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RESEARCH MAGAZINE FOR KANSAS STATE UNIVERSITY

FALL • 2016



Bronze beauty

University research helps growth of sorghum around the world

Producing better produce

K-State improving the quality and shelf life of fruits and vegetables

The sounds of STEAM

Hear the concert of creativity in science, technology, engineering, art and mathematics



A look at *Fusobacterium necrophorum* in a petri dish. The bacterium causes infection in livestock and people, but researchers at Kansas State University have patented a way to protect animals and humans from *Fusobacterium necrophorum* infections. Find out more about the university's latest patents on Page 38.

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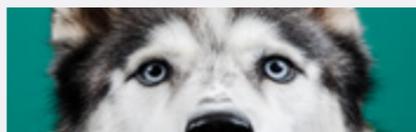
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KANSAS STATE
UNIVERSITY



Kansas State University researchers have worked to improve people's lives since 1863. The best thing about producing our university's flagship magazine is taking time to review some of our recent accomplishments and ongoing projects that do just that — it's the mission of our land-grant university; it's our mission to SeeK.

Kansas is renowned for its wheat production, but we're also the No. 1 sorghum-producing state in the country. Sorghum is an increasingly important crop worldwide. Ongoing work at K-State to fight pests such as sugarcane aphids, to develop genetic tools that breeders use to create new varieties, and to provide products that boost nutrition for children in Tanzania solidify our role as a global food systems leader.

Feeding the world's growing population requires more than growing the crops. Development of modified atmosphere packaging to extend the shelf life of food products is another example of how K-State helps enhance food security. This work demonstrates our creativity in attacking this multifaceted problem.

Speaking of creativity, our multisensory, interactive story on the sounds of K-State research will make you think of research in a new way. You will hear laser-induced thunder, a concrete compression test, a music composition and more — and you'll find out about projects from exercise on Mars to prairie burning. Other creative activities on display in these pages include an exploration of how the K-State drama therapy program — one of only five in the country — helps children on the autism spectrum form social connections and learn to work together by engaging them in after-school and summer drama activities. The College of Education is also producing an outstanding series of documentaries, one of which we spotlight here. Teachers in Kansas classrooms are using "Dawn of Day: Stories from the Underground Railroad" to encourage kids to learn more about the history in their own backyards.

Our backyard companion animals are another area of strength at K-State. Researchers in our College of Veterinary Medicine are producing knowledge that benefits both animal and human health. Our people are investigating whether discoveries about the communication barriers in human breast cancer cells apply to canine cancer cells, they are conducting clinical trials of treatments for dogs with a type of bone cancer that is also common in humans, and they are using stem cells to decrease dogs' pain from hip dysplasia, which may lead to treatments for human osteoarthritis.

This summary is far from complete. Our fall issue has much to offer, so please take a few minutes to "See" (and hear!) how "K"-State research, scholarly, and creative activities and discoveries are affecting our world. I promise you'll be impressed.

Peter K. Dorhout, Vice President for Research

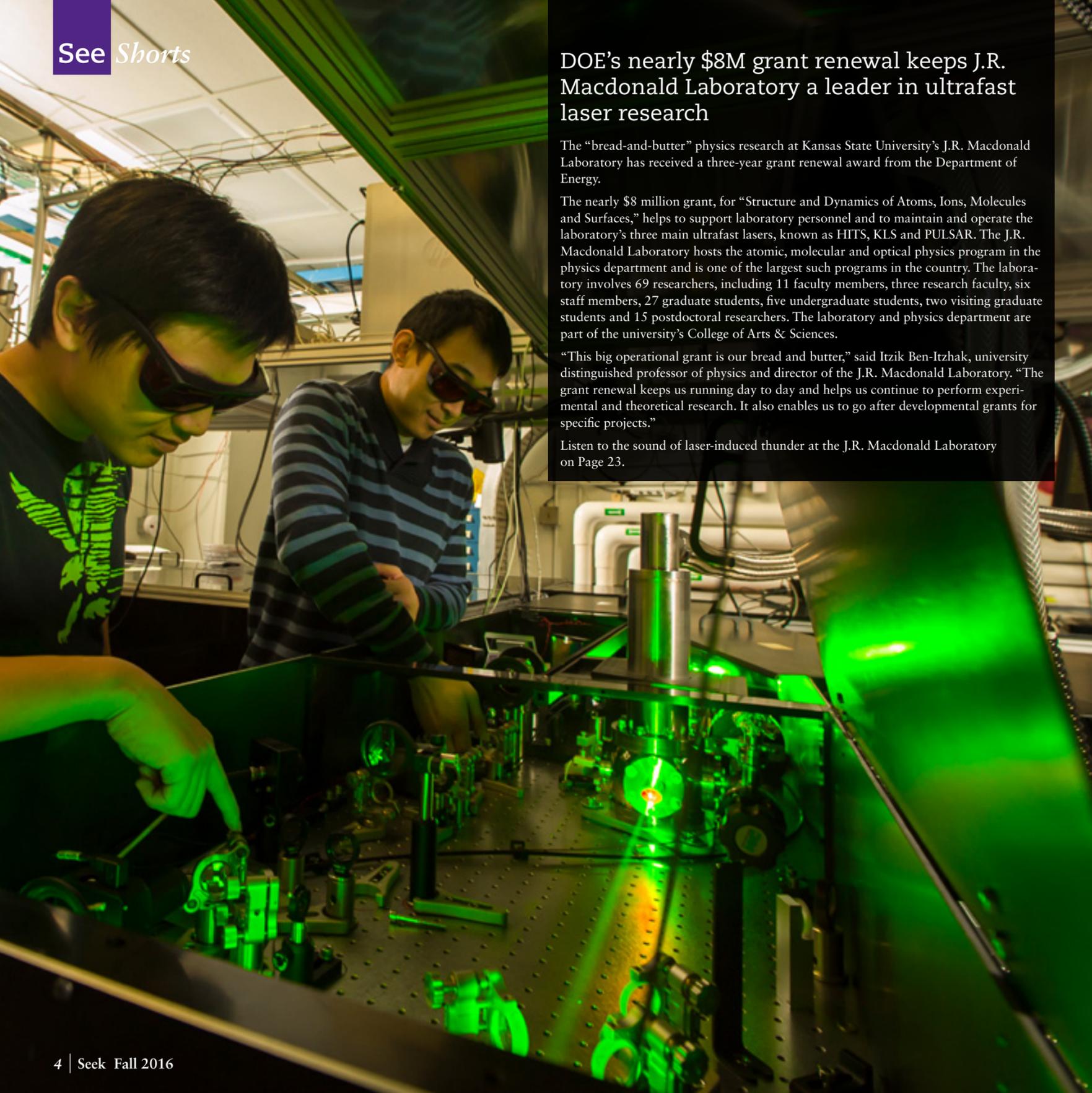
DOE's nearly \$8M grant renewal keeps J.R. Macdonald Laboratory a leader in ultrafast laser research

The "bread-and-butter" physics research at Kansas State University's J.R. Macdonald Laboratory has received a three-year grant renewal award from the Department of Energy.

The nearly \$8 million grant, for "Structure and Dynamics of Atoms, Ions, Molecules and Surfaces," helps to support laboratory personnel and to maintain and operate the laboratory's three main ultrafast lasers, known as HITS, KLS and PULSAR. The J.R. Macdonald Laboratory hosts the atomic, molecular and optical physics program in the physics department and is one of the largest such programs in the country. The laboratory involves 69 researchers, including 11 faculty members, three research faculty, six staff members, 27 graduate students, five undergraduate students, two visiting graduate students and 15 postdoctoral researchers. The laboratory and physics department are part of the university's College of Arts & Sciences.

"This big operational grant is our bread and butter," said Itzik Ben-Itzhak, university distinguished professor of physics and director of the J.R. Macdonald Laboratory. "The grant renewal keeps us running day to day and helps us continue to perform experimental and theoretical research. It also enables us to go after developmental grants for specific projects."

Listen to the sound of laser-induced thunder at the J.R. Macdonald Laboratory on Page 23.



Sweet success with new food technology that cuts calories, fat

A food technology donated to Kansas State University's Institute for Commercialization is on the cusp of transforming chocolate and many other popular food products.

Indianapolis-based Choco Finesse LLC has introduced Epogee Fat Replacement, which can replace up to 80 percent of the fat and drop total calories by 20-45 percent in typical recipes.

The fat replacement tastes like fat that comes from natural vegetable oils. Epogee's use in food has been confirmed by the Food and Drug Administration for candies, baked goods, spreads, nutrition bars and other foods.

Ken Williams, director of licensing for the Institute for Commercialization, said the university has been involved for several years in creating the relationships needed to advance the technology.

At the Institute of Food Technologists' annual meeting in July, Choco Finesse unveiled a partnership with Blommer Chocolate, the largest cocoa processor and ingredient chocolate supplier in North America. Blommer will be using Epogee in a new line of chocolate coatings.

David Rowe, founder and chief president of Choco Finesse, said Epogee's use is supported by 65 scientific studies and seven journal articles.

"The FDA has noted that Epogee's effectiveness to safely lower calories is backed by one of the strongest databases ever developed for a new food ingredient," he said.

Choco Finesse officials say that products containing Epogee will begin to reach consumers in 2017. For more information, visit the company's website at epogee.net.

A 'bear' necessity: Research uses webcam to study our emotional connection to wildlife, parks

If you visited Alaska's Katmai National Park in July, you probably enjoyed watching brown bears fish for salmon at the iconic Brooks Falls.

But what if you didn't have to venture to Alaska to see the bears in action because you could watch on a live webcam? Would you have the same emotional response as viewing the bears in their natural surroundings?



Jeffrey Skibins



Ryan Sharp

That's what two Kansas State University researchers want to find out through a live-stream video study of brown bears. Jeffrey Skibins and Ryan Sharp, both assistant professors of park management and conservation, want to answer an important question: Do people

have the same emotional connections with animals when watching them through live webcams and in real life?

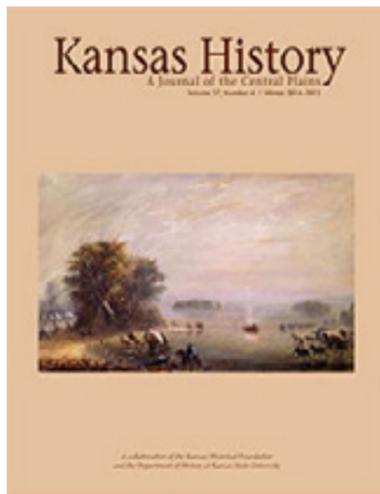
Skibins and Sharp are focusing the study on a "bearcam" provided by multimedia company explore.org, which is the philanthropic media organization and division of the Annenberg Foundation. The "bearcam" offers live footage of brown bears at locations throughout Katmai National Park, including the iconic Brooks Falls, where salmon jump up waterfalls and bears wait nearby to catch them.

"Ultimately we want to know how viewers are affected by seeing something online — not having an actual experience, but having the virtual experience of viewing animals in nature," Skibins said. "Does it create a conservation behavior action within the viewer? Does it cause people to want to get involved in saving these animals?"

The research project has received financial support from K-State's horticulture and natural resources department and K-State Research and Extension.



Home on the range: Kansas history journal moves to K-State



Kansas History: A Journal of the Central Plains, which has been published in some form for more than 130 years, has a new home. Editorial operations moved to Kansas State University's history department in 2013, and K-State has been responsible for all production from manuscript selection to printing since the spring 2014 issue.

Jim Sherow, K-State professor of history and managing editor of the journal, oversees a team of editors and student

editorial assistants. Undergraduate interns assist the book review editor and do general office work, and graduate students do copy editing and manuscript proofing.

"The student assistants gain invaluable experience in how professional scholarship is researched, written, vetted and published," Sherow said.

The fall 2016 issue contains articles about a visit Walt Whitman made to Missouri, Kansas and Colorado in 1879; the history of B-29 production in Wichita; postwar Mennonite church architecture; and more. Subscribe or find information at k-state.edu/history/kansas-history or email Sherow at jsherow@k-state.edu.

EPA grant to K-State engineers could help clear the air in the Windy City

Chicago communities most at risk for poor air quality will soon have the opportunity to participate in their own air quality monitoring with help from Kansas State University.

The project, "Shared Air/Shared Action: Community Empowerment through Low-cost Air Pollution Monitoring," is being conducted by three K-State researchers and seven Chicago organizations. It received a \$750,000 grant from the Environmental Protection Agency to investigate if giving communities access to low-cost portable air pollution monitoring devices could help improve air quality, which is directly related to human health concerns.

Chicago's environmental justice communities — areas that share a disproportionate amount of the risk in contamination and pollution from industrialization and modern society — are the focus of the project. The researchers will do a pilot study in winter 2016 and will launch the full study in spring 2017.

"In a crowded city, many people end up living next to landfills, major highways or industrial areas," said Wendy Griswold, the project's principal investigator and Kansas State University's Center for Hazardous Substance Research project manager. "Studies have shown that people living in lower-income, minority communities adjacent to such pollution sources have historically experienced higher pollution levels."

Chicago's industrialized history and repeated air quality citations make it an ideal area to test the researchers' hypothesis that communities will become more engaged in improving their environmental surroundings if they are provided with relevant scientific and technical tools. According to the grant proposal, 17 to 25 percent of children in Chicago's Little Village neighborhood have asthma. Griswold said that this neighborhood and other similar neighborhoods could benefit from closer ambient monitoring stations.



Zika virus research at Biosecurity Research Institute aims to control, fight mosquitoes

Kansas State University is helping the fight against Zika virus through mosquito research.

The university's Biosecurity Research Institute is taking a two-part approach: Researchers are studying mosquitoes to understand how they become infected with Zika virus and researchers are providing the virus to collaborative organizations for further study.

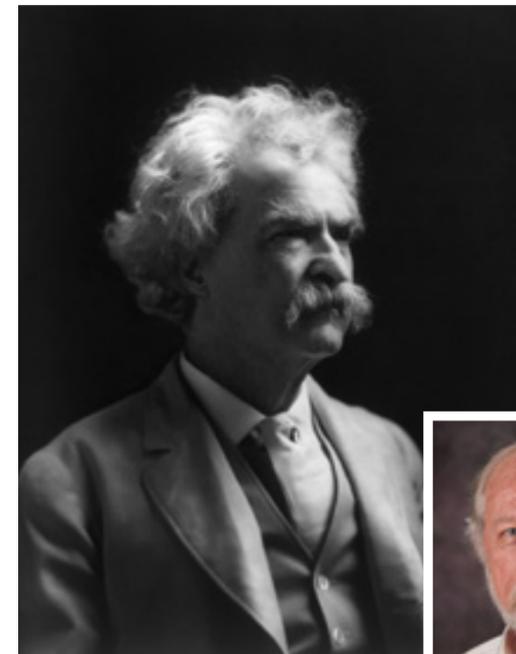
The institute recently contributed to the development of a promising DNA vaccine that is safe and effective against Zika virus and could offer more affordable long-term protection.

"We are hoping to provide some answers and insights into the relationship between Zika virus and the mosquitoes that transmit the virus," said Stephen Higgs, director of the Biosecurity Research Institute.

Higgs and other Biosecurity Research Institute scientists — including Dana Vanlandingham, assistant professor of virology, and Yan-Jang Huang, postdoctoral fellow in diagnostic medicine and pathobiology — have published their collaborative work in Nature Medicine, Science, and Vector-Borne and Zoonotic Diseases.

The researchers have been involved in several important findings, including:

- *Culex mosquitoes, which transmit West Nile virus and Japanese encephalitis, do not appear to transmit Zika virus.*
- *People infected with Zika virus may not be susceptible to Zika virus again.*
- *Zika virus is present in the blood very early during infection and remains in some tissues for a long time but is only briefly present in other tissues.*



English professor seeks the true Twain in NEH-supported project

A Kansas State University English professor used a summer stipend from the National Endowment for the Humanities to explore how Mark Twain came to be thought of as the folksy writer from Missouri who spouted quotable wisdom.

The NEH stipend is helping James Machor with his book project about how readers received Twain's work. Summer stipends support advanced research that is of value to humanities scholars, general audiences, or both. The National Endowment for the Humanities funds approximately 9 percent of proposals to the program, and Machor's award was only one of two given in Kansas for 2016.

To determine how Twain's readers and critics shaped the way he is remembered, Machor is looking at the way the author's works were received in his lifetime as well as the way Twain has been represented and viewed in the last 160 years. He also is working to address a gap in Twain reception scholarship; most of the work has focused on "Huckleberry Finn," "The Prince and the Pauper" and "Tom Sawyer," and posthumous reception has been limited almost exclusively to "Huckleberry Finn," a book that was controversial for encouraging bad behavior in boys long before readers raised questions about racism and racially charged language.

Machor hopes to finish a draft of his book in 2018.

They didn't bring home a medal for their efforts, but two Kansas State University faculty members did bring home golden memories from the 2016 Summer Olympics in Rio.

Bryan Pinkall, assistant professor of voice who is a professional singer with the Grammy-winning Kansas City Chorale, assisted with the opening ceremony at the Rio Games. Pinkall was part of the performance operations team for the opening ceremony, which is one of the world's largest artistic events. Pinkall also assisted with the opening ceremony for the 2014 Winter Olympic Games in Sochi, Russia.

Phillip Vardiman, director of K-State's athletic training program, served as an athletic trainer on the medical team for U.S. track and field athletes competing at the Rio Olympics. Vardiman was selected for the medical team by the U.S. Olympic Committee. It was the first time he served at the Olympics.

Olympics more than games to two K-State faculty members

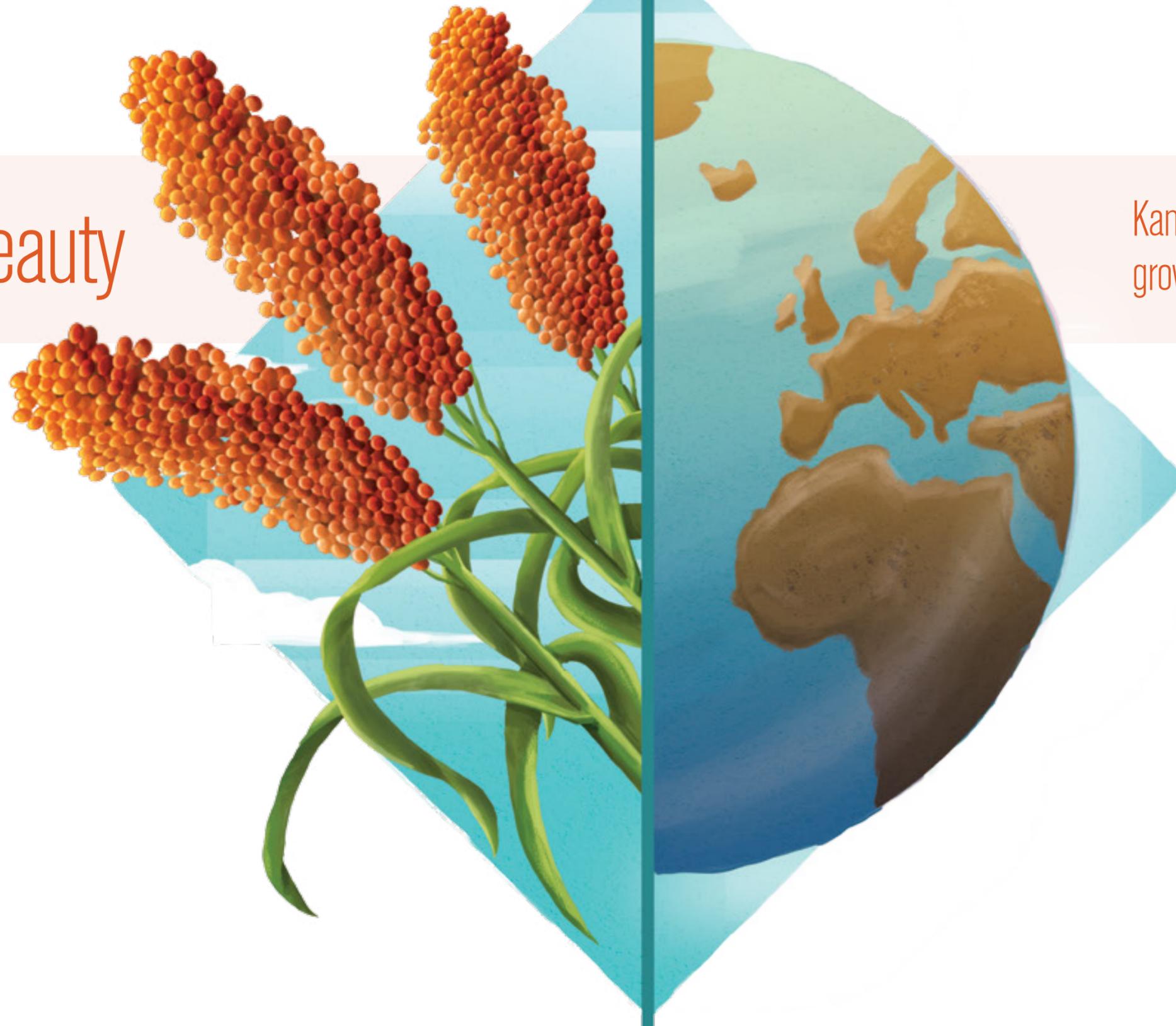


Bryan Pinkall



Phillip Vardiman

Bronze Beauty



Kansas State University research helps the growth of sorghum in Kansas, worldwide



Bronze Beauty

Kansas State University research helps the growth of sorghum in Kansas, worldwide

By Pat Melgares

EACH FALL, A SEA OF BRONZE FILLS THE KANSAS landscape, from the most rural areas of the state to lush farm fields that are sometimes just a stone's throw from Interstate 70 and the most heavily populated cities.

This is a hotbed for American sorghum, whose origins in Africa may contribute to its relative anonymity in the United States.

Also known as milo, sorghum is the beaded heads of the mature crop. The farther west you travel in Kansas, the more sorghum you're likely to see because it is an ideal crop in areas where water is sparse.

"Sorghum is a very hardy, water-sipping crop, making it fitting for our harsh, unpredictable weather," said Pat Damman, director of the Kansas Grain Sorghum Commission. "It also is gaining in popularity because of our growing export market. China has really made the world look at grain sorghum."

Sorghum's standing in the world's agricultural economy is growing and increased funding for science is helping Kansas State University and other U.S. researchers study its uses for food, fiber and fuel.

Kansas: No. 1 in production

Kansas farmers grow the crop better than farmers in any other state. In 2014, Kansas ranked first in grain sorghum production in the United States with 200 million bushels grown — or more than 40 percent of the country's total production.

"We rely on the drought tolerance of sorghum," said Matt Splitter, who planted 750 acres of sorghum this year on his farm near Lyons, Kansas. "With sorghum, we are able to raise high yields even when we have long periods of drought and heat."

Damman, who farms near Clifton, Kansas, noted that traditionally one-third of U.S. sorghum is used as livestock feed; one-third is used to produce biofuels; and one-third goes to the export market.

But in 2013, the Gun Jen Juee Agriculture Trading Co. rocked the export market when it became the first Chinese company to import U.S. sorghum.

"In recent years," Damman said, "nearly 80 percent of U.S. sorghum has been exported."

"The demand for sorghum is at an all-time high because of the purchasing patterns of the export market," said Florentino Lopez, executive director of the United Sorghum Checkoff Program, which has contributed \$5.1 million since 2009 to the Kansas sorghum industry for research, market development and education.

Sorghum's ability to survive and grow in harsh environments is largely responsible for its rising popularity for food, fiber and fuel uses. Kansas State University scientists are among those developing new varieties that can be grown in the most severe environments in the world.



Women in Niger use hand tools to thresh sorghum grown and harvested in their village. Women are an integral part of agriculture in most African countries.



Sorghum stalks are often used in construction, such as this granary in Niger. The granary stores pearl millet, another drought-resistant, hardy crop grown worldwide.



Food products made from sorghum are popular in many African countries. The picture shows one store's display of sorghum cakes.

Nutrition for the hungry

The beauty of fully mature sorghum is a stark contrast to the deprived, drought-stricken villages where the crop is a critical food product.

In the Mara Region of Tanzania, one of the most starved areas of the world, Kansas State University grain scientist Sajid Alavi is part of a research team working to improve child nutrition and health by providing a sorghum-soybean porridge blend to children under age 5.

The study is being conducted in partnership with Project Concern International, a humanitarian agency that combats food insecurity and poor health in 15 countries by promoting nutrition education.

“Sorghum as a staple crop is grown in this part of Tanzania and is something that is a known and accepted part of the diet,” said Michael Mulford, country director for Project Concern International in Tanzania. “We saw this as an opportunity, in an area where sorghum is a common and drought-resistant crop, to look at its potential use in fortified food-blended products that help with undernutrition and are often part of supplementary feeding programs.”

Earlier this year, 2,000 children ages 6 months to 5 years and their mothers traveled up to 10 miles by foot to a central distribution point to receive the porridge blend. While the results of the five-month study are yet to be finalized, Alavi said the early indications are that children were healthier and grew at a more normal rate.

Many porridge blends — known as “uji” in Tanzania — are made of corn-soy blends. Sorghum may provide more long-term stability in this region because it can be grown in the dry, hot climate common to many parts of Africa where millions of people consider sorghum a staple in their diets.

“This whole project was started by our own sorghum farmers in Kansas and nationwide through the checkoff program and the Kansas Grain Sorghum Commission,” Alavi said. “Through the checkoff program, farmers realize that the university’s work might help them in terms of creating more demand for their products, adding value and getting them better prices.”

Protecting the industry with science

In 2013, the U.S. Agency for International Development awarded Kansas State University \$13.7 million to establish the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet.

The five-year project focuses on advancing the science of sorghum and pearl millet in semiarid regions of the world. The award was a huge boost to a university already well-positioned to conduct research on climate-tolerant crops.

USAID also recently awarded another \$1.08 million to the lab, supporting a genomics-assisted breeding platform in Haiti.

“We’re confronting stresses to crops that we see elsewhere in the world before they get to the United States,” said Tim Dalton, the lab’s director and a professor of agricultural economics at Kansas State University.

“Largely, the solutions that we’ve found at this time have been through exploration of genetic diversity around the world,” Dalton said. “That’s a huge benefit to the U.S. That’s why it’s important that we have researchers on campus who are involved in breeding for the Kansas

sorghum community and who also are involved with international sorghum. They can take advantage of those genetic traits, where possible.”

In the 1980s, the tiny greenbug aphid became a giant pain to U.S. sorghum producers, causing economic losses in several states. But U.S. scientists dipped into the country’s germplasm stocks to develop host plant resistance and saved an estimated \$389 million in economic losses for the nation’s farmers in 1989 alone — the equivalent of \$750 million in 2015 dollars.

The new bully in U.S. sorghum fields is the sugarcane aphid, which in the past three to four years has pushed its way from Louisiana to Kansas, and more recently into the Rio Grande Valley in south Texas and northern Mexico. Stocks of germplasm, originally from Africa, will help U.S. researchers develop varieties to combat the pest.

Research unlocks sorghum’s potential

Geoffrey Morris, an assistant professor of agronomy at Kansas State University, develops genetic tools that sorghum breeders use to create new varieties.

Traditional breeding techniques may require 12-15 years to develop resistant varieties of sorghum. Morris and his research team can cut that time in half by identifying genetic markers and developing genetic tools that breeders use to develop varieties with desired traits.

One project funded by the Sorghum and Millet Innovation Lab is developing genomic tools to accelerate marker-assisted breeding, as well as training West African students to develop drought-tolerant varieties for the Sahel, the dry savanna region south of the Sahara Desert. Another project supported by the Kansas Grain Sorghum Commission is developing climate-resilient sorghum for Kansas farmers.

“We look for genetic differences that help plants cope with climate stresses, like limited availability of water and chilling stress early in the season,” Morris said.

“Chilling tolerant sorghum would allow Kansas farmers to plant earlier and capture more of the moisture from early season rains,” Morris said. “It could increase yield by extending the growing season, and will give Kansas farmers more options for their rotations by having a sorghum season that matches the corn season.”

In Kansas, the work means that farmers like Splitter worry less about what they’re planting in their field.

“What I love about what Kansas State University does is that it solves problems that are real and applicable to what I do in the field,” he said. “When the research is being done 80 miles from my farm, 50 miles from my farm, or sometimes right on my farm, it’s more likely to help what’s going on here.”





Scientists hustle to stay on top of wheat blast fungus

The discovery of the wheat blast fungus in Bangladesh earlier this year served notice to the world's farmers and scientists that no one is safe from a disease that has wreaked havoc in South America for more than two decades.

"It's really scary," said Barbara Valent, Kansas State University distinguished professor of plant pathology. "Before February, wheat blast was never reported outside of South America."

Wheat blast thrives in warm, wet environments, the exact conditions that Bangladeshi farmers dealt with as the wheat crop was heading this year.

"They started seeing symptoms that spread very quickly across whole fields," Valent said. "It affected about 15 percent of the wheat crop in Bangladesh."

That translates to an estimated 162,000 wheat acres lost, small by U.S. standards but a significant amount to Bangladeshi farmers. Many burned entire fields in an attempt to rid their farms of the fungus. It may not be enough.

"The fungus is just too widespread," Valent said. "It's probably finding a different host in the country, which will help it stay around. We've sequenced strains from five states in Bangladesh, and they are basically identical. It appears to be a single recent introduction from South America. The fact that it's so widespread is puzzling."

Valent is leading a major research project funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture. The team includes more than a half dozen researchers from Kansas State University plus scientists from six other universities, the USDA and agricultural agencies in Brazil, Bolivia and Paraguay.



Their wheat blast research includes field trials in South America and laboratory studies in K-State's Biosecurity Research Institute, a biosafety level-3 facility on the north side of the Manhattan campus. Valent's team has developed diagnostic tools to identify wheat blast and other tools to help control the disease.

In fact, the research team recently discovered a resistance gene called 2NS that has helped control the disease in Bolivia and Brazil.

"The Bangladeshi strains behave like the most aggressive strains we've seen from South America," said Valent, adding that the 2NS resistance together with fungicide treatments should help but is unlikely to stop the spread of the disease in the near future.

"This fungus is notorious for being able to overcome resistance," she said. "We need more resistance genes, and that's what we're focused on now. It's a safety backup; some of the fungus in South America already is able to overcome the 2NS gene."

Valent said that Australian scientists are monitoring the situation in Bangladesh closely. She said that with the fungus already jumping one ocean, her Australian colleagues are expressing concern about wheat blast reaching their country.

"It's an important time to stay on top of it," she said.

Valent's team developed an extension publication, "Identifying Wheat Diseases Affecting Heads and Grain," that provides agricultural specialists and farmers needed information to identify wheat blast if it occurs in U.S. fields. More than 32,500 copies of this publication have been distributed in 29 states and Canada. The publication is available from the Kansas Agricultural Experiment Station. [!\[\]\(e97636a3328cdaccd5ffd8fe3bc69ce6_img.jpg\)](#)

Morris said that providing farmers the varieties they need doesn't happen by chance: "We think about farmers every day and make sure we're heading in a direction that is going to benefit farmers."

Industry, university helping each other

Damman noted that the Kansas Grain Sorghum Commission invests approximately \$1.2 million each year to help the industry. Much of that, he said, supports research at Kansas State University.

"Historically, sorghum hasn't had the research investments that a crop like corn has had, but that means that research investments now can have a huge effect on accelerating sorghum breeding," Morris said.

Dalton said that there are increasing opportunities to fund sorghum research. The Sorghum and Millet Innovation Lab, for example, is funding more than a dozen projects at U.S. universities and in several countries.

"We are talking about somewhere between \$2 million to \$3 million annual investment in this international research program that has trained students and has incredible international benefits, including improving food availability and training scientists so they can have their own research agenda. The benefits to the U.S. because of this have been phenomenal," Dalton said.

"What we did at K-State was we kept our programs moving along and we were always linked to producer demands in Kansas," he said. "When agencies and industries became more interested in sorghum, we were in the right place at the right time. We were ready to broaden out and continue what we were doing in the past at a greater scale." [!\[\]\(b8fd39419355f2801758b7c4d0596d9e_img.jpg\)](#)



Producing Better Produce

How researchers are maintaining the quality and extending the shelf life of fresh fruits and vegetables

By Greg Tammen

ELENI PLIAKONI AND COLLEAGUES have an appetite for fresh produce production and storage research.

An assistant professor of horticulture and natural resources at the Kansas State University Olathe campus, Pliakoni specializes in urban food production and postharvest handling, or how the handling procedures of fresh fruits and vegetables affect these foods and what techniques safeguard their quality and extend their shelf life.

“Fresh fruits and vegetables are very diverse, so there is not one postharvest-handling approach that will work for all,” Pliakoni said. “For example, tomatoes and broccoli cannot be stored at the same temperature. Because of the differences between fresh fruits and vegetables, we are required to use multiple techniques to

develop different handling methods for every type of produce.”

Pliakoni collaborates with Cary Rivard, assistant professor of horticulture and natural resources, extension specialist and director of the Horticultural Research and Extension Center in Olathe, Kansas, and Helena Pontes Chiebao, postdoctoral research associate in Pliakoni’s lab. Pliakoni also leads a team of three graduate students who conduct research on various fruits and vegetables.

The researchers are focusing on a combination of tools and techniques, ranging from temperature control to low-cost greenhouse alternatives, to maintain taste and nutrition while extending the shelf life of fresh produce grown by smallholder Kansas farmers. These small-acreage farmers have fewer than 10 acres of land and represent more than half of the vegetable producers in the Midwest.

Helping smallholder farmers increase the



availability of locally grown, fresh fruits and vegetables in metropolitan areas is important for several reasons, Pliakoni said. Urban populations are continuing to grow. Also growing is consumer interest in locally produced food and farmers markets, which account for more than \$6 billion in annual sales. Even more pressure will be placed on local food systems as the world's population balloons to a projected 9.6 billion people by 2050.

No 'one size fits all'

The Kansas State University researchers work with Kansas-grown broccoli, asparagus, beets, spinach, tomatoes, strawberries, melons and sweet potato slips.

Produce is grown on a university research farm, then harvested and transported to the lab for study in KoolKat, a trailer turned into a mobile refrigeration unit. The trailer can keep food cooled to as low as 35 degrees Fahrenheit, which reduces losses of temperature-dependent foods.

Because there is no "one-size-fits-all" approach to produce handling, projects often involve multiple tools and techniques, Pliakoni said.

For example, a completed Kansas Department of Agriculture-funded project had researchers looking at how a combination of an ozonated water wash and modified atmosphere packaging — packaging that substitutes atmospheric air inside it with a mixture of oxygen, carbon dioxide and nitrogen to lower the product's respiration rate and prolong its shelf life — could help Kansas farmers maintain the quality of vegetables while ensuring food safety even if storage conditions aren't perfect.

"Washing vegetables with ozonated water decreases the natural microbes that are on the surface of the produce, while the modified atmosphere

packaging was used as a replacement for cold storage," Pliakoni said. "In the conditions we used it, we found that the ozonated water didn't have any effect on the natural microflora, while the modified atmosphere packaging extended the shelf life of broccoli, spinach and asparagus in non-optimum storage temperatures."

High tunnels

Under Rivard, one of the team's main research focuses is high tunnels, which are long, semicircular structures made of polyethylene that serve as a low-cost alternative to greenhouses. High tunnels protect crops from high winds, heavy rains and damaging storms, and they create a beneficial microclimate for the crop.

As part of an ongoing collaboration with the University of Florida, researchers have been able to prove that high tunnels boost fresh produce production. Chiebao's part of this project is to investigate the effect of growing in high tunnels on the quality of produce. She has found that produce grown in high tunnels has a longer shelf life, which makes fruits and vegetables more marketable and adds to growers' profits.

"As much as 40 percent of fresh fruits and vegetables are lost from harvest to market because of spillage, rot and other causes," Pliakoni said. "We're seeing that produce grown in high tunnels have better quality and are more marketable than produce grown in the open field. Fruits, such as tomatoes, have fewer cracks, splotches and other aesthetic defects."

Pliakoni, Rivard and Chiebao's high tunnel project involves several graduate students. They are conducting the research on tomatoes and spinach with Kostas Batziakas, graduate research assistant and doctoral student in horticulture with an emphasis in postharvest physiology. The project is in its third year and is funded by the National Institute of Food and Agriculture through the Agriculture and Food Research Initiative.

Graduate students also are using high tunnels for projects on strawberries and sweet potato slips. Kelly Gude, master's student in horticulture, found that strawberries can be grown in Kansas under high tunnels. She taste-tested the berries with consumers. Riley Sunday, master's student in horticulture, and Rivard are using high tunnels to grow sweet potato slips — shoots that grow into mature sweet potatoes — in an effort to find better storage and shipment solutions for the slips. Kansas producers ship the slips to growers across the state, and their main challenge is quality loss during shipment. Zach Hoppenstedt, master's student in horticulture, and Rivard also are using high tunnels to examine the possibility of growing sweet potato slips earlier in the

season. Slips typically originate in the South early in the season and then are produced in Kansas as the weather warms in spring.

Hot water treatment

One of the objectives of the Agriculture and Food Research Initiative project with the University of Florida is using hot water treatments and acetic acid to reduce microbial rot on tomatoes and spinach. Produce is dipped into water heated to 131 degrees Fahrenheit. The temperature, which researchers are tweaking for optimal results, controls the natural microbes on the surface of the produce. Microbes cause decay, particularly if they enter a crack in the skin of the produce.



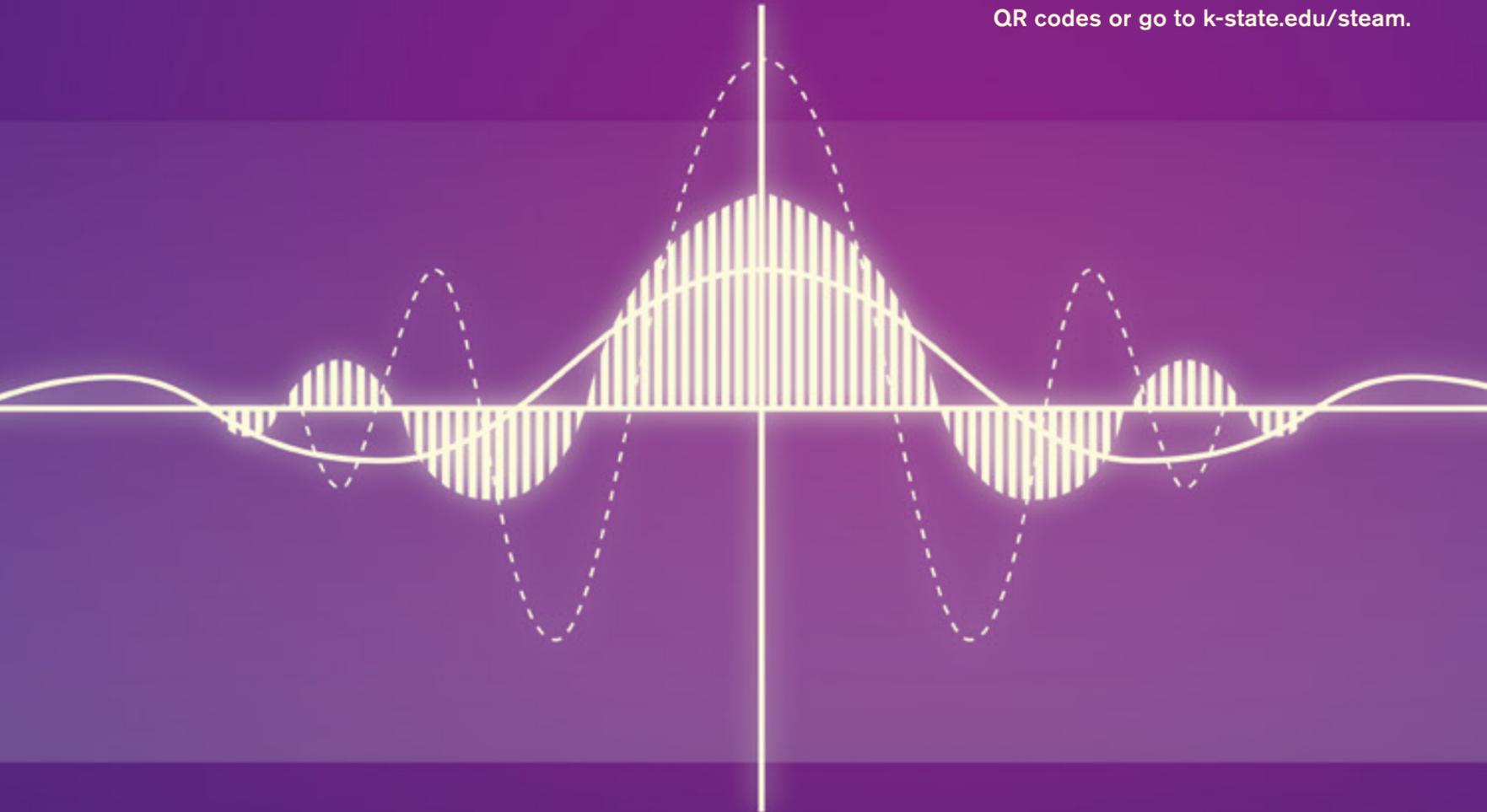
Agricultural engineering students at the University of Florida are developing a prototype hot water treatment device that farmers can use on spinach and tomatoes in the field. Once developed, it will be reproduced at Kansas State University and used for research as well as for demonstrations. As part of the project, Rivard is working with a consultant and software developer to make a smartphone app that will help growers and extension agents keep track of locally grown crops, identify what is causing a crop loss, and adjust what crop is planted and when so that growers can maximize their food production.

Modified atmosphere packaging

Batziakas also is working with modified atmosphere packaging. Modified atmosphere is the practice of changing the composition of the internal atmosphere of a produce bag to maintain the quality of the produce inside and extend its shelf life. Typically the bags are flushed with a gas mixture that has decreased oxygen and elevated carbon dioxide content. Bags are produce-specific and designed for a specific optimum temperature. "The problem with this type of packaging is that it is designed only for a certain temperature," Pliakoni said. "If leafy greens are processed and packaged at 40 degrees Fahrenheit, they then travel in a refrigerated truck to a distribution center, then to a grocery store and then onto the store display. The cold chain is disrupted in many of those steps, and you can imagine how big the temperature fluctuation is throughout its journey. That makes it challenging to design a singular package that adjusts to the different temperatures and remains beneficial."

Researchers on the Agriculture and Food Research Initiative project are working on a possible solution: improving the storage efficiency of this packaging by determining proper atmospheric conditions for bags kept in ambient temperatures. They are storing spinach in commercial bags in above-optimum temperatures to identify possible improvements. The researchers then plan to collaborate with a packaging company to manufacture a better packaging solution for spinach kept at ambient temperatures. 

To hear the sounds of STEAM scan QR codes or go to k-state.edu/steam.



The sounds of STEAM

Grab your smartphone and lend an ear. Listen to the multidisciplinary symphony of research in science, technology, engineering, art and mathematics.

By Jennifer Tidball

IF A KANSAS STATE UNIVERSITY RESEARCHER makes a discovery and no one is around to hear it, does it make a sound?

Of course it does. We collected the sound bites to prove it.

The perception of sound is more than a philosophical thought experiment. Sound plays an active role in

STEAM — science, technology, engineering, art and mathematics — research at Kansas State University. These research noises come from laboratories, studios, industrial plants and the great outdoors.

This interactive text describes research projects at Kansas State University and the sounds associated with them. Scan the QR codes with your smartphone to hear the research beeps, squawks, squeaks, pitches and fractures.



Nuclear noises

When the countdown reaches zero, the Triga Mark II nuclear reactor facility executes its special capability: a reactor pulse. With a loud “ca-chunk,” the reactor ejects a control rod using air pressure, which causes the power to increase by a factor of 100 million in 0.01 seconds and then rapidly return to low power. Six seconds later, a “clank” means the rod has fallen back into place in the core.

The special capability produces a large amount of neutron flux in a short period of time, which can be used for analyzing materials and developing radiation detectors, said Jeff Geuther, nuclear reactor manager.

The nuclear reactor, part of the mechanical and nuclear engineering department, has other important research capabilities and also supports academic and education programs, industrial service and outreach.

Listen to a reactor pulse from the nuclear reactor facility.



A natural symphony



The Flint Hills are alive with the sounds of ... bison, bugs, birds and burning.

Those sounds are part of research at the Konza Prairie Biological Station, an 8,600-acre native tallgrass prairie jointly owned by Kansas State University and The Nature Conservancy. The Konza Prairie — nestled in the Flint Hills just south of Manhattan — provides an outdoor laboratory for long-term ecological research, education and prairie conservation.

Research at the Konza Prairie includes watershed-level experiments focused on tallgrass prairie ecosystems and the effects of fire, bison grazing and cattle grazing, as well as other basic biological research. A recent study found that more frequent burnings in the Flint Hills are needed to keep the tallgrass prairie ecosystem from transitioning to woodland, said John Briggs, director of the Konza Prairie.

Listen to researchers and a fire crew conduct an experimental burn at the Konza Prairie.





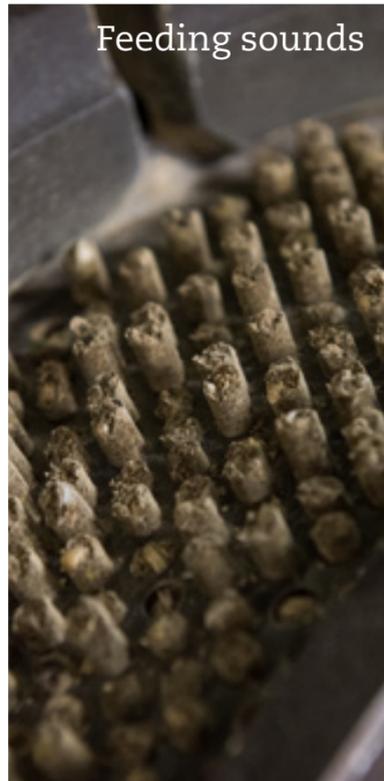
Think pink

Birds of a feather make sounds together. A flock of flamingos can be especially noisy. From the flapping of feathered wings to low grunts and higher-pitched honking, flamingos are social birds.

Researchers with the university's Veterinary Health Center are improving the health of the pink birds. James Carpenter, professor of zoological medicine, and veterinary medicine interns and students are collaborating with Manhattan's Sunset Zoo to study the zoo's Caribbean flamingo flock. The researchers are determining the proper dosages for antibiotics and anti-inflammatory drugs that can treat disease in this species. They also have tested a vaccine that prevents West Nile virus infections, which can be fatal to flamingos and other birds.

Flamingos are also susceptible to eye infections, and Carpenter and the Veterinary Health Center ophthalmologists have performed ocular examinations in flamingos to develop better diagnostic procedures and early treatment options.

Listen to the noisy flock of flamingos.



Feeding sounds

From the whirling of the pellet-making skip touch to the pouring of corn and other grains, the university's O.H. Kruse Feed Technology Innovation Center is full of the sounds of industrial research.

The center includes a modern, automated 5-ton per-hour production and teaching feed mill and a biosafety level-2 teaching and research feed mill. The center is the home of the university's feed science and management program — one of only two such university programs in the country, said Charles Stark, director of the center.

Several times a week, the mill receives grain from delivery trucks. Researchers grind the grain, weigh it and then mix it to make various feeds. Finished feed goes to the cattle, swine and other animals in Kansas State University units and also is used for research and industry projects.

Listen to the day-to-day sounds at the feed mill.



Taking off

Unmanned aircraft systems, or UAS, are a common sound at the Kansas State University Polytechnic Campus. After a few start-up beeps and noises, the whirling of motors and blades begins and the UAS is ready for takeoff.

Kansas State Polytechnic is a national leader in UAS research, education and flight training. The UAS program is the principal initiative of the university's Applied Aviation Research Center, which completes hundreds of missions yearly and allows students to participate in these missions, said Kurt Carraway, UAS program executive director.

Some UAS research projects involve mapping natural resources and using UAS to inspect power infrastructure, such as power lines or wind turbines. The program operates under numerous FAA operational regulations, including Part 107 — the FAA's newest regulations for small UAS commercial operations. The program began training students in those operations the day the regulations went into effect.

Listen to an unmanned aircraft system take flight.



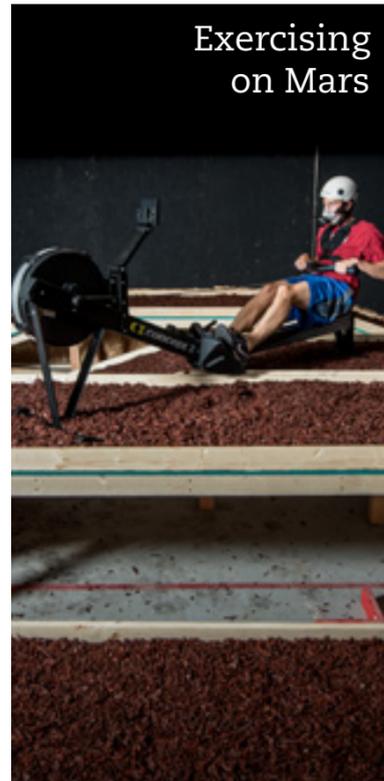
The harmony of clay

When graduate student Eliza Weber creates a ceramic bowl or vase, she also creates a ceramic chorus.

Weber, master's student in fine arts, starts a new piece of pottery by wedging or slamming the clay against a table to remove all air bubbles. She rolls clay on the potter's wheel and uses the rhythmic wheel to form shapes. The clicking noises of the electric kiln or the burning noises of the gas kiln signify the artistic process is nearly complete.

Through ceramics, Weber is studying the continuity between form and pattern. Her pottery portfolio includes bowls, vases, plates, cups and other vessels — often decorated in colorful geometric shapes, flowers and designs.

Listen to the creation of a piece of ceramic art.



Exercising on Mars

Before astronauts explore Mars, NASA has to make sure they are healthy and fit enough for outer space. University kinesiology researchers have a solution.

Carl Ade, assistant professor of kinesiology, and his research team have designed a Martian obstacle course — complete with red rubber mulch — that resembles the terrain of Mars. The NASA-funded course simulates critical mission tasks that astronauts may perform on the red planet — unloading cargo, walking for 1.5 kilometers and rescuing a crew member.

A key piece of equipment is a portable rowing system, which NASA plans to send to outer space with astronauts to measure their fitness level during long-duration missions. Using breath-by-breath metabolic and ventilatory data and ergometers such as the rowing system, researchers can measure astronaut fitness to predict successful completion of the simulated critical mission tasks.

Listen to the rowing machine and 1.5 kilometer walk on the Martian obstacle course.



A 'Glimmer' of sound

For composer Craig Weston, sound begins with an idea: a pattern, an emotion or a tune. He often writes musical compositions in segments — one segment may focus on a faster tempo while another segment may feature only two instruments. Using notation software on the computer, Weston puts the segments together to create the finished work.

Weston, associate professor of music, has composed dozens of pieces and teaches student composition courses. He composes music for a variety of instruments in a variety of styles — from orchestral to chamber to electronic music. His newest composition, "Glimmer," is for clarinet, cello and piano and premiered in October at the College Music Society Conference in Santa Fe, New Mexico.

Listen to Weston explain the composition of "Glimmer" and listen to the computer program play a facsimile of the final piece.



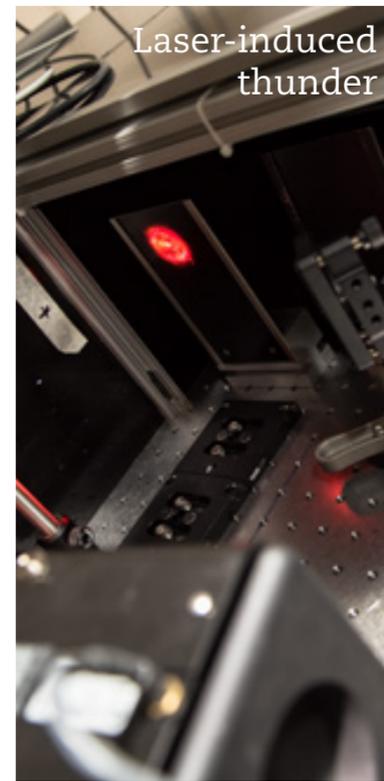
Fracturing and shattering

The road to stronger, safer concrete starts with the sound of it breaking.

Bob Peterman, professor of civil engineering, manages the Structural Mechanics Laboratory where his research team tests the materials used to manufacture concrete railroad ties. Some machines can apply up to 400,000 pounds of force to determine the compressive strength of concrete cylinders while others pull steel reinforcing wires in tension until they break.

These tests help Peterman determine at what point concrete and other materials crack, shatter or break. His team uses that knowledge to improve concrete by making it safer and stronger.

Listen to the engineers conduct two tests: a compression test for a concrete cylinder and a tension test for a steel wire used in concrete railroad ties.



Laser-induced thunder

Researchers at the university's J.R. Macdonald Laboratory can use ultrafast lasers to create a thunderous sound. The laboratory, part of the physics department, hosts one of the country's largest atomic, molecular and optical physics programs.

Physicists use the laboratory's ultrafast lasers to expose ions, atoms, molecules, surfaces and nanostructures to short, intense bursts of electromagnetic radiation. Researchers — such as physics doctoral students Travis Severt and Brandin Davis — study these interactions to understand the properties of the systems and the dynamical processes that occur.

In one example, laser pulses are focused in air, which creates a plasma and induces a shockwave that creates sound, similar to lightning creating thunder. The frequency of the resulting sound is the repetition rate of the laser — 10,000 pulses a second from the lab's PULSAR laser is a high squeal while the 1,000 pulses a second from the HITS laser is a much lower hum.

Listen to the high pitch of the PULSAR laser.





Dog's best friend:

Humans are fetching up new ideas to improve health of canine companions

By Stephanie Jacques

A DOG'S SMILE — THAT DROOLING, BAD-BREATH SMILE — warms a dog lover's heart and begs for a pat on the head or a scratch behind the ears. Kansas State University researchers and veterinarians are giving that and more to improve health for man and his best friend.

College of Veterinary Medicine researchers are extending pets' quality of life while learning more about diseases that cross the species border between animals and people, such as breast cancer, bone cancer and arthritis.

"Similarly to how diseases in animals have been studied to advance human health, what

we know about human diseases also can be applied to animal health," said Denver Marlow, university veterinarian and director of K-State's Comparative Medicine Group. "There are many noninfectious, naturally occurring diseases that affect both animals and humans."

According to researchers in the College of Veterinary Medicine, understanding and treating dogs with naturally acquired diseases can provide insight into human diseases since dogs have cellular similarities to humans, often share human environments and can share diseases.

"It all goes back to One Health," Marlow said. "What we learn about animal health helps advance veterinary and human medicine, as well as the discovery of new vaccines, drugs or therapies for treating or preventing diseases in animals and humans."

The One Health concept that human health is linked to animal and environmental health encourages collaboration among human health professionals, veterinarians and scientists on various stages of research — basic research in a lab, model systems testing, safety testing and, finally, clinical trials.

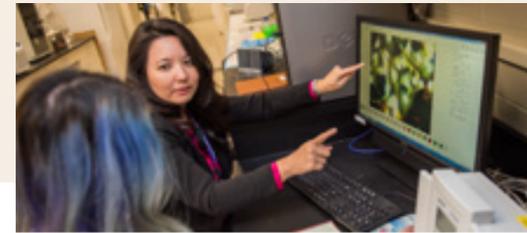
Among those working on health-related research in the college are three researchers who are at various research stages and who are specifically investigating diseases that affect dogs and humans.





Left: Raelene Wouda, assistant professor of clinical sciences, administers a small dose of chemotherapy to Abby, a 7-year-old Saint Bernard mix with cancer. According to Wouda, the small dose extends the patient's quality of life and prevents sickness.

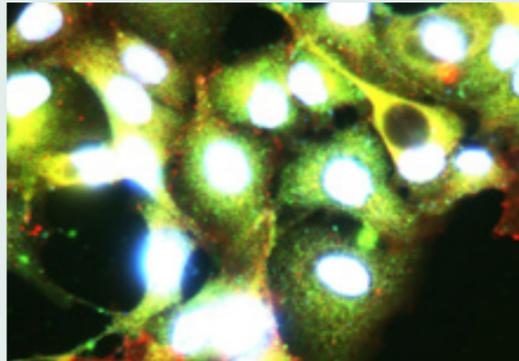
Below: Annelise Nguyen, associate professor in diagnostic medicine and pathobiology, discusses canine mammary carcinoma cells with Savannah Luu, second-year veterinary medicine student.



Deciphering canine cellular communication

Understanding the secret language of dogs is more complex than figuring out what woof, bark and bow-wow mean. Annelise Nguyen, associate professor of diagnostic medicine and pathobiology, is looking deeper at canine cancer cell communication — or lack thereof. The research is based on her previous work with human breast cancer.

“There is a lack of understanding of cell-to-cell communication,” Nguyen said. “Normal cells have great communication and regulation. We do not see that with cancer cells. We want to learn more about how the loss of cell communication is the driving force of cancer.”



Proteins connexin 43 stained red, and connexin 26 stained green, in canine mammary carcinoma cells.

According to Nguyen, current cancer treatments in dogs kill all cell growth — harming even healthy cells — in order to prevent the cancer cells from growing. Nguyen is looking for a more targeted approach that could open up closed communication channels called gap junctions in cancer cells and allow proteins that regulate cell growth back into the cell. The approach already has been successful in Nguyen's human breast cancer research and resulted in a patent.

“If the cell communication blockage is there in humans, it could be in dogs,

too,” Nguyen said. “If we can show that is the case, it would be the first research to demonstrate this pathway occurs in canine carcinoma.”

Nguyen and Savannah Luu, second-year veterinary medicine student, spent summer 2016 researching if cancer cells in dogs have the same communication barrier. They tested three cell lines of canine mammary carcinoma — the dog version of breast cancer and the most common cancer in unspayed female dogs. In the in vitro tests, Luu found a decrease in the connexin 43 protein of the CMT27 cell lineage, which she said might be the cause of the loss of cell communication and has potential for targeted therapeutics that are needed in veterinary medicine.

“As a veterinary student working in clinics, I've seen several dogs get cancer — nearly every one above the age of 10 — so I wanted to make a change,” Luu said.

Nguyen and Luu said the targeted approach could prolong dogs' quality of life and give a comparison to what the therapy can do for humans.

“If a dog gets cancer at 10 years of age, we can't prevent death but we can prolong their quality of life,” Nguyen said. “This is an approach, a treatment, that could add two to three years — that's worth it. In dog time, that's a long time. In humans, a comparable time frame would give more time to a patient for personalized care.”

Give a dog a bone-fighting chance

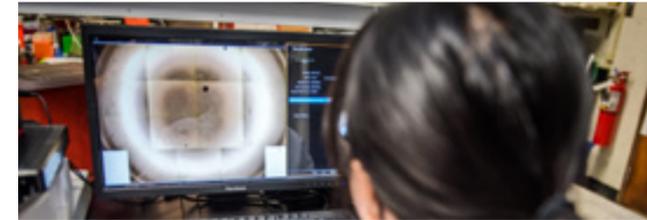
Built into a veterinarian's DNA is a love for animals and a desire to improve their health and welfare. Raelene Wouda, assistant professor of clinical sciences, is such a soul who is trying new treatment approaches to give her patients and their owners hope.

Wouda and her colleague Mary Lynn Higginbotham, associate professor of clinical sciences, oversee an active clinical trials program at K-State's Veterinary Health Center. One of their current clinical trials is enrolling pet dogs diagnosed with osteosarcoma, the most common type of primary bone cancer in dogs and people, particularly children and young adults.

“Clinically and genetically, osteosarcoma is indistinguishable between dogs and humans,” Wouda said. “Any treatment we develop that shows clinical benefit in our canine patients can therefore be translated to provide benefit for children with osteosarcoma.”

The osteosarcoma clinical trial at K-State is part of a multi-institutional trial overseen by the National Institutes of Health National Cancer Institute's Comparative Cancer Research Center and its comparative oncology program.

Nationwide, the clinical trial has now enrolled more than 150 of the 200 desired canine participants to research the therapeutic role of rapamycin, a molecularly targeted drug that modifies the patient's immune system. Preliminary research suggests that rapamycin might inhibit the spread of disease to the lungs, which is common in the late stages of osteosarcoma.



A lab technician in Mark Weiss' lab measures the growth of living stem cells using an automatic cell imaging system.

“Many of our clinical trials at K-State's Veterinary Health Center are predicated on ideas gleaned from human medicine, and we try to use those in our veterinary patients and vice versa,” Wouda said. “Information we develop can certainly be translated into human oncology and other areas of medical research. If the canine osteosarcoma trial is successful, this treatment will move onto trials in human pediatric patients.”

All the pet dogs enrolled by their owners in the study receive the standard-of-care treatment, which involves amputation of the cancerous limb followed by carboplatin chemotherapy. Wouda said the average survival time for dogs with osteosarcoma that undergo only an amputation is approximately four months. With the addition of chemotherapy, the average survival time is closer to 10-12 months. After the standard-of-care treatment, half of the enrolled dogs are randomized to receive rapamycin for several months. The clinicians then follow the dogs, specifically mapping their disease-free periods and comparing between the two groups.

“We hope that by adding rapamycin to a patient's treatment plan, we are providing an additional way to kill or inhibit the tumor cells in the dogs and improve their survival time, or even achieve a cure in a certain population of patients,” Wouda said.

According to Wouda, a growing number of pet owners are seeking high-level medical care for their pets. They might choose to participate in clinical trials for a variety of reasons, including access to novel therapeutics. Clinical trials are especially attractive to owners whose pets have not responded to standard-of-care therapy or for those that the existing therapies do not achieve ideal outcomes, she said. The willingness increases the chances of success for comparative studies like the osteosarcoma trial that will benefit both canine and human health.

“Our pet dogs live longer now than they used to because of a combination of improved veterinary care and improved client care,” Wouda said. “Consequently, we have the opportunity to answer critical research questions in a timely manner using a population of dogs with comparable diseases, shared environmental circumstances, access to high-level health care, and comparatively shorter lifespans — one dog year equals seven human years. These factors and wonderful owners who are willing to pursue investigational therapies provide a steppingstone for improving the outcomes of both pets and humans with cancer.”

Arthritis relief stems from cells

Mark Weiss, professor of anatomy and physiology, has unbiased data to change the game of fetch for dogs with inflammatory diseases.

Weiss has finished a clinical trial that used stem cells in dogs to decrease pain from osteoarthritis, also a disease that affects humans. The study



A pressure-sensitive walkway provides objective data of a dog's pain severity by measuring how much weight the dog puts on each foot — a first in canine stem cell studies.

showed objective data — a first in canine studies with stem cells — that the therapy is effective at reducing pain.

“The preclinical data suggests that stem cell therapy could be disease-modifying — a game changer,” Weiss said. “We wanted to see if we could make clinical improvements in the animals. That's what we got.”

The study, which enrolled 22 dogs diagnosed with hip arthritis, followed the patients for six months after placebo or stem cell therapy. The study was a double-blind, placebo-controlled clinical trial, which means the veterinarian and the dog owner did not know which dogs received the stem cell treatment and which received a placebo injection.

“There is a placebo effect, even in dogs,” Weiss said. “Part of the problem is that dogs are not the ones telling you they feel better. Dogs attempt to please their owners, and if owners are biased and expect to see an improvement in their dogs, then there is a placebo effect in the short term.”

The computer measurements from a pressure-sensing walkway showed that dogs that received stem cells — collected from the dogs' intestinal fat — had moderate improvements in weight distribution within the first month after the injection. The walkway provided

measurable data in addition to subjective data from owner and veterinarian surveys that indicated that the dogs that received the treatments had significant functional improvements.

“We had baseline, one-month, two-month, three-month and six-month measurements from the walkway after treatment,” Weiss said. “At one month, the treated dogs had shown improvement and they remained improved six months later. We are extremely excited that our study showed that stem cells were safe and had a positive effect.”

Weiss is recalling the dogs involved in the study to make a case to start a similar clinical trial in humans with arthritis.

“The potential of these findings to inform and translate human medicine is huge,” Weiss said. “If we can safely and effectively treat dogs with arthritis, then we can make a case to use stem cells for treating humans with inflammatory diseases.”

A photograph of three people on a stage, seen from behind. They are standing with their arms raised in a dramatic gesture. The stage is lit with several spotlights from above, creating a dramatic atmosphere. The background is dark, and the floor is a light-colored wood.

STAGE FOR SUCCESS

Drama therapy students work with kids on autism spectrum at summer camps

By Sarah Caldwell Hancock



Sherry Brown, Mike Rogers and Sarah Edwards share a flair for drama and helping others through K-State's drama therapy program, one of only five in the country.

WHEN IT COMES TO BETTER PREPARING KIDS ON THE AUTISM SPECTRUM FOR LEARNING and social environments, Kansas State University's drama therapy program is showing how theatre techniques can have a starring role.

Graduate students in the K-State program, one of only five such university programs in the country, collaborated with a Kansas school district to offer six-week summer camps this year for three groups of kids from middle school to high school. One of the graduate students also delivered drama activities twice a week to attendees of the Flint Hills Summer Fun Camp, which offers summer activities designed to build social skills and compassion and maintain academic skills in kids both on and off the autism spectrum.

Sally Bailey, K-State professor of drama therapy, supervised second-year graduate students Mike Rogers, Sarah Edwards and Sherry Brown as they provided the camps for about 30 kids this summer. Bailey's students also work with the school district's after-school programs during the academic year.



Drama therapy graduate students Sherry Brown, Sarah Edwards and Mike Rogers use a variety of props, drama techniques and games to cue the enthusiasm of middle and high school groups and Flint Hills Summer Fun Camp attendees.

Drama therapy uses techniques such as performing a scene, improvising or developing a script, or acting out a story with puppets for therapeutic purposes ranging from anger management to drug rehabilitation. Bailey said drama games and activities are also helpful for kids on the autism spectrum.

“Drama helps kids express themselves vocally and physically, helps them interact appropriately socially, develops self-confidence and increases imagination and problem-solving skills,” Bailey said. “Kids on the autism spectrum are able to practice social and communication skills in a fun, motivating way.”

The collaboration between the K-State drama therapy program and USD 383, the Manhattan-Ogden School District, is the only one of its kind in the country. The after-school and summer activities — which Bailey characterizes as a partnership with the drama therapy program, the school district and the parents from the very beginning — have grown. Based on the after-school program’s success, one summer camp offered four years ago morphed into four separate camps in summer 2016. The camps were organized by the autism department at USD 383 and offer activities for the students’ range of needs and ability levels.

The strength of this partnership helps draw graduate students from around the country with a range of experiences. Brown completed her undergraduate degree at K-State in secondary education with a concentration in speech and theater. Rogers earned a Bachelor of Arts from Columbus State University in Georgia and lived

in Hong Kong, where he taught English and drama for the last five years before coming to Manhattan to study drama therapy. Edwards came to K-State after completing a Bachelor of Fine Arts in theater education at Belmont University in Nashville.

As more students come to K-State to study drama therapy and benefit from this ongoing community connection, a second drama therapy professor will be needed.

“We value partnerships and the attraction they have for our students, where we can reach out to the region to share the many ways in which the arts can be used to enrich people’s lives,” said Jeffrey Ward, director of the School of Music, Theatre, and Dance in the College of Arts & Sciences at K-State.

All of these students, plus others working on creative projects, meet regularly with Bailey to plan activities, solve problems, and gather props and costumes. This summer, Rogers’ high school and Edwards’ middle school camps, known respectively as Creative Endeavors Camp and Magical Mystery Camp, were centered around filmmaking. Brown provided her group with a more general approach at Social Adventures Camp aimed at middle schoolers. Rogers also contributed a lively drama class for Flint Hills Summer Fun Camp students two mornings a week.

Ashley Smith, director of Flint Hills Summer Fun Camp and a first-grade teacher in Manhattan, said she was surprised at the range and impact of drama activities.



“When I picture drama, I picture rehearsal and putting on a performance, but it’s definitely more than that,” she said.

Smith said drama builds relationships and social skills by helping students use teamwork to act out a story, identify their own emotions and recognize them in others, and make better choices in their reactions to difficult situations. Drama activities also level the playing field between peers and students on the autism spectrum because everyone is a little nervous when developing or acting out a story. She said the drama activities provided by Rogers work well because he encourages the group to take risks together.

“Where I notice it has the biggest and most obvious impact is for students who are nonverbal and lacking communication skills, because they are able to participate fully in drama,” Smith said. “They can act something out in a way that doesn’t require language and participate in a story in a way that involves them.”

Along with building flexibility and collaboration skills, another benefit of the summer camps is friendship.

Kimberly Rieckmann is the mother of a student in the high school film camp. Her son has been with the program since it began four years ago as an after-school group for middle schoolers. Rieckmann said the camps are a tremendous resource, and that each camp caters to students’ specific needs such as socializing or expressing emotions. She’s thankful for the friendships the students have formed.

“They have so much fun,” Rieckmann said. “They make their own movies, develop their own scripts, create settings, have costumes — they even work with a green screen now. It’s fun for them to be able to express their interests and have it come out in something tangible.”

The most important part is the friendships they make, she said.

“Drama brings them together and gives them something to do, to work together on. They build friendships based on similar interests and gain understanding of the challenges others face,” Rieckmann said.

For the graduate students, the summer work with the camps counts toward the 800 practicum hours required to attain a master’s degree. The students also learn from seeing the campers make progress.

“It’s helped me understand the autism spectrum itself and taught me patience and understanding more than anything,” Rogers said, adding that his campers have become more social with each other throughout the six-week program.

“In the chat circle at the beginning of camp each day, they’ll share and ask each other questions. That’s huge, because it means they’re showing interest and interacting more,” he said.

Edwards and Brown also have gained perspective from their work.

“I think I’ve realized how you can have all the skills in



the world as a facilitator, but the most important thing is building relationships,” Edwards said. “The kids are really comfortable. I never in a million years thought I’d make a movie with middle schoolers.”

The movie by Edwards’ group has superheroes and monsters from an arcade coming to life in a middle school. The students developed the concept and the story and built an arcade as a setting for the film.

The creative process isn’t always smooth. Campers experience many differences of opinion, but Edwards always ensured they found a positive solution. In a regular school environment, teachers and staff may not have the time to do that, and it makes a difference in how the students relate. Edwards noticed students navigating conflict without her help at times because of the positive relationships they established.

Brown’s group worked on more basic social skills by learning about emotions. She used a variety of games and art activities to support that goal. One popular activity is feelings yoga, which couples a physical pose with an emotion: students stretch upward to depict a grateful giraffe, or fold their arms in to become a caring koala bear. They have daily lessons such as how to give a compliment. Nonverbal students or students who need longer processing time participate. The group doesn’t leave them behind.

One of the major lessons Brown has learned is that students on the autism spectrum shouldn’t be babied.

“They are capable of doing things on their own,” she said. “Even if it takes 15 minutes for them to get a straw in their juice pouch, let them do it. If they don’t, they will never learn.”

Helen Miller, autism coordinator for USD 383, says she’s seen progress in social connection for the campers.

“One of my concerns for any young person is isolation — the mental stress that causes,” Miller said. “Depression and anxiety can become full-blown in our kids on the spectrum. It’s mitigated by having friendships and having people who are in the same boat. These kids can be incredibly supportive of each other. It’s good for their mental health.”

Support from Bailey and K-State is crucial to the success of the after-school fun clubs and summer camps.

“Without these grad students doing drama therapy, I don’t know where I’d find people with that knowledge,” Miller said.

She also is thankful that kids on the autism spectrum are offered an opportunity to use creative outlets instead of being isolated in front of television or video games.

“The kids reporting a sense of belonging is the most encouraging piece,” Miller said.

The after-school clubs and summer camp activities are supported by USD 383 and a variety of grants and community donations. [K](#)



LIVING HISTORY



KANSAS' largest teacher preparation college using original documentaries to aid classroom teachers, benefit students

— *By Sarah Caldwell Hancock*



Left: “Dawn of Day” used family histories and other documents to tell the story of Underground Railroad operations in Kansas. Right: Rusty Earl films a scene with local expert Richard Pitts and associate professor Brad Burenheide.



Successful teachers make subject matter come alive for students. Kansas State University’s College of Education and its specially produced documentaries are helping teachers do just that for a variety of education-related topics.

The college’s documentary about a turbulent period in Kansas history is helping teachers show students how escaped slaves risked their lives to gain freedom with the help of Wabaunsee County, Kansas, abolitionists.

“Dawn of Day: Stories from the Underground Railroad” was released in May 2016, and free lesson plans and DVDs of the 53-minute documentary are available for teachers. The film is also available online along with others the college has produced since 2012 thanks to the efforts of Rusty Earl, the college’s video producer.

Earl enjoys the challenges and rewards of the filmmaking process.

“When you dig into people’s history and find out what they sacrificed, you get to know them. I like to show the best side of human beings,” he said.

Earl has displayed the best of humanity several times, and his efforts have brought national and international attention to the college. A 15-minute film called “Life in a Jar: The Irena Sendler Project” chronicled how three Kansas students used a school project to learn and tell the story of an unsung hero in Poland who helped save more than 2,500 children from the Warsaw Ghetto in 1942. The video has been viewed more than 60,000 times, and has played on KTWU, a public television station in Topeka, Kansas.

K-State’s College of Education, with Earl, also developed a video series called “A Walk in My Shoes” to build awareness about students’ diversity, challenges and opportunities. The first two videos in the series were about international and military-connected students. The third, a 2014 piece about first-generation college students, was featured in a blog written by first lady Michelle Obama and has been seen by students and staff at more than 100 universities and junior colleges, partially because of promotion from NACADA: The Global Community for Academic Advising (see Page 34). A new film about social justice in education premiered in October 2016.

Backyard history

“Dawn of Day” differs from the other documentaries produced by the College of Education because of the level of historical research it required.

“So much research has been done and can still be done,” Earl said. “New discoveries are

being made. We were only recently able to say there was an underground railroad stop near Manhattan, Kansas.”

After separating fact from fiction and doing more research than for any other project, Earl and his team decided to concentrate on Wabaunsee County. The film dramatizes the flight of an escaped slave and shows actual locations where slaves were sheltered. Local experts discuss landmarks, historical documents, family history and the overall effort of those who risked working or traveling on the Underground Railroad.

“When you dig into people’s history and find out what they sacrificed, you get to know them. I like to show the best side of human beings.” — Rusty Earl

One of those experts is Richard Pitts, director of the Wonder Workshop Children’s Museum, a Manhattan nonprofit that offers exhibits and programs to the public as well as camps and after-school programs for kids. Years of working with local youth have shown Pitts that knowledge of heritage and local history is lacking.

“Schools don’t teach much about Native American or African-American history,” Pitts said.

Pitts has found that kids of European ancestry may know they are German or Italian, but they don’t know about contributions of different groups. He said African-American youth tend to lack knowledge of their histories, so he has tried to help. He shared stories, and he made a timeline with Wonder Workshop attendees and had them add contributions of their ancestors. He also started offering tours in 1997 of Underground Railroad sites in Riley and Wabaunsee counties with the objective of bringing people together.

“This is a story that needs to be told over and over again because it shows that that we have always worked together in one way or another. It’s not polarizing — it’s something that brings unity,” Pitts said.

Brad Burenheide, associate professor of curriculum and instruction, agreed.

“The documentary is a great example of what local and public historians can do to impact society’s understanding of history and the events that matter,” Burenheide said.

Burenheide is featured in the film. At one point, Pitts asks Burenheide why it’s important to study the Underground Railroad. “My answer is that it offers an episode in history that shows we can do right. Humanity can do the right thing, even in the most dire of circumstances,” Burenheide said.



He also is excited about energizing teachers and students to explore their own areas, and Pitts hopes that more people will start looking in their own backyards or find unsung heroes in their towns.

“History not only shows us our past, but inspires us and shows us our potential: People have done extraordinary things with limited resources,” Pitts said. “History helps us realize whose shoulders we’re standing on. We all contributed to this America that we hold so dear.”

More than marketing

The College of Education expresses a breadth and depth of information through the documentaries that conventional marketing brochures can’t convey.

Burenheide said community members have approached him about the “Dawn of Day” documentary, which aired on a Topeka public television station. “They say, ‘What else do you do in the college?’ It’s creative, unique and lasting,” he said.

“History is important,” said Debbie Mercer, dean of the College of Education, which is the largest teacher preparation program in Kansas. “We don’t want part of our history to be forgotten or assume that children are going to automatically know or pick up on what we think is important. We need to be very purposeful in what we share and what we teach them.”

Along with more “Walk in My Shoes” films, plans are in the works for another ambitious documentary that follows several first-year teachers in schools across Kansas. The new teachers will keep video diaries that capture their daily challenges and successes.

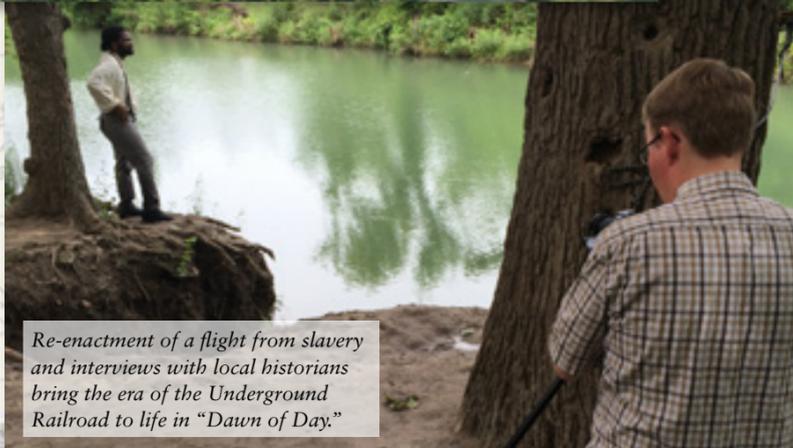
“The response to our documentaries has been overwhelmingly positive, and I believe that is because we are addressing issues of importance and we are doing so thoughtfully and respectfully,” Mercer said. “Rusty is a unique talent in that within him the art and science of videography and the art and science of teaching converge.”

“The videos bring validity to the great community work our faculty do,” Earl said. “They also show that we care more about our students and their personal stories than trying to pull people in. And the end result is, we pull people in because we show that we care about our people.” [k](#)

NACADA: The Global Community for Academic Advising calls the K-State College of Education home. The organization supports advising professionals at K-State and around the world. It also seeks to foster collaborative research between faculty and primary advisors. Charlie Nutt, NACADA executive director, said research in the field is thriving. Serving first-generation college students is a major focus.

NACADA has made the College of Education’s “A Walk in My Shoes: First-Generation College Students” documentary available as a resource to its 14,000 members worldwide.

“Many are using the first-generation documentary, and the materials are available online,” Nutt said. “Workshops have been presented all over the country based on the information in the documentary and its companion e-book.” [k](#)



Re-enactment of a flight from slavery and interviews with local historians bring the era of the Underground Railroad to life in “Dawn of Day.”



Serving those who serve:

Stith’s research on intimate partner violence helps military address issue

By Taylor Manges

Kansas State University distinguished professor Sandra Stith personifies the College of Human Ecology’s motto: “In a world focused on things, we focus first on people.”

The professor of marriage and family therapy is developing programs and tools to understand and treat intimate partner violence.

Working with the Department of Defense, Stith and her colleagues have developed a 15-item Intimate Partner Physical Injury risk assessment tool to assess the likelihood that an individual who has had an alleged incident of intimate partner violence will have a subsequent incident.

They tested a 56-item tool that included factors that increase partner violence risk among civilians and factors commonly experienced by military personnel — including deployment, post-traumatic stress disorder, frequent moves or isolation — to identify 15 items that most significantly predicted a subsequent incident.

Results of their research indicate that the 15-item tool is highly accurate in predicting a subsequent incident. The tool is currently being disseminated and mandated across all branches of service to enhance intimate partner risk assessment and management within the military.

The project’s second phase is examining if different treatment programs help lower an individual’s risk of a subsequent incident, which also may help determine what kind of treatment or what length of treatment is most beneficial in reducing risk.

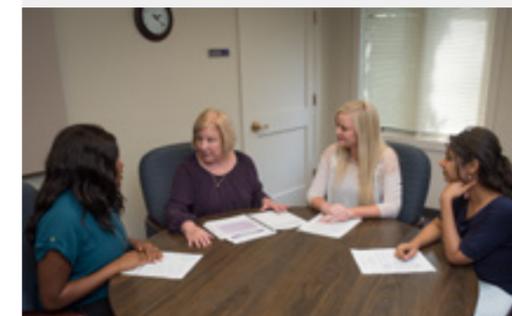
“Currently, some bases design their own treatment programs,” Stith said. “We might have some data to help decide if providers should be using a more standardized approach.”

Stith credits the strong university-community relationship for providing opportunities for her to volunteer and make a difference while obtaining her master’s degree and doctorate at Kansas State University.



“In a world focused on things, we focus first on people.”

College of Human Ecology motto



These experiences inspired Stith to continue working in the community when she returned to Manhattan to join the K-State faculty. She serves as a board member at the Manhattan Regional Crisis Center.

“I am personally excited to serve at the Crisis Center, where I once volunteered, because I feel like it got me started,” Stith said. “I was studying domestic violence in an office with data, but going out to work with victims and leading support groups for victims of violence gave me so much insight and credibility.”

Stith uses her research, scholarly achievements and travels abroad to engage students in the marriage and family therapy program.

“The research we are doing and the evidence-based practice we are teaching affects the kind of clinical work our students do,” Stith said. “Our students receive cutting-edge training about models of therapy they will use to help families.” [k](#)

Searching the past to inform the future

By Mary Lou Peter

Just call Sarah Jones a super sleuth. The senior in food science and industry is spending part of her last year at Kansas State University digging into just how long people have been concerned about the connection between human and animal health. At least 130 years, it turns out.

Jones' interests have taken her from her hometown of Riverton in southeast Kansas to Washington, D.C., in spring 2016 where she met with officials from the Food and Drug Administration, the Congressional Research Service and others; to Bethesda, Maryland and the



I hope to marry my scientific background in food science to the legislative implementation of public policy."

National Library of Medicine archives this summer. While in Bethesda, she delved into hundreds of historical documents and photos, including a review of the One Health philosophy advocated by Dr. John Shaw Billings in 1879.

Billings' One Health approach, sparked by diseases at the time that affected both humans and animals such as trichinosis, held that human and animal health were inextricably linked. His beliefs were not well received in the late 1800s but are widely accepted today by public health, veterinary and food-system scholars, Jones said.

"I work with Randall Phebus, professor of food safety in the Food Safety and Defense Laboratory on campus and am involved with the Frontier program as well; these experiences allow me to explore food microbiology as well as regulatory issues," she said.

The Frontier program, co-directed by Justin Kastner, associate professor of food safety and security, and his

Washington, D.C.-based colleague Jason Ackleson, is a multi-institutional collaboration designed to provide students in-depth knowledge of border security, food security, trade policy and related issues. Through experiential-learning field trips to venues across America, the Frontier program has developed a reputation as an innovative and holistic skill-development program that builds multidisciplinary breadth into students — including students studying the complexity of the global food system.

That is exactly what Jones is doing. She is focused on the current-day concern about antimicrobial resistance in animals and humans.

Antibiotics and similar drugs, together called antimicrobial agents, have been used for 70 years to treat patients who have infectious diseases, according to the Centers for Disease Control and Prevention. Since the 1940s, these drugs have greatly reduced illness and death from infectious diseases. But they now have been used so widely and for so long that the infectious organisms the antibiotics were designed to kill have adapted to them, making the drugs less effective.

Each year, at least 2 million people in the United States become infected with bacteria that are resistant to antibiotics and at least 23,000 of them die as a direct result of these infections, according to the CDC.

"Antimicrobial resistance, one of society's current public health concerns, is increasingly included in the list of problems worthy of tackling with a One Health approach," Jones said.

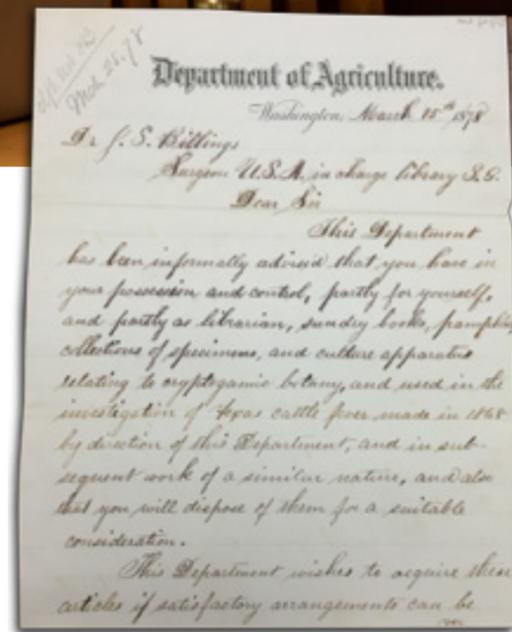
To keep up with global demand for a safe, consistent food supply, livestock producers have used subtherapeutic levels of antibiotics for maintenance to maximize output. Because of concerns about antimicrobial resis-

tance, the Food and Drug Administration is implementing new regulations that provide for more direct veterinary oversight of antibiotic use in livestock production. The Veterinary Feed Directive will be fully implemented in December 2016.

"Though more research needs to be completed, treatments common in the food industry such as rapid chilling and sub-thermal heating in food preservation, in addition to acid interventions and chemical chlorines used to clean equipment, may actually be leading to a breeding ground for stronger, more resistant microorganisms," Jones said.

Her review of the history of antimicrobial resistance led to a deeper understanding of current-day challenges and approaches, she said.

"I hope to marry my scientific background in food science to the legislative implementation of public policy as a civil servant in the federal government," Jones said.



What do you know?

Artist Carlos Castellanos explores how different disciplines create knowledge

By Sarah Caldwell Hancock

Laypersons, artists and scientists see the world and its problems differently. Interest in their diverse ways of knowing and in finding where they can overlap to create new knowledge has led Carlos Castellanos, assistant professor of art at Kansas State University, to take on some unusual projects.

Castellanos has built a mobile bioenergy lab, for example, and explored how art, medicine and virtual reality can help treat chronic pain.

"The idea is art as an alternative form of knowledge production," Castellanos said.

When artists work with scientific materials and in scientific laboratories, they are not merely communicating scientific principles, but they also are conducting their own line of research, which may lead to knowledge construction. So how do we identify the line between science and art? Castellanos finds fertile ground in ambiguity.

"I say to students, 'Look at all the stuff happening. How do you as an artist respond?'"

Earlier this year, Castellanos considered environmental questions in China as he completed a seven-week residency in Wuhan, China's fourth largest city, in conjunction with the 22nd International Symposium on Electronic Art in Hong Kong. Wuhan is on the Yangtze River, and other rivers and lakes abound in and around the city, so water is part of its identity. The area has struggled with pollution. Castellanos wanted to engage citizens, so he built a floating wetland that measures water quality through dissolved oxygen and pH.

"An engineer would call it a sensor network, but it's a mix of citizen science, art and social engagement," Castellanos said.

The project's success helped Castellanos envision more citizen involvement. He hopes "regular people" will take agency to fight pollution rather than leaving the task of monitoring to government agencies or trusting that industry won't contaminate Wuhan's water.

Pollution doesn't respect international borders, and Castellanos says sharing ideas through cultural exchange and the arts is important.

"Pollution, issues relating to environmental health and climate change — we face them here. We think about what engineers and biologists have to say. They have



Carlos Castellanos' blend of citizen science and art led him to create a floating wetland to measure water quality in Wuhan, China.

good ideas, but what do the arts have to say? The arts can be involved in catalyzing change and public awareness," he said.

Castellanos has engaged in topics of local interest, such as prairie ecology, by starting a chapter of Leonardo Art Science Evening Rendezvous, or LASER, at K-State. LASER gatherings bring artists and scientists together for informal presentations and audience conversations, and the K-State chapter is the first in the Midwest. Castellanos hopes to use the group as a springboard to host more events such as art festivals and symposia.

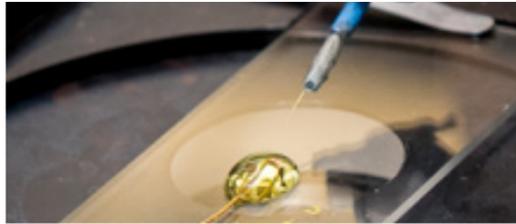
Castellanos came to K-State in fall 2014. He received a 2016 Big 12 Faculty Fellowship Award to conduct an art-science collaborative research initiative exploring human-animal interaction, communication and collaboration as well as the use of layperson interpretations as a form of knowledge construction within a scientific research context. The fellowship will yield an installation created with his collaborator at West Virginia University.



Patented discoveries vanquish viruses, boost batteries, advance agriculture

By Tiffany Roney

Kansas State University faculty and students are some of the most inventive people around. The following original methods and devices are among the patents the university earned in 2016 — with additional patents expected by year-end.



Electrochemically-grown nanowires and uses thereof

Inventors: Bret N. Flanders, associate professor of physics; and Govind Paneru, graduate research assistant in physics

Several biomedical fields can thank K-State for a new helpful tool. These nanowires can manipulate and sense characteristics of individual cells in transplant procedures. Before this tool, there were few measurements and little characterization at the single-contact cellular level. Whereas conventional scalpels and curettes are too big and bulky to remove surrounding tissue and cells for transplant procedures, this sleek device can get in close and do the job.



Macrocyclic and peptidomimetic compounds as broad-spectrum antivirals against 3C or 3C-like proteases of picornaviruses, caliciviruses and coronaviruses

Inventors: Kyeong-Ok Chang, professor of diagnostic medicine and pathobiology; Yunjeong Kim, associate professor of diagnostic medicine and pathobiology; and William C. Groutas, Wichita State University

Many important human and animal viruses share a common thing — a specific type of virus protease. The newly patented compounds target multiple viruses with such protease, which include noroviruses, coronaviruses and picornaviruses. Each year noroviruses cause 21 million cases of gastroenteritis on cruise ships, at schools and in Army barracks in the U.S. alone. Noroviruses also embody a potential bioterrorism threat. Other viruses also affected by the patented compounds include human rhinoviruses, coxsackieviruses and enteroviruses.



Composition and methods for controlling parasitic nematodes

Inventors: Harold N. Trick, professor of plant pathology; Timothy C. Todd, instructor of plant pathology; and Jiarui Li, formerly of K-State

If parasites want to get to soybeans, they'll have to go through K-Staters first. Soybeans are the second largest crop in the U.S. and bring in about \$37 billion each year. But nematode parasites plague soybeans with stunting, chlorosis, wilting and higher susceptibility to other diseases, which cause annual losses of more than \$1 billion. This new crop variety controls parasitic infestation so soybeans can survive and go on to feed the world.



Direct and sequential formation of monolayers of boron nitride and graphene on substrates

Inventors: Michael R. Seacrist, SunEdison Semiconductor; Phong Tuan Nguyen, doctoral student in chemical engineering; and Vikas Berry, formerly of K-State

What's stronger than Superman? The answer may be graphene. It's the strongest known nanomaterial, and it also has high thermal conductivity — 25 times that of silicon — and high optical transparency — 97 percent see-through — as well as a flexible structure, meaning it can bend to each use. This invention, a new method of large-area, high-quality graphene production, will potentially detect single molecules, transform electric signals into magnetic ones, and provide hydrogen visualization templates for transmission electron microscopes.



Lithium-ion battery anode including core-shell heterostructure of silicon coated vertically aligned carbon nanofibers

Inventors: Ronald A. Rojas, Catalyst Power Technologies Inc.; Jun Li, professor of chemistry; and Steven Klankowski, K-State doctoral graduate

Wouldn't it be great if batteries could last longer and charge quicker? Thanks to K-State, there's a new kind of battery that can do just that. This battery uses silicon rather than graphite or other carbonaceous materials, which are common anodes in current commercial batteries, so it provides higher capacity limits, shorter charging periods and significantly longer battery lifetimes. The development will be key for energy supply in future hybrid and all-electric vehicles, portable electronics and power tools. [k](#)

KSURF and KSU-IC: Turning discovery into commercial success

By Pat Melgares

Chris Brandt knows that in the business world, the knowledge that is created in the laboratories and classrooms of Kansas State University has value.

Brandt, the president and chief executive officer of the Kansas State University Research Foundation, or KSURF, heads a team that makes sure researchers and faculty get credit for their discoveries.

"KSURF provides oversight to ensure faculty and university rights are protected," Brandt said. "This includes inventions, software, copyrights, seed and plant varieties, and proprietary materials."

Brandt noted that the research foundation helps faculty members connect with resources and expertise to protect their intellectual property.

"We do this by assisting faculty with evaluating a discovery's potential to be protected and generate commercial interest," he said. "The research foundation also protects discoveries through confidential disclosure, material transfer and other agreements."

Once intellectual property is protected, the Kansas State University Institute for Commercialization, known as KSU-IC, works with the research foundation to connect faculty with potential industry partners that have an interest in licensing the protected intellectual property.

Kent Glascock, president and chief executive officer of the KSU-IC, said interactions with industry partners can lead to other benefits for university faculty.

"New corporate relationships can often result in sponsored research opportunities, either to further the development of the marketed technology, or in completely new areas of interest to our industry partners," he said.

KSURF and KSU-IC help spur marketing and economic development that can get the faculty member's discovery more quickly into the channels where it benefits people.

"The research foundation believes K-State's world-class research and discoveries should be shared with the widest possible audience through commercialization of new products and global solutions to benefit society," Brandt said. "It is important to develop strategies to protect discoveries and give them the best chance to reach the marketplace."

More information on how the Kansas State University Research Foundation and Kansas State University Institute for Commercialization help university faculty is available at k-state.edu/tech.transfer. [k](#)

"KSURF provides oversight to ensure faculty and university rights are protected."

— Chris Brandt



Cyber-physical systems

sı-bər-fi-zi-kəl sis-təms

Eugene Vasserman, associate professor of computer science, explains, in under 100 words, what cyber-physical systems are and how Kansas State University computer scientists are ensuring they can be used to improve health care without compromising safety.

Cyber-physical systems — as small as light bulbs or as big as power plants — consist of components communicating over networks to coordinate how they sense and act on the physical world. Usually this involves much more software than found in typical physical objects. The Internet of Things is different, frequently used for human interfacing and control, while cyber-physical systems are also used for autonomous “closed-loop” control like self-driving cars. Securing cyber-physical systems is critical because component vulnerabilities may allow attackers to directly affect the physical world. In medical cyber-physical systems, patient safety is the main priority, and often depends on security. [k](#)



Planted in history

“Women in Greenhouse” is a print made in 1995 from an undated negative in the Kansas State University archives. Although the exact date of this photo’s origin is not known, the university archivist and the director of K-State’s Historic Costume and Textile Museum date it to 1890-1900 based on clues in the photo. The first clue is the angle of the greenhouse roof, which matches that of the university’s original greenhouses used from 1883 to around 1910. The second clue comes from the clothing worn by the women pictured, especially the Mother Hubbard gown worn by the woman on the left. This American garment, with its looser style, was popular everyday apparel for women from around 1880-1920. The photo also illustrates how K-State has long been involved in plant research, including on sorghum as detailed in the story starting on Page 8.

Photo courtesy of the Kansas State University archives

Colors of health

In this photo of work by Annelise Nguyen, an associate professor of toxicology in Kansas State University's College of Veterinary Medicine, immortalized cells, derived from normal human mammary tissue, were used to identify proteins of interest: early growth factor in green and mesenchymal biomarker in red. Nguyen has research interests in cancer biology and the role of gap junctions in intercellular communication. Read more about Nguyen's latest research in the story starting on Page 24.

