with acetylene or ethylene gas and oxygen. Use a vehicle spark plug to create a contained detonation. Collect the graphene that forms afterward.

Chris Soumniou, Cortelyou-Rust university distinguished professor of physics, is the lead inventor of the recently issued patent. “Process for high-yield production of graphene via detonation of carbon-containing material.” Other Kansas State University researchers involved include Arjun Nepal, postdoctoral researcher and instructor of physics, and Gajendra P. Bhadra Singh, former visiting scientist.

“We have discovered a viable process to make graphene,” Soumniou said. “Our process has many positive properties, from the economic feasibility, the possibility for large-scale production and the lack of nasty chemicals. What might be the best property of all is that the energy required to make a gram of graphene through our process is much less than other processes because all it takes is a single spark.”

Graphene is a single atom-thick sheet of hexagonally coordinated carbon atoms, which makes it the world’s thinnest material.

‘Shrew’-d finding on climate change

The shrew and its parasites — even 40-year-old preserved ones — are the new indicators of environmental change, according to a Kansas State University researcher.

Andrea Hope, assistant professor of biology, has colleagues across the U.S. who have published “Shrews and Their Parasites: Small Species Become Big Changes” in the National Oceanic, and Atmospheric Administration’s 2016 Arctic Report Card. The study indicates an expansion in the range of the boreal-heath Shoeless Shrew in Alaska, while the range of its forest-dwelling masked shrew has constricted.

“Each shrew carries within it or on it parasites and pathogens that can be transmitted among different shrews and possibly to other animals. Each shrew matters within it or in a whole community of other species,” Hope said. “Many people don’t know what a shrew is but they are an important part of community dynamics around the world. We can use small mammals, like shrews, as a tool to understand the processes of change. By taking it a step further, we learn how parasites and pathogens spread through the environment.”

The researchers are using field collections of shrews archived in museums to understand how the populations of shrews and their parasites change in response to changes in the environment. From these collections, the researchers can tell that the tundra community has survived previous warm periods, and then expanded back out again when it got colder. “But the current rate of that upsurgence is unprecedented.”

“The tundra community has survived past extreme weather periods, and then expanded back out again when it got colder,” Hope said. “We are in a period now where it is as warm as it ever was in the history of these species and we’re moving into a phase that’s unprecedented.”

Worst cooks in America? Researcher finds celebrity chefs may be in running

Celebrity chefs are cooking up poor food safety habits, according to a Kansas State University study.

K-State food safety experts Edgar Chambers IV and Curtis Maughan, along with Tennessee State University’s Sandria Godwin, published “Food safety behaviors observed in celebrity chefs across a variety of programs” in the Journal of Public Health. The researchers viewed 100 cooking shows with 24 popular celebrity chefs and found several unclean food preparation behaviors.

“Twenty-three percent of chefs licked their fingers, that’s terrible,” said Chambers, university distinguished professor and director of the Sensory Analysis Center at Kansas State University. “Twenty percent touched their hair or dirty clothing or things and then touched food again.”

The chefs’ most common food safety hazards included lack of hand-washing, not changing the cutting boards between raw meat and vegetables that wouldn’t be cooked, and not using a meat thermometer to check meat doneness.

“Washing your hands is not a one-time thing,” Chambers said. “We saw some chefs wash their hands in the beginning before preparing food, but they didn’t wash their hands during food preparation when they should have.”

Chambers said this is not modeling good behavior for viewers. Celebrity chefs’ purpose is to entertain and educate about food preparation techniques and helpful kitchen tips, which should include proper food safety practices, he said.

According to the study, about 1 in 6 Americans are exposed to foodborne illnesses each year, which can economically and socially affect consumers.

See Shorts

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“Washing your hands is not a one-time thing,” Chambers said. “We saw some chefs wash their hands in the beginning before preparing food, but they didn’t wash their hands during food preparation when they should have.”

Chambers said this is not modeling good behavior for viewers. Celebrity chefs’ purpose is to entertain and educate about food preparation techniques and helpful kitchen tips, which should include proper food safety practices, he said.

According to the study, about 1 in 6 Americans are exposed to foodborne illnesses each year, which can economically and socially affect consumers.
Federal fellowships boost global food systems research

Two agriculture researchers at Kansas State University have received federal fellowships totaling $246,660 to study issues that affect local and worldwide food systems. Kevin Dorn, associate scientist in plant pathology, was awarded a two-year $111,640 postdoctoral fellowship to assess how climate change under the differences between annual and perennial plants—a finding that could lead to the development of new perennial grains crops while improving the environment. Caroline Ylioja, doctoral student in animal science, was awarded a two-year $55,000 postdoctoral fellowship to study strategies that could improve the health of replacement dairy animals and their lifetime milk production.

The Agriculture and Food Research Initiative fellowships were awarded through the Food, Agriculture, Natural Resources and Human Sciences Education and literacy Institute of the U.S. Department of Agriculture- National Institute of Food and Agriculture. Don’t project looks to shed light on the mechanisms underpinning some crops’ genetic growth cycles and inform long-standing efforts to personalize major annual crops like wheat. He also will help in the development of new perennial crops like intermediate wheatgrass.

The project builds upon Don’s ongoing research of intermediate wheatgrass genetics, which he and his adviser, Jesse Poland, assistant professor of plant pathology, are exploring in collaboration with The Land Institute and several other academic partners. Ylioja’s project, which is focused on goats milk, is the first milk a cow produces for its calf after giving birth. Typically, the milk is used primarily for the first 20 to 30 days of the calf’s life, but Ylioja proposes additional strategies, such as assessing the presence of antibodies that carry messages between cells, organs and tissue to boost immunity.
April 6, 2017, marks the centennial of U.S. entry into World War I, a grim chapter of world history. America lost more than 116,000 soldiers during the war. The loss of life in Europe was even more staggering: Germany and Russia alone lost 3.4 million soldiers. Military and civilian deaths during the war totaled 16.5 million, and 20 million more were wounded. If the total number of American casualties was relatively small, the rate was severe: The vast majority was suffered in just six months.

The scale of loss had pronounced and lingering effects. Tim Dayton, professor of English at Kansas State University, says understanding WWI is central to understanding 20th century culture. Dayton’s study of literature and poetry from the period, “American Poetry and the First World War,” chronicles a pronounced cultural shift. The book is forthcoming in winter 2017-2018 from Cambridge University Press.

Prior to WWI, poetry tended to be closed-form, following set patterns or structures in terms of rhyme scheme, number of lines or meter, Dayton said. Poetry also was romantic, idealizing its topics, including war. The modern warfare and mass casualties of WWI called into question the idea of noble sacrifice on the battlefield.

“The war amplifies the idea that things don’t make sense,” Dayton said. “The enormous increase in productive capacity in industrial societies correlates with enormous destructive capacity. Things that make life better also can make life worse.”

The dark side of progress led to a struggle in the depiction of war in the literature of the 1920s. “The grounds of judgment change in large part because of reaction to the war,” Dayton said.

America’s reaction differed from Europe’s. Whereas British wartime figures such as Wilfred Owen protested the war through the classics — Owen’s best-known poem “Dulce et Decorum Est” exposes “the old lie” that it is “sweet and fitting to die for one’s country” — American literature assumed what Dayton calls a deflationary style. Dayton argues this reaction arose from the high-minded reasons Woodrow Wilson and other Americans offered in support of entering the war.

“The U.S. couldn’t claim it was defending itself in the war. The justification was more rhetorical, and more on a moral basis — the Russians could say, ‘You must defend the motherland from the Germans,’ the Germans could say, ‘You must defend the fatherland from the Russians,’ and so on. Wilson’s justifications for the war were lofty — war to end war to make the world safe for democracy — and his prose style was very winding,” Dayton said.

According to Dayton, Ernest Hemingway’s prose style is one example of an attempt to define Wilson’s rhetorical speech. Dashiell Hammett provides another example in his prose fiction. He adopted a clipped, direct style devoid of rhetorical flourish.

Dayton discovered his affection for the literature of the post-WWI period while researching his dissertation, which wasn’t about the war, and then while teaching undergraduate literature courses at K-State. The Library of Congress online catalog and a bibliography from a dissertation written in the 1960s led him to many forgotten poems. One of his favorite discoveries is “Father Hiram on the World’s War,” a long poem entirely in Midwestern dialect. No one had previously written about the poem. Several such instances later, Dayton now has a bibliography of 400 volumes of American poetry — many more than the 120 he started with in his original Library of Congress search results.

Dayton’s bibliography forms the basis of another project, a digital archive to allow anyone to access annotated versions of the poems. Although the poetry was usually not written in an elevated style, it can be fairly obscure to modern readers because of historical references, place names and other details, so annotations are helpful. He plans to add biographical and critical introductions for the authors, many of whom published nothing apart from a single volume of war poems. Dayton is working to obtain funding for the archive, which will be useful for the general public as well as for literature and WWI scholars.

He and several graduate students have made good progress; half a dozen volumes are ready for display as soon as a content management system is in place.

The work is valuable for students. “It’s a really nice opportunity to teach grad students and some talented undergrad how to do primary research and annotation,” he said.
“Our students learn that if they unlock one door, there are a million doors behind that door,” said Bonnie Lynn-Sherow, associate professor of history and executive director of the center. Launched with a gift in 2006 from Mark Chapman, a 1965 K-State history and political science alumnus, the Chapman Center’s initial focus was on preserving the memory of Chapman’s hometown, Broughton, Kansas. It now is a busy multidisciplinary center that supports undergraduate students’ research endeavors, especially in the social sciences and humanities — disciplines that Lynn-Sherow said have fewer opportunities for hands-on experiences.

“Undergraduates have clearly expressed their desire for skills-based experiences,” Lynn-Sherow said. “This opportunity is extremely exciting for a lot of students, and we’ve had hundreds of students from all majors and departments involved at the center.”

Center faculty also select four student interns each semester based on their class work, most often a published history of a small town. The interns receive scholarships, travel funds and their own workspaces. They also are mentored one-on-one by faculty on original research projects, as well as contributing to larger projects, such as the recent “Going Home: Hidden Histories of the Flint Hills” exhibit at Manhattan’s Flint Hills Discovery Center.

Brandon Williams, sophomore in history, is a current Chapman Center scholarship intern. “Through the Chapman Center I found what it was I was supposed to be doing, what I am passionate about,” Williams said. “I would not have had the opportunity to do research had it not been for the center.”

Williams’ project for the spring 2017 semester is a photo essay of Orion, Kansas, a town that no longer exists. He is working with an elderly former Orion resident and will scan her six generations of family photographs taken in and around the town.

Many of center’s alumni are now working in or running historical societies and cultural institutions, have started consultancy firms or produce and edit historical films. Based on their work at the center, several have received scholarships for graduate school to study public history.
‘Chocolate pie guy’ shows how exercise affects the way our bodies process high-fat meals

By Tiffany Roney

Nutrition researcher Sam Emerson is gaining a slice of research fame by asking people to eat pie.

Emerson, a doctoral student in food, nutrition, dietetics and health at Kansas State University, and his team had volunteers eat chocolate pie to document effects on glucose, lipids and triglycerides for three groups of people: active adults, ages 18-35; inactive adults, ages 60-plus; and inactive adults, ages 60-plus.

The researchers found the largest disparities between active and inactive persons, including a 76-year-old runner and an inactive man, 10 years younger. The team measured triglycerides, a type of fat in the blood that, at higher levels, can increase the risk of heart-disease and signal a metabolic disorder. The inactive man’s triglycerides increased more than three times over pie-laden weeks, whereas the active man’s triglycerides hardly changed. Emerson said these findings show the benefits of a lifetime of physical activity.

“The thread connecting all my studies is the examination of how nutrition and exercise relate to human health in true-to-life situations,” Emerson said. “Nourishment and movement have a powerful effect on quality of life.”

This spring, Emerson will present the results of the pie study at the K-State Graduate Research, Arts and Discovery Forum and the American College of Sports Medicine’s annual meeting. In addition, he will share findings from another study he conducted at the American Society for Nutrition’s annual meeting.

Emerson is the primary author of five papers and co-author of eight papers published in the Journal of the International Society of Sports Nutrition, the British Journal of Nutrition and other publications.

Emerson earned his bachelor’s in nutritional sciences at Oklahoma State University and his master’s in kinesiology at K-State, where he was named a distinguished master’s student and received the American Kinesiology Association Master’s Student National Research Award. Emerson is the primary author of five papers and co-author of eight papers published in the Journal of the International Society of Sports Nutrition, the British Journal of Nutrition and other publications.

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He chose to stay at K-State for his doctoral studies because he wanted to work with Sara Rosenkranz, assistant professor of food, nutrition, dietetics and health.

“Working under Dr. Rosenkranz has helped me see the type of professor I would like to be so that I can guide students and give them opportunities to participate in exciting research,” Emerson said. “K-State has allowed me to discover and develop my passion for research while developing my teaching skills as a graduate teaching assistant.”

Prasad’s work all about feeding the future

By Beth Robin

P.V. Vara Prasad believes research goes beyond finding solutions to problems; it’s also about preparing the next generation of scholars and practitioners.

The Kansas State University distinguished professor of agronomy and new fellow of the American Association for the Advancement of Science enjoys teaching and research equally.

“If I believe they are complementary,” Prasad said. “Conducting good research requires that you keep up with new science and recent literature. This allows you to teach students with good material and explain the science behind the principles. Interactive teaching also allows students to ask non-vowel and critical questions, which will help us to design your research and develop hypotheses to find answers and viable solutions.”

Research and teaching are the backbone of Prasad’s latest challenge as principal investigator and director of the university’s Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification.

The lab, funded by a $10 million grant through the U.S. Agency for International Development’s Feed the Future program, seeks ways to increase food production with limited resources and reduce stress on the environment.

The lab is fully established and working on projects in its focus countries of Bangladesh, Ethiopia, Burkina Faso, Senegal, Tanzania and Cambodia.

“I am proud that we are working with smallholder farmers to improve their livelihoods,” Prasad said. “We use the model of collaborate, learn and adapt. Our lab brings together about 100 scientists from 40 different organizations in 10 countries to work together and create an environment that facilitates innovative research and education. We are building the capacity of the next generation of scholars and practitioners to train, and we are providing knowledge to students, teachers, scientists, farmers and policymakers.”

The lab’s strong focus on sustainability is key to the future of farming in the countries it serves, Prasad said.

“We want to ensure that we safeguard our environment and natural resources so that the next generation can survive and thrive,” Prasad said. “The biggest challenge is how do we translate this knowledge generated from research to practices that will improve productivity from existing land and will minimize impact on environment and on food and nutritional security?”

Prasad’s research looks at understanding responses of food grain crops to climate change and developing crop, water and soil management strategies for efficiency and improved crop yields.

Since joining K-State in 2005, Prasad has secured $42 million in grant funding to support research, education and extension activities from local, national and international agencies. He has published more than 100 peer-reviewed journal articles and book chapters, and his research has been cited more than 5,100 times. He also has mentored and trained more than 100 research scholars and graduate students.

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See

Engagement

Center for the Advancement of Entrepreneurship helps turn ideas into business

By Tiffany Roney

New businesses are popping up across Kansas with the help of Kansas State University’s Center for the Advancement of Entrepreneurship. The center, housed in the College of Business Administration, provides entrepreneurship education and opportunities to prospective entrepreneurs across campus and the state. Annually, it provides:

- More than 800 hours of research support for businesses started by Kansans.
- 240 hours of mentoring by entrepreneurial alumni for students.
- Thousands of dollars in cash and in-kind prizes for Kansas entrepreneurs.

Since 2008, the center has involved more than 2,200 students in K-State Launch, an annual program that has awarded $180,000 to help start 48 new companies, many of which have stayed in Kansas.

Launch, an annual program that has awarded $180,000 to help start 48 new companies, many of which have stayed in Kansas. For example, the center recently helped launch EcoSilk, a new company providing sustainable products to the consumer market. The center also provides training to K-State students who want to start businesses, pairing students with community mentors or using K-State’s resources to encourage new entrepreneurs in Kansas.

Launch a Business accepts the top applicants for a five-week intensive program in which entrepreneurs engage with students, faculty and alumni to refine and improve their ideas. Participants present their pitches at a public launch party at the end of the program. In 2015, 14 high-potential startups in Kansas competed for thousands of dollars in cash prizes. In all, the center has awarded more than $320,000 to more than 50 emerging companies.

Jackson said the center hosts these events because it takes K-State’s land-grant mission seriously.

“The center’s statewide outreach program include the Kansas Entrepreneurship Challenge and the Launch a Business competition. The Kansas Entrepreneurship Challenge is for future entrepreneurs from Kansas high schools and Kansas Board of Regents institutions. Their business ideas are evaluated by a panel of judges. In 2016, more than $10,000 in cash prizes was awarded to six winning teams.”

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“We’re here to support entrepreneurs, whether we’re teaching students who want to start businesses, pairing students with community mentors or using K-State’s resources to encourage new entrepreneurs in Kansas.”

Jackson said: “It’s all about leveraging K-State’s intellectual, financial and relational — to benefit Kansas’ economy and citizens.”

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B cell

Stephen K. Chapes, professor of biology and interim director of the Johnson Cancer Research Center at Kansas State University, explains, in an untold 100 words, what a B cell is and its role in immune systems. Chapes’ lab wants to know how the genes and gene combinations used by a B cell to make antibodies change after vaccine administration.

A type of white blood cell, a B cell makes antibodies, which are used by the immune system to fight pathogens such as bacteria and viruses. Several genes are needed by B cells to make antibodies. The Circos plot at right shows how often a gene is used as well as the combination of genes used by B cells to produce antibodies. The arc size on the circle’s circumference correlates with the frequency of the gene’s use, while the gene combinations are shown by lines drawn between genes, with size representing frequency of the combination. These combinations determine to what pathogens an antibody will bind.

Circos plot by Tricia Rettig, doctoral student in microbiology, Kansas State University.

Range rovers

Much of the 8,600-acre Konza Prairie Biological Station was at one time part of the Dewey Ranch, a working cattle operation. These photos, courtesy of the Konza Environmental Education Program, show what life was like on the range in the late 1930s to 1950. Top left: In this photo from 1938, steers brought up from the Paloma Ranch in Eagle Pass, Texas, graze on the rich and nutritious tallgrass prairie before being sold. Bottom left: This photo taken in 1950 is of Orville Burtis Sr., manager of the Dewey Ranch, in a Jeep feed wagon. The photo was taken in what now is the present-day headquarters area of Konza. Right: Not much is known about this photo other than it was taken in 1947, probably along the Konza’s main road.
Earth tones

Inspired by the Flint Hills eco-region of Kansas, "Mineral Strata" is a naturally dyed ahimsa — or peace — silk by Sherry Haar, professor of apparel and textiles at Kansas State University. Haar specializes in natural dyes, and is using plant- and tree-based dyes made from dried walnut, marigold, fustic, madder root, hollyhock, Hopi sunflower seed, sorghum, coreopsis and cosmos for her latest exploratory project involving sustainable textiles for use in green burials.