Seek

RESEARCH MAGAZINE FOR KANSAS STATE UNIVERSITY SPRING • 2016



Senses and sense ability

How sensory analysis investigates what we see, taste, smell, feel, touch ... and buy

Air travel with dummies

Detect and defeat

Engineers use special mannequins to improve airplane safety, comfort

Researchers take aim at deadly swine diseases



Kansas State University's TRIGA research reactor operating in steady state at 100 kW of thermal power.

See: Contents











- 2 Intro
- 4 Shorts
- 32 Faculty Focus
- 34 Undergraduate Research
- 36 Research Scholar

Features

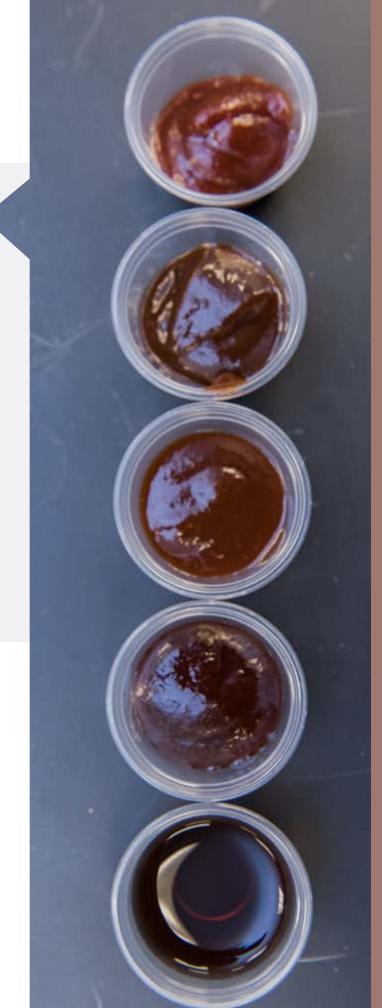
- 8 Senses and sense abilities How sensory analysis investigates what we see, taste, smell, feel, touch ... and buy
- 16 Air travel with dummies Engineers use special mannequins to improve airplane safety, comfort
- 20 Rock stars

Geoscientists exploring how interrelated processes protect resources and human health

24 Detect and defeat

Researchers take aim at deadly swine diseases

- 28 Hello, my name is... Meet Kansas State Polytechnic: A campus transforming for the future
- 37 UDP Focus
- 38 Patent Spotlight
- **39** Explain It
- 40 Corporate Engagement
- 41 The Past





Seek is a publication of Kansas State University and

Seek contributors

Ben Cleveland Michael Oetken

Tommy Theis

Beth Bohn Julee Cobb Sarah Hancock Cindy Hollingsworth <u>Stephanie Jacques</u> Steve Logback Taylor Manges Pat Melgares Tiffany Roney Greg Tammen Jennifer Tidball

Production assistance: Ashlev Martin Qiwu Zhu



Kansas State University's



Knowledge. Discovery. Creativity. Answers. Solutions. These are what we seek at Kansas State University - and more.

That's why Seek is a fitting name for our new magazine about the many facets of K-State and our quest to become a Top 50 public research university by 2025.

In the pages of Seek, we invite you to experience, or "See," some of the best "K"-State has to offer.

And there is much to discover. As a university with the Carnegie Classification of highest research activity, K-State researchers are involved in wide-ranging work that addresses such key areas as bio-agro security and global food systems, better health and nutrition practices, advanced technologies and the natural world.

Our inaugural issue looks at why Kansas State University is a world leader in sensory analysis, where the human senses are used to develop products and make them better. Our internationally recognized Sensory Analysis Center conducts research and works with companies across the globe to feed hungry children, provide pets better food and even develop a better cup of coffee.

Worried about catching the flu when flying? Learn how FAA-supported K-State research uses a unique approach in air cabin research to keep passengers healthy and comfortable.

As the nation's first operational land-grant university, Kansas State University has a long history of leadership in animal health. See how K-State swine research is successfully taking aim at deadly diseases, particularly the devastating porcine reproductive and respiratory syndrome, or PRRS. Our research has produced vaccines, diagnostics and more to help swine producers in the U.S. and worldwide.

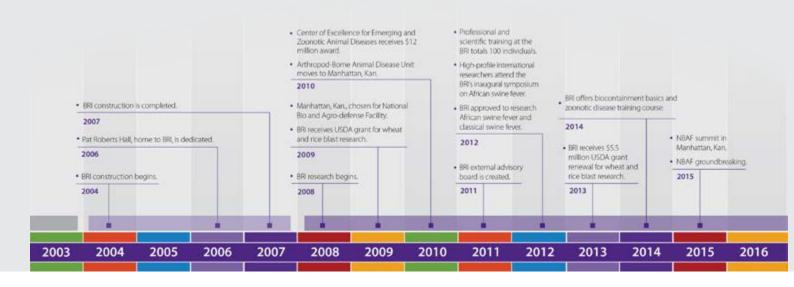
Geomicrobiology is a relatively new field, but one in which Kansas State University geoscientists are making strides. These researchers are studying the role microorganisms play in driving the chemistry of geological environments, which could lead to safer drinking water and even new ways to extract energy from depleted oil reservoirs.

Seek is not the only addition to the K-State family. Our Salina campus has a new name to better reflect the hands-on, interdisciplinary and applied learning approach of its professional programs that prepare students for their chosen career field. Find out how Kansas State University Polytechnic Campus is positioned to meet industry needs in technology, aviation and more.

Seek also will introduce you to our nationally recognized students, faculty and staff. In this issue, meet two anthropology students who show why undergraduate research is a hallmark at K-State, learn how we're boosting our graduate student enrollment and meet the man leading the university's corporate engagement efforts.

We invite you to Seek. We know you'll find much to discover about Kansas State University.

Peter Dorhout, Vice President for Research



Proposed NBAF diseases:

Rift Valley fever	 Rift Valley fever
Classical swine fever	 Ebola Sudan
African swine fever	MERS
Japanese encephalitis	 Lassa fever
Chikungunya	 Chikungunya
Wheat blast	Marburg
Yellow fever	 Paratyphold fever
Avian influenza	 Schistosomiasis
 Schmallenberg virus 	 SARS
Chinese porcine reproductive respiratory syndrome virus	Hookworm
	Classical swine fever African swine fever Japanese encephalitis Chikungunya Wheat blast Yellow fever Avian influenza Schmallenberg virus Chinese porcine reproductive

Current diseases being studied at the BRI

Science magazine ton 10:

Visualizing vaccines

Outbreaks of nasty diseases remind us of the importance of vaccines in protecting our health. Last year it was Ebola, and this year it's Zika. In January 2016, Science magazine released a list of the top vaccines researchers need to develop. Kansas State University is working on two of them at its Biosecurity Research Institute, or BRI. Other pathogens being studied at the BRI are among those proposed for the National Bio and Agro-defense Facility, or NBAF, which is under construction near the institute.

"BRI is an important asset to K-State, and it became a reality with the groundbreaking in 2004. In the 12-year history of the BRI, we've brought some of the best people in the world who are thinking about these critical disease problems right here to Kansas because we — the state and federal government and K-State — have invested in the research infrastructure to be able to study highly impactful diseases in the safest laboratories in the world," said Peter Dorhout, vice president for research.

Dorhout says some of the most virulent diseases, such as H1N1 and other flu viruses, develop because of human interaction with animals. "Even though we have best practices in the developed world for managing livestock, the kitchen garden farm is pervasive in the rest of the world. That is at the nexus of a lot of human-animal disease interactions," Dorhout said.

K-State's investment in faculty and staff equipped to address these problems attracts students who want to make the world a safer place. "From food supplies to drinking water to farming practices, they want to ensure that the Kansas and American food supply are the safest they can be," Dorhout said. "We want it to be the envy of the world."

Research activity at highest level

According to the latest Carnegie Classifications for Institutions of Higher Education, Kansas State University classifies as a university with the "highest research activity." The Carnegie Classification is issued every five years to recognize and describe institutional diversity in U.S. higher education. The new classifications, announced in February 2016, use 2013-2014 data from the National Center for Education Statistics, the National Center for Science and Engineering Statistics, and The College Board. "K-State has had a rich history of research coupled with our land-grant mission, and we've made a conscious effort to build off our strengths in animal health and global food systems to enable impactful technologies, address real-world problems and enhance well-being," said Peter Dorhout, vice president for research.

Research activity is a key piece of the university's plan to be a Top 50 public research university by 2025, said Dorhout, who noted that K-State research expenditures grew 22 percent from 2009 to 2014.

A toxic shock: Discovering how genes help this fish thrive in troubled waters

Good golly, Atlantic molly.

Meet the Atlantic molly — an extremophile fish that lives and thrives in toxic water in Mexico that is full of hydrogen sulfide from natural oil deposits and volcanic activity environments.

How? It's all in the genes. That's according to Michael Tobler, K-State assistant professor of biology, who helped lead a 10-year collaborative project with a biologist at Washington State University to discover how the molly can survive an environment of hydrogen sulfide, which shuts down energy production in cells by interfering with specific proteins.

Using genomic tools, the researchers compared gene expression of the mollies living in toxic hydrogen sulfide environments with those mollies living in nontoxic environments just a few yards away. They found that the fish have a two-pronged approach to survival: They become inert to the toxins that enter the body and they are able to detoxify hydrogen sulfide more efficiently.

"Learning how these extremophiles function tells us something very fundamental about life itself," Tobler said. "We are able to learn about the boundaries where life can exist, which tells us something basic about how cells and organisms work."

The research appears in Molecular Biology and Evolution.



See Shorts



Teen speak on fleek and reason to freak? Not in the way you think, linguist says

How teenagers speak IRL — in real life — is not ruining the English language, according to Kansas State University linguistics research.

In fact, teenagers may not be causing language change the way that we typically think, said Mary Kohn, assistant professor of English. Kohn studies language variation and how language changes over time.

Kohn's latest research - published in PADS, a

publication of the American Dialect Society found that teenagers are not solely causing language change. Rather, language changes occur throughout a lifetime and not just during the teenage years.

"Our research has shown teens are being dynamic with language, but not necessarily in a consistent way," Kohn said. "We aren't eliminating the possibility that teenagers are driving sound change, but we might be grossly overstating the role of teenagers."



New CAREER award winner

Pavithra Prabhakar, assistant professor of computing and information sciences, has received a five-year \$446,000 CAREER award from the National Science Foundation for her project "Robust Verification of Cyber-Physical Systems."

"Cyber-physical systems are an important part of modern society and they have transformative applications in the transportation, health care and energy sectors," Prabhakar said." This research will bridge an important gap in the existing methodologies for the analysis of cyber-physical systems. through the novel paradigm of robust verification, which will enable the development of high-confidence cyber-physical systems, particularly automotive and aerospace systems."

The NSF's Faculty Early Career Development Program is one of the foundation's most prestigious awards for supporting early career faculty who effectively integrate research and education in the context of their institution's mission.



Following the crowd

Your high school classmate hit you up to help fund his movie, and you've seen crowdfunding used for disaster relief and medical costs — but for research? Turns out there's crowdfunding for that, too.

Amber Vennum, assistant professor of marriage and family therapy, became the first at K-State to attempt to gain crowdfunding for research. She raised \$5,625 to support her applied project, "Working on What Works," a classroom intervention technique that uses positive reinforcement. Vennum selected Experiment.com, a platform that helps researchers raise funds to conduct studies in fields from social science to chemistry. Experiments have 30 days to raise the necessary cash, and backers can access lab notes to see how the work proceeds.

Vennum likes the idea of connecting with her funders. "For the applied projects I do — and this one in particular is local — crowdfunding is giving the community the chance to be involved in the research," Vennum said. "On the site I used, anyone who donates or supports the project gets updates on how it's going and an inside look at the research process and outcomes. With the school districts I work with, making that connection is important."



problems.



See Shorts

Riding the wave

In 1889, the second annual report of the Kansas State Agricultural College Experimer Station included a description of research in "Ammonia and Nitric Acid in Atmospheric Waters." K-State's expertise in the area of water has only grown since then. In the present day, worries about water quality and quantity in our agriculture-dependent state lead researchers across campus to form interdisciplinary teams to tackle real-world

In December 2015, the Office of the Vice President for Research offered a Water Seed Grant Program to fund one research award and three grants to develop teams to address water research needs from many angles. The \$89,710 research award will help a team from the geology department develop a critical zone observatory for water research in Kansas. Team development awards will explore teff, a grain that requires less water than other crops; systems to manage water across the rural-urban interface; and decoupling fertilizer production from fossil fuels.

A mobile approach for better animal health

Veterinarians across the country can now get results sooner from the Kansas State Veterinary Diagnostic Laboratory thanks to the lab's new app for mobile devices.

Gary Anderson, director of the lab in the university's College of Veterinary Medicine, said the new app is a time-saver.

"This is a major advancement in being able to provide diagnostics to practicing veterinarians out in the field," Anderson said. "Traditionally, we have used a variety of methods of delivery, from snail mail, telephone, fax and email. This app will give veterinarians a way to track the results as soon as they are received here in the lab. It will save time for everyone involved and is a real win-win for veterinarians and their clients who are seeking the best in medical care for their animals."

The app is available at the App Store and at Google Play; just search for "KSVDL Mobile." Clients can get more information about the app by contacting the Kansas State Veterinary Diagnostic Laboratory at clientcare@vet.k-state.edu, 866-512-5650 or visit ksvdl.org.



Senses and sense ability

EXIT

versity Distinguished sas State University's

K-State's internationally recognized Sensory Analysis Center uses our five senses to analyze and improve products

By Jennifer Tidball

THE SENSATION BEGINS WITH A BLANK CANVAS: A white room. White fluorescent lights. People in white lab coats. White and clear utensils on a white circular table.

It is around this white circular table that the research magic happens. Coffee becomes "earthy," "savory" and "berry." Essential oils smell "minty," "floral" and "grassy." Pet food looks "oily," "porous" or "fibrous."

The research magic has a more accurate name: sensory analysis. Sensory analysis measures how people react to products and items through the five senses: sight, smell, taste, touch and hearing.

Through sensory analysis, Kansas State University researchers are trying to answer questions such as: Will children eat a high-protein porridge made of sorghum? How can people improve food safety while they are grocery shopping? Do consumers consider dye color or pattern symmetry when they buy clothing?

"Sensory analysis is a really important field because it helps people improve their lives with better food and better products," said Delores Chambers, professor of food, nutrition, dietetics and health.

For more than 30 years, Kansas State University's Sensory Analysis Center has investigated sensory analysis and worked with companies across the globe. At the Manhattan and Olathe campuses, faculty, students and panelists conduct consulting, education and consumer research on a variety of products and topics: food, beverages, cosmetics, fabrics, packaging, paints, personal care products and fragrances, as well methodologies and food safety.

What is sensory analysis?

Sensory analysis evaluates products from a sensory perspective. It measures consumer reaction through the five senses: sight, smell, taste, touch and hearing.

Current research:

- Textiles
- Essential oils
- Steak
- Meat
- Nail polish
- Pomegranate juice
- Cheese
- Bread
- Chocolate
- Fresh fruits and vegetables
- Beverages
- Shampoo
- iPad usage research
- Methodology research



One of the center's biggest projects tackles two of coffee growers' biggest challenges: rust disease, which can infect many of the best-tasting coffees, and climate change, which is causing rising temperatures that make it difficult to grow coffee.

Researchers want to find varieties of coffee that taste good but are less susceptible to rust disease and can be grown in difficult temperatures. The center is working with coffee cuppers to profile 800 coffee varieties and find 100 varieties that contain flavors and characteristics that people like and will buy.

Once researchers find the top flavors, they will work with coffee roasters to make easier-to-grow coffee varieties.

A \$110,000 World Coffee Project grant is supporting the project, which also involves Texas A&M University and World Coffee Research.

Sorghum

The center is helping malnourished children in Tanzania by offering a new product: a high-protein porridge made of sorghum.

By blending sorghum with soybeans, cowpeas and corn-soy, researchers have developed porridge products that provide nutrition and protein for children ages 6 months to 5 years. The center developed 33 products and has narrowed the list to three products that are being market-tested in a five-month feeding trial with children in Tanzania.

Sorghum is a major sustainable crop in Africa. Kansas is the largest sorghum producer in the U.S., and the research has economic potential for the state.

A \$5 million USDA Micronutrient Fortified Food Aid Products Pilot initiative grant is supporting the project, which also involves the university departments of grain science and industry; agricultural economics; and food, nutrition, dietetics and health.



Pet food

To help our pets have better food, human panelists have tasted — but not eaten the food for themselves.

The center has conducted several major pet food studies. To gather data on the smell, taste and appearance of pet food, trained panelists tasted human-safe dog food (and spit it out!) to determine ingredient, shelf-life and fiber characteristics. They also studied a vast array of dog foods — kibbles or bones, grain-free or grain-added, and food for puppies or adult dogs.

Consumer pet food studies showed that owners prefer multi-colored kibbles for their pets and consumer home tests have helped researchers learn how much food dogs will eat. The center also is working with trained kennel dogs to determine what types of food the dogs prefer.



 \odot or \otimes may be the key to healthier lunches in the U.S. and Ghana.

To reduce food waste, the center's Olathe location is studying if children like healthy food served at lunch.

Researchers are using emoticons to reach schoolchildren of all ages. Young children who are learning to read may not be able to write words that adequately express how they feel about lunch food. But younger children may be able to choose a happy face if they like a dish or a sad face if they didn't like it.

The image-based emoticon research translates across cultures and languages: A happy face has the same meaning in the U.S and in Ghana. Researchers are conducting trials in both countries.



Only 20 percent of people use a meat thermometer when they are cooking at home. But when a recipe includes a reminder, 80 percent of people will use a thermometer, according to center research.

For one food safety project, the center researched consumer safety practices in 10 different countries: the U.S., Argentina, Colombia, Italy, Spain, Estonia, Russia, Thailand, India and South Korea.

By shadowing consumers, the center developed a list of steps to improve food safety: using meat bags at the grocery store leaving raw meat in these bags in the refrig erator, and using a meat thermometer.

Researchers are working with the Partnership for Food Safety Education to embark on a nationwide food safety educational campaign promoting these safety steps. The collaborative \$2.5 million project involves Tennessee State University and RTI International.



What do people want in artisan textiles? Natural dyes? Perfect patterns?

Center researchers are finding out by studying shawls and clothing from Turkey, Peru, India and across the world.

Researchers have discovered that consumers want high-quality artisan textiles, but don't mind a few minor imperfections — such as a small crooked pattern or a slightly uneven edge — because it shows the handmade characteristics of the textiles.

Researchers also are working with artisans to describe Internet-sold products, such as ways to convey the scratchiness of a wool jacket or the smoothness of a silk shawl.

The online research can help the textile artisans make a living from their homes, even if they live in a remote village in the mountains of Peru. The research is important for maintaining rural populations and cultures.

Kansas State University excels at the research, too. The Journal of Sensory Studies recently named the Sensory Analysis Center the top in the world for sensory analysis research influence.

Even more, the journal ranked three university research ers among 784 individuals worldwide for sensory research influence: Edgar Chambers IV, director of the center and university distinguished professor of food, nutrition, dietetics and health, ranked No. 1; Delores Chambers, co-director of the center, ranked No. 5: and Kadri Koppel, assistant professor of food, nutrition, dietetics and health, ranked No. 40.

The rankings were based on a combination of research articles published and number of citations from 2009 to 2015.

"The rankings and recognition tell us that the work we do is useful to people," Edgar Chambers said. "Our research is used by people every day, which is what we want."

Common senses

THE SENSORY ANALYSIS CENTER CONDUCTS

more than 50 studies every year. Some studies are industry-sponsored work, while other research studies focus on the products that people use every day: coffee, shampoo, soda, cheese, smoky sandwich meat, steaks and pet food.

The center, part of the College of Human Ecology, started at the university's Manhattan campus in 1983 and moved to Ice Hall in the K-State Research Park in 2014. A second location opened at the university's Olathe campus in 2011.

Ice Hall is equipped to handle two areas of research: objective scientific analysis using instrumentation and trained sensory panelists and well as sensory analysis with consumers.

Walking through the building shows the center's dedication to improving the products that we use every day. Textiles from across the globe hang in the hallways. Several kitchens with sinks, refrigerators, ovens and stoves help researchers prepare food for studies. A laboratory room contains instruments that allow researchers to study the chemistry of products.

Throughout the building are white rooms for sensory analysis research. In these white rooms free of visual distractions and competing colors, trained panelists study a product's appearance (Is it grainy or smooth?), fragrance (Does is smell like citrus or spice?), taste (Does it taste

smoky or have an ashy aftertaste?) and various other characteristics.

The center's 13 trained panelists have each received more than 120 hours of extensive training on sensory analysis and product evaluation. When needed the center also brings in consumers to evaluate products.

"Sensory analysis is a tool kit that provides a number of methods to use in prod-

uct development, quality control or maintenance," Edgar Chambers said.

Beyond sensory analysis, the center also conducts instrumental analysis of products. Koppel's research connects descriptive testing and chemistry. Using a gas chromatograph — an instrument that uses chemistry to separate and analyze compounds in a vapor format — she can measure aromatic compounds of a product, such as coffee or pet food.

"We connect the two sides of research," Koppel said. "We want to figure out the compounds that are causing some of these aromatic sensations that we perceive as human beings. It is often a matter of using both data sets and understanding one through another."

Making cents of sense

"Our research is

diverse, but it affects

each of our lives. We want

to change the world one

person at a time."

Edgar Chambers IV

ENTER INDUSTRY, SENSES MAKE CENTS for the university and economy, and industrial partnerships are another way the Sensory Analysis Center aims to understand the world around us. The center tries to maintain a healthy balance between research projects and industrial

client projects.

"The center serves as a facility where companies can ask for a project to be done," Koppel said. "We can analyze their product, determine their position in the marketplace and compare their product to competitors. Sensory analysis can explain why some products are liked or not liked and what makes a product successful in the marketplace."

That's where the Olathe location fits in. While the Manhattan location performs a mix of research projects and industry projects, the Olathe location in the Kansas City metro area primarily conducts consumer testing funded by industry.

"We are still K-State, but we are K-State with an industry bend," said Marianne Swaney-Stueve, project manager for the Olathe location. "When you partner the center's industry work with its descriptive analysis work, it makes



Kansas State University stand out compared to other schools."

Swaney-Stueve studies how to improve methodology so that companies can use test results to make their products better.

"We apply academic tools to industry," said Swaney-Stueve, also a research assistant professor of food, nutrition, dietetics and health. "We work with product developers to help them understand how to structure the best test so that they can use the results to improve their products."

Any successful center project — commercial or research-based — contains the not-so-secret ingredient: collaboration. Internal collaboration throughout Kansas State University and external collaboration with companies and universities around the world help the center reach diverse audiences, Edgar Chambers said.

Through the Sensory Analysis Center, Kansas State University research has reached more than 20 different countries, including the U.S., Columbia, Argentina, Russia, Spain, Estonia, India, Thailand, South Korea, Turkey and Egypt.

The center has had a collaborative facility at Kasetsart University in Bangkok for almost 10 years, Chambers said, and is working to establish one at Miguel Hernandez University in Spain.

"We need collaboration because so many times, we work with international products," he said. "Partnerships help us find the people and resources we need for our studies."

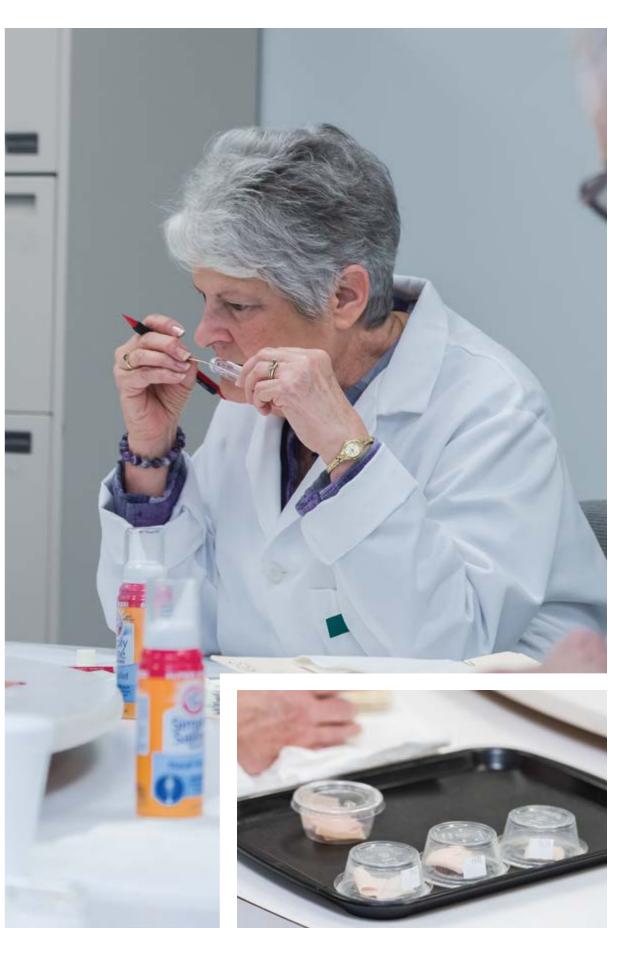
A sense of learning

ALL OF THE WORLD IS A CLASSROOM. a laboratory and a stage for Kansas State University sensory analysis students. The Sensory Analysis Center emphasizes hands-on learning through a variety of research-based experiences, from consumer projects to international travel to Turkish cooking shows.

At the Manhattan and Olathe campuses, graduate students can perform extensive consumer testing before entering the workforce. Previous students have had internships and jobs with companies such as Coors Brewing Co., S.C. Johnson & Son Inc., Nestle, Mars Inc., Unilever, Nabisco, Avon Products Inc. and PepsiCo Inc.

Approximately 10 graduate students work at the center every semester and help with consumer and descriptive sensory projects. Each semester a graduate student lab manager takes on additional leadership responsibilities by scheduling panelist sessions, coordinating student schedules and keeping supplies stocked and organized.

"K-State has one of the top sensory programs in the country," said Brendan Kelly, master's student in food science and the lab manager for the fall 2015 semester. "For me, it is great to gain such extensive experience in flavor profiling because it will be key for my future career in food chemistry."





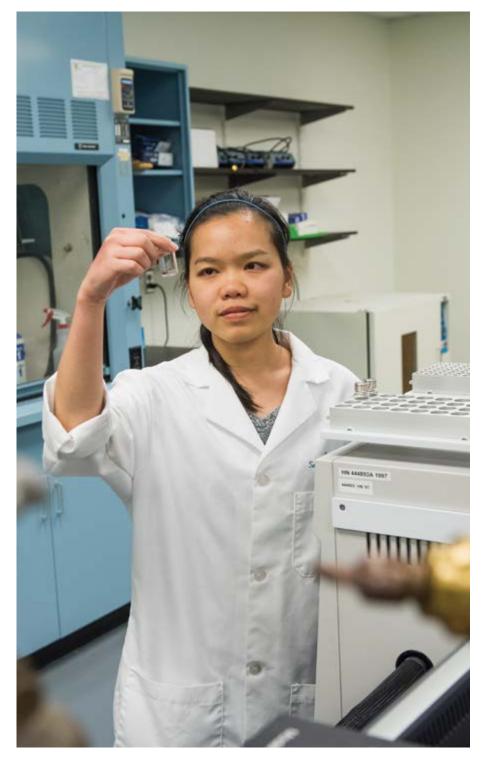
Panelists discuss the scents and characteristics of essential oils during a testing session at the Sensory Analysis Center. The center's trained panelists have evaluated a variety of products, from dog food to deodorant. For students such as Kelly, these extensive experiences reach across the globe. Delores and Edgar Chambers have led several graduate student research study tours to various countries, including a 10-student trip to Turkey in October 2015 and an eight-student trip to Egypt in January 2016.

In Turkey, students researched eating habits and learned how to translate and conduct research in different languages, Delores Chambers said. The group even appeared on a Turkish cooking show, "Cooking with Oktay Usta."

"The trip really allowed students to visit with families to learn about how they eat, what their homes look like and what their lives are like," said Delores Chambers, who also has taught classes in Thailand. "It is important for our students to have these cultural learning experiences and interactions."

Such international experiences may be far away geographically from the white research rooms of Ice Hall, but the Sensory Analysis Center makes the world seem smaller through its partnerships and research on products that are used around the world every day.

"Our research is diverse, but it affects each of our lives," Edgar Chambers said. "We want to change the world one person at a time."



with dummies

How a team of engineers and mannequins is improving comfort and safety for passengers in airplanes

By Greg Tammen

"This is it," says Byron Jones, professor of mechanical engineering, as he flips several switches. The large, darkened air cabin springs to life with warm electronic hums and the sound of air circulating overhead. Stubby nozzles above passenger seats begin forcefully blowing air downward. Portable lighting rigs illuminate the cabin and its silent, lifeless passengers.

This is a scale-model Boeing 767 passenger cabin. Kansas State University researchers use it as a laboratory to conduct ground-based air cabin research for the Federal Aviation Administration and the commercial air transportation industry.



Jones operates the research passenger cabin with Mo Hosni, the university's Charles and Nona Frankenhoff chair in engineering and professor of mechanical and nuclear engineering. Together with a team of graduate students, research engineer Garrett Mann who ensures equipment is operational, and the 77 silver, inflatable dummies riding in the cabin's passenger seats, they are responsible for the safety and comfort of our air travel.

"We're a one-stop shop when it comes to air cabin research," Jones said. "We develop the experiment, build the components we need to conduct it and then analyze the data from that experiment so we can make recommendations. In the nine years we've been in operation, there really hasn't been anything like this in the U.S."

Ground control

Despite having never left the ground, Kansas State University's lab is considered a crown jewel in aviation research by the FAA and is part of the agency's Air Transportation Center of Excellence for Research in the Intermodal Transport Environment, or RITE. Kansas State University co-leads the center with Auburn University and partners Harvard University, Purdue University, Boise State University and Rutgers Biomedical and Health Sciences, each specializing in a different sector of aeronautical research.

The 10,000 square-foot research lab was previously a showroom for a car dealership and later a children's dance studio. For the past 12 years, though, the space has been used to conduct research ranging from how diseases spread throughout the cabin to what happens to body heat passengers release. All tests are performed with the cabin's crew of dummies some of which sport magic marker eyes and mustaches.

The space is divided into sections. One section houses large ventilation ducts and cooling units that dry and dehumidify air circulated in the replica passenger cabin. This dehumidified air is the same consistency as air that circulates in passenger cabins 30,000 feet above ground. Another section houses several smaller laboratories and workshops - one of which contains a working jet engine.

In the center of the lab is an elevated, enclosed room containing the replica Boeing 767 passenger cabin, which was built with the seats, air diffusers and outlets from a decommissioned 767. The cabin is monitored with computers and serves as the team's primary testbed.

With hundreds of passengers sitting in close proximity and electronics a staple of air travel, keeping a steady temperature in the cabin can be a challenge as an increase in heat can quickly create discomfort.

Researchers use the dummies to test and account for heat in the cabin. Wires suspended from the cabin's ceiling are taped across every dummy. Each wire set generates about 100 watts of heat, roughly equivalent to how much heat a person puts out when using a laptop or other electronic device, Hosni said.

"It's a bit of an extreme scenario with every passenger using a laptop at once, but it tests everything at its maximum limits, which is important to account for when tens-of-thousands of feet in the air," Hosni said.

As the dummies are warmed, the heat begins to rise and warm the cabin. Cold, dehumidified air is released into the cabin through long metal vents called linear diffusers. The two temperatures mix to create a sustained, comfortable cabin temperature identical to that of an airline in flight.

"The first criteria for how these systems in airliners are designed is to remove the body heat that comes with people in close proximity and using electronics," Jones said. "Even at 30,000 feet up where it's 40 degrees below zero outside, you still have to cool the cabin because all of the body heat in that enclosed space."

Researchers use this method to test for temperature fluctuations in the cabin as well as a variable for other studies.

Air combat

Using the passenger cabin's airflow and ventilation to combat germs, diseases and carbon dioxide is a common focus for the team.

Jignesh Arvind Patel, master's student in mechanical engineering, is studying the effectiveness of the cabin's ventilation systems.

The FAA requires that the heated air and the carbon dioxide passengers produce during breathing need to be ventilated from the cabin as soon as possible for comfort and safety, Patel said.

"If someone has a cold and they sneeze, you don't want those germs to spread among the other passengers," Patel said. "Instead, you want to ventilate those germs as soon as possible so that they are removed from the equation."

To study this, carbon dioxide is injected into the passenger cabin in the lab. The carbon dioxide begins to rise to a steady state. Over time it gradually begins to decline. Patel measures how fast the carbon dioxide takes to decline in the cabin to find out how fast a contaminant in the cabin is ventilated. He then looks at seat arrangement and whether ventilation varies from seat to seat or if it is uniform throughout the cabin.

"So far we've found that it's pretty much uniform," Patel said. "This is ideally what we want because it means that the systems are designed for maximum efficiency."

Another project looked at whether passengers could be getting more than refreshments from the beverage cart.

"We were really curious to see if someone sneezes on the airline attendant or on the beverage cart, how far can those germs be transported," Jones said. "Someone had done a mathematical equation that looked at disease distances on airplanes, but nobody had done experimental measurements on it."

aisles. A dummy was attached to a beverage cart and a electronic control system moved the two up and down the aisle to mimic the attendant's route. Carbon dioxide and smoke were released into the cabin so that researchers could visualize the air movement.

"We saw that there is so much motion in the cabin's air from the ventilation system that even if someone sneezed on an attendant, it did not have a significant effect on how far the germs could travel," Jones said. "There is almost zero chance of germs hitching a long ride."

Shortly after 9/11, a big focus was put on national security and air travel. Researchers were asked to study how contaminants such as biological agents moved throughout the cabin and how they could be controlled. Several studies were conducted that used baby powder to visualize the source of the contaminant and its movement. Researchers found that while the contaminants spread to upward of eight rows rather than the predicted three, airflow quickly neutralized the spread to a majority of the cabin.

Researchers also found that personal air outlets or "gaspers" - those round, protruding nozzles above seats that stream air — affect disease transmission.

Researchers built a track down one of the cabin's seating

"We found that when you have these blowing air beside you rather than toward your face, they act as a barrier against disease," Hosni said. "It essentially works as a personal air dam."

Engine safety

Shahin Nayyeri Amiri, instructor of civil engineering, works with a jet turbine engine in one of the smaller labs. He is looking at whether chemicals and tiny, toxic particles in the plane's fuel and oil can be released into the passenger cabin if one of the engines has a leak.

"There are several case studies in which passengers sued an airline because they reported smelling oil during the flight and then after the flight felt sick and had memory loss," Nayyeri Amiri said. "These passengers reported that they could smell oil inside the cabin during the flight. It's something that's hard to prove because you can't see it, so we want to figure out if it's actually happening."

Airplanes do not have an air-conditioning system. The turbine engines that propel the plane also compress fresh air from outside the craft into the passenger cabin to cool it. If oil or jet fuel leak into the engine as it's compress-

"We develop the experiment, build the components we need to conduct it, and then analyze the data from that experiment so we can make recommendations. In the nine years we've been in operation, there really hasn't been anything like this in the U.S."

— Byron Jones

can be released inside the passenger cabin, Navyeri Amiri said. To study the particles being released, Navyeri Amiri relies on a turbine engine and an air simuladifferent concentrations

ing air, chemicals and particles from those fluids

tor to produce particles at through temperature and pressure adjustments. Oil and fuel are then injected into the engine and Navyeri Amiri looks at what comes out during compression.

While he cannot speak to

the medical affects, Navyeri Amiri and colleagues have published multiple studies on their findings about various particles and chemicals that are released.

"If an engine is healthy, this bleed through will not happen," Nayyeri Amiri said. "But if there is something wrong with an engine, even a small amount of oil may leak inside the cabin and cause a problem."

The FAA is working to develop sensor technology that can detect the source of a leak and automatically turn air compression off for the affected engine.



Air outlets (top) and sensor connectors help researchers with *experiments* for air cabin comfort.



Kansas State University geoscientists explore interrelated processes to protect resources and human health

Geosciences researchers at Kansas State University are making those connections in everything from the formation of volcanoes and mineral resources to finding the "control knobs" for natural processes that cause sediments to release metals in water. Their work ultimately helps protect precious resources to boost food, energy and water security as well as human health

The lost arc

Brueseke's particular interest is in igneous petrology, or rocks that solidify from lava or magma. Samples of rocks that came from magma can shed light on the relationships between volcanoes and the movement of large sections of the earth's crust over the underlying mantle, also known as plate tectonics. Studying material volcanoes churned out in the past helps us understand hazards like Yellowstone and other volcanically and seismically active areas. The best place to do this is where there's a plate boundary.

Brueseke said the fieldwork is more intense than he's ever done, but the fist-sized samples he and his team haul out of the park yield a wealth of information with global Alaska fills the bill; specifically, Wrangell-St. Elias National Park and Preimplications. Back at home, the researchers look at thin slices of the rocks under a serve's 13.2 million acres encompass a huge, complex arc of volcanoes. microscope and pulverize some into a powder to send to labs that determine element "We hardly know anything about them," said Brueseke, an associate and isotope concentrations that indicate what melted to form the rock. Radiometric datprofessor of geology at K-State. "We're calling it the lost arc." ing helps researchers piece together a history of the mysterious volcanic field: frequency One reason we don't know much about the area is that it's not an easy and types of eruptions, relative ages of different volcanoes, and the relationship between volcano formation and plate movements. All of this helps advance understanding of place to take samples. Everything is remote: so much so that Brueseke and other members of his National Science Foundation-funded team how the volcanoes developed, when eruptions occurred and how dangerous those eruphave to travel in Piper Super Cubs. The light planes can land in 30 feet tions were. Many trans-Pacific flights go near and over the Wrangell Mountains, and

Humans have not had a long time, geologically speaking, to advance understanding of the earth and its processes. We've had even less time to connect knowledge in different disciplines.

If you were a kid who hoarded rocks and minerals, you can probably relate to Matt Brueseke's specialty in petrology, or how rocks form.



Matt Brueseke



when necessary, which is handy in a place where paved runways are out of the question. The planes each carry supplies for one or two people for five days in bear containers and buckets with lids. Weight limits are strict.

Conditions and logistics are challenging. Researchers hike up surrounding cliffs and through muskeg, the local term for bogland - sometimes for many miles - and collect lava samples. Helmets are required because terrain can be steep and researchers must guard against falling rock. Alaskan summers are damp, with temperatures in the 60s to 70s in the daytime and the 40s at night. As researchers empty their bear containers of food, they fill them with rocks. The next site's supplies are already packed and ready, so when the team has collected enough samples at one site, the plane comes and takes everyone to another spot, a process that requires four or five flights. If the wind is blowing or the cloud base is too low, the Super Cubs can't fly, so schedules and supplies may have to stretch and team members can be stuck in their tents.



Wrangell arc-derived ash has been identified in Europe. When these volcanoes erupt again, they will affect people well beyond Alaska and the Yukon because of the significant hazard they pose to worldwide air traffic.

Another major project of Brueseke's is applying this research to the process of gold and silver mineralization.

"You can apply the same skills and techniques that determine why the magmas are there to determine why the ores are there and how they are related to plate tectonics," he said.

This mineralization work in Nevada and Idaho differs in obvious ways from his project in Alaska — he's not volcano hunting, and the scenery, although striking, isn't as photo-worthy — but he says both projects have great benefits to Kansas State University students.

"It opens up those research experiences, whether they are for undergrads or grad students, " he said. "It allows me to bring modern, advanced techniques into the classroom. I teach introductory geology, mineralogy, petrology and economic geology. I can bring in firsthand knowledge of how we study mineral deposits and plate tectonics. That happens at the undergraduate level and the graduate level, in classes for both geology majors and nonmajors."

Brueseke said that geoscientists with training in solid earth processes are in demand.

"As a society, it's important to understand minerals. No matter where you live, we use resources," Brueseke said.



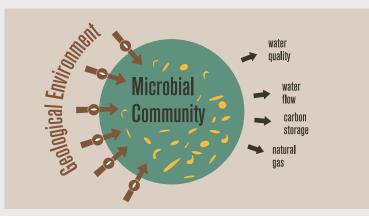
Protecting resources with microbial 'control knobs'

Protecting those resources is an ongoing task for two other Kansas State University geologists. Their work operates at disciplinary boundaries, uses the latest techniques, and opens surprising avenues between geology and food, energy and water security.

Matthew Kirk, assistant professor of geology, studies microorganisms in detail.

"Geomicrobiology was virtually unheard of 30 years ago," Kirk said, "and so we

have only recently begun to appreciate the role that microorganisms play in driving chemistry in geological environments."



Kirk studies aquifers, or permeable underground layers of rock or sediment that are saturated with water. Aquifers are populated with microorganisms that drive reactions and affect water quality, and he works to understand the influences on microbes.

"Understanding environmental controls on microbial populations helps us understand how microbial reactions are distributed and how they affect water resources. We can also use the 'control knobs' on microbial populations to adjust quality in both natural and engineered systems," Kirk said.

Like us, many microorganisms eat organic matter and essentially breathe oxygen, but they can eat and breathe many other compounds as well. When they eat and breathe these compounds in aquifers, it changes the chemistry of the water. Microbes that breathe iron and sulfate can make pyrite particles, or fool's gold, for instance, or release trace elements like arsenic. Instead of looking at specific contaminants, Kirk said an overall understanding of the microbial community may lead to better and less expensive ways of enhancing water quality.

"You may be able to do something simple to perturb the microbial community in such a way that a contaminant is removed from the water," he said.





Saugata Datta, associate professor of geology, helps Kirk determine how microbial populations release sediments in water and conducts other water-related research. He looks for toxic trace elements such as arsenic and heavy metals such Saugata Datta as tungsten in drinking waters around the world. Water is essential for everyone and needs to be protected, so his collaborations with U.S. and international colleagues explore how water is affected in places such as Bangladesh, India, Argentina, Tanzania and Cambodia. Another project explores plant uptake of heavy metals and assesses effects on the food supply. In the Mississippi Delta, for example, sediment contains arsenic because pesticides used for ages in cotton-growing regions contained the poison.

"The problem doesn't really happen if the arsenic is retained in the soil, but when it gets mobilized and goes into the water., then it goes into the plants because you're irrigating the lands with the same contaminated water," Datta said.

What happens when we boil the rice grown in this area? How much arsenic does the grain absorb, and how much does it pass on to us? Datta is measuring arsenic uptake with the latest synchrotron radiation techniques and using facilities in national laboratories across the U.S.

Datta's work on what contaminants do to humans is an emerging and highly interdisciplinary field known as medical geology. He notes that 80 to 85 percent of the



Matthew Kirk







problems are from natural rather than human-caused pollution. Fluorides in water are another example, as is manganese, which can cause symptoms that resemble Parkinson's disease. The World Health Organization currently has no maximum contaminant level, or MCL, for manganese in water, but Datta advocates stipulating a safe limit. Datta is working with atmospheric scientists to combine findings with soil science and hydrology to understand the risks of manganese and how to keep people safe.

Contaminants aren't limited to water, and neither is Dat ta's research. He also considers the dangers of inhaling atmospheric particles that contain fractions of metals. "Metals have three possible primary pathways in the environment: water, soil and air," Datta said. Both the National Science Foundation and the U.S. Environmental Protection Agency support his work.

Geoscience researchers are well positioned to help solve pressing problems, Datta said.

"I'm in a field that can work with many other fields," he said. "Think of the earth where you are living - so many different interrelated processes are going on around you. How are you going to offer a solution? You can gain that knowledge from geosciences."

"I have water and food security in my heart," Datta said. "Nothing can be bigger than that right now."



The future of energy extraction

As Kansas State University researchers apply their work in fields outside the conventional boundaries of geology, they also work to see traditional areas through the lens of new discoveries. One such field is the extraction of fossil fuels, where Kirk's research into microbial populations may have huge implications.

Microbes are instrumental in the formation of natural gas. Because natural gas is the cleanest fossil fuel and is inexpensive, it's overtaking coal as our main source of electricity. Kirk is exploring the Cherokee Basin in southeast Kansas, where relatively shallow coal beds are helping him study how microbes make methane, the main constituent of natural gas. If we understand how to stimulate naturally occurring microbes so they make more methane, we could convert crude oil in depleted oil reserves — which still contain as much as 60 percent of their oil but can't be pumped — into recoverable fuel.

Research into microbial activities in water and fossil fuels are both important to Kansas.

"What's agriculture going to look like in Kansas in 20 years when the High Plains Aquifer is getting closer and closer to the end of its useful lifetime? It's a huge factor in where we go economically," Kirk said.

Kirk believes his research could help the declining oil and gas industry in Kansas, too. Microbial methanogenesis may be the future of energy extraction from subsurface hydrocarbon reservoirs.

"You could move into those depleted oil reservoirs and continue to extract energy," he said.



DETECT AND DEFEAT

By Pat Melgares

Kansas State University researchers take aim at deadly swine diseases

Late in 2015, scientists at Kansas State University and the University of Missouri delivered news that likely had swine producers worldwide rejoicing: The researchers had developed pigs that are resistant to porcine reproductive and respiratory syndrome, the most devastating disease in the industry.

Known as PRRS, the disease has wreaked havoc on swine operations to the tune of \$10 billion over the last 20 years. It is estimated that the disease robs the swine industry of \$600 million each year.

So pardon Raymond "Bob" Rowland if the universities' discovery seemed surreal. The professor of diagnostic medicine and pathobiology at Kansas State University has studied this disease for more than 20 years, nearly his entire professional career.

"I always thought that it would be a generational problem," Rowland said. "That is, it wouldn't be solved by me, but probably by the next generation of scientists."

Resistant pigs are 'game changer'

It took Randall Prather, a professor of animal science at the University of Missouri, 10 years to genetically engineer pigs so that they would lack a critical protein that seemed to make the pigs susceptible to PRRS. Staff in Kansas State University's Large Animal Research Center challenged the pigs in a research setting with the PRRS virus.

"Our first experiment was with the CD 169 protein, but it turned out that was not the molecule," Rowland said. "We moved on to CD 163 and we found almost immediately that it not only was the right target, it was black and white. When we saw the data, it was very clear that we had the desired result."

The scientists may be able to apply the same concepts to other diseases, Rowland said. At Kansas State University's Biosecurity Research Institute and the Department of Homeland Security's National Bio and Agro-defense facility, which is under construction adjacent to campus, Rowland sees numerous opportunities to continue research that benefits animal well-being, supports industry and helps meet the global demand for animal protein.

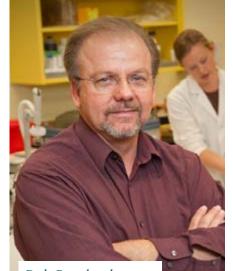
"It's a unique way of tackling viral disease. It is truly a game changer."

University relentless in solving PRRS

It shouldn't come as much of a surprise that Kansas State University researchers were part of the breakthrough on PRRS. In terms of a commitment to research of that disease, "we own PRRS," said Rowland. "There are a lot of groups in the U.S. doing research in this area, but for "IT'S A UNIQUE WAY OF TACKLING VIRAL DISEASE. IT IS TRULY A GAME CHANGER."

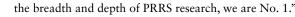
Raymond "Bob" Rowland





Bob Rowland





Rowland said the university has been relentless

in addressing PRRS, using its resources in diagnostics, genetics and biotechnology, vaccines, economics, education and outreach, biosecurity, epidemiology and ecology, and disease modeling to help swine producers in the U.S. and worldwide.

For instance, Jianfa Bai, an associate professor in the Kansas State University Veterinary Diagnostic Laboratory, has managed a team that analyzed gene sequences for more than 250 strains of PRRS over the last 10 years.

"It's very practical research that helps people to make management decisions in the field," Bai said, noting that the information his team is able to provide also helps scientists with their research.

Ying Fang, an associate professor of molecular virology, develops and tests vaccines against the PRRS virus. She is also working to develop vaccines against other high-risk viruses, such as swine influenza, African swine fever and Senecavirus A.

Fang has studied PRRS since 1998, and is considered one of the world's top experts on the disease. In 2015, she was named chair of the 2017 International Nidovirus Symposium, which will be in Kansas City.

Rowland, too, is recognized as one of the country's foremost experts on PRRS. Since 2010, he has been the executive director of the PRRS International Symposium, which draws scientists from around the world to learn the most updated information on the disease.

In 2008, the U.S. Department of Agriculture selected Rowland as project leader of the multistate PRRS coordinated agricultural project. The project was funded for \$4.8 million, and set the stage for some of the early genetics work.

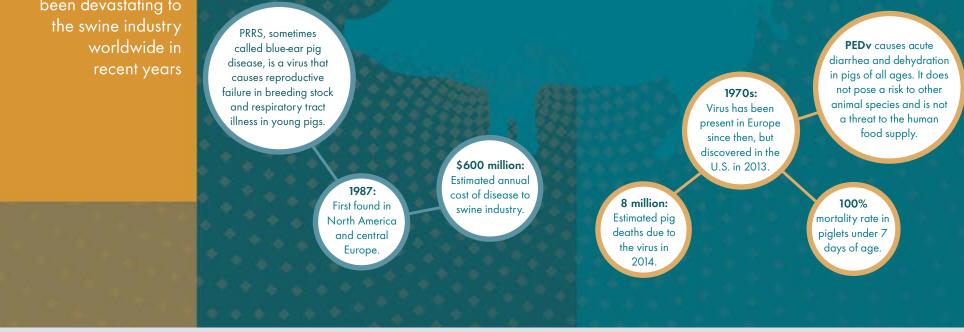
In a state known for beef, pig research thrives

In Kansas, cattle and calves dominate agricultural production. That industry is booming, with an estimated 6 million head and \$8 billion in



Fast facts

A look at two diseases that have been devastating to the swine industry worldwide in



cash receipts each year.

But even in that environment, Kansas State University has stamped itself as a leader in the U.S. swine industry.

Recently, a university swine nutrition team announced that they are making steady progress in developing improved diets for pigs, a science so exact that even a 1 percent improvement in feeding efficiency can translate into \$100 million of added profit to the industry.

"Our first goal is to save feed and thus reduce costs for producers, which ultimately reduces the cost of pork to consumers," said Mike Tokach, university distinguished professor of animal sciences and industry. "The other very important part of our research is the environmental side. Anything we do to improve feed efficiency reduces the output of nitrogen and phosphorus from that farm."

The \$5 million project is funded through 2017 by the National Institute of Food and Agriculture.

In another project, Kansas State University researchers are hoping to take down a deadly virus that is said to have a 100 percent mortality rate in piglets under 7 days old.

PRRS

Porcine Reproductive and Respiratory Syndrome

PEDv Porcine Epidemic Diarrhea Virus

European farmers have dealt with the porcine epidemic diarrhea virus, or PEDv, since the 1970s, but it wasn't until 2013 that the costly disease was discovered in a U.S. herd. Some estimates indicate that 8 million pigs died due to the virus in 2014.

"We have established that feed and feed ingredients may act as a vehicle to transfer the virus," said Kansas State University's Jason Woodworth, an associate professor of animal sciences and industry. "This is extremely important because feed and ingredients are not normally considered a vector in transmitting diseases."

In the university's Veterinary Diagnostics Laboratory, Benjamin Hause, an assistant professor, led a research team that identified a new pestivirus that killed pigs in North Carolina. In pigs, the virus is similar to Parkinson' disease in humans.

In early 2016, Hause's lab also reported the first formal identification and characterization of porcine parainfluenza virus 1 from U.S. pigs, which had previously only been detected in Asia. This work will help lead to vaccines.

"This virus does not typically cause severe disease, but it's the kind of disease that causes an infected pig to fall behind," Hause said. "A pig will get a mild cold, won't eat as well, wean as fast or take off like its litter mates, so there is likely economic significance with the disease."

Research benefits people, animals

Rowland said that beyond such major projects as discovering pigs resistant to PRRS, Kansas State University is supporting swine research that is for the common good.

"As researchers, we are free to pursue the problems that we want to pursue, the problems that will do the most good," he said. "It's not just studying a virus, it's a philosophy.

"To do swine work in a cow state is remarkable," he said. "Kansas State University has allowed us to do this work, and I think what that reflects is that the university chooses to pursue excellence, regardless of area, as opposed to doing research only in targeted areas."



What's in a name?

For some, it symbolizes tradition and valuing previous generations. To others, it's a vanguard statement or trendy distinction. Of course, if you consider William Shakespeare's "Romeo and Juliet," a moniker means reputation, which to the star-crossed lovers was both important and inconsequential at the same time.



By Julee Cobb

The name of Kansas State University's campus in Salina has, for 50 years, signified change. Since its establishment in 1965, the property has been given four different titles, and just this past October, transformed again. But what sets this recent identity shift apart from the others is its substance — there is more, a lot more, than what meets the eye.

Kansas State University Salina is now known as Kansas State University Polytechnic Campus — an idea that came about two years ago when university officials were planning for the future. Several committees were formed to discuss, research and develop concepts that could exhibit the campus's unique and somewhat exclusive educational style in a way to give it a much-needed niche and help with national growth.

When examining what the campus is at its core and the type of learning environment provided to students, there was an undeniable consensus that the word "polytechnic" encompasses the campus mission. A polytechnic education is synonymous with hands-on, interdisciplinary and applied learning, focusing on professional programs that prepare students to move directly into their chosen career field. From the beginning days of Schilling Institute through Kansas Technical Institute, Kansas College of Technology, K-State Salina and now, the campus on Centennial Road has always offered that kind of immersive experience and it's precisely the direction in which current Dean and CEO Verna Fitzsimmons wants to keep moving.

"Since its inception 50 years ago, the campus has consistently provided an educational climate that integrates theory with experience through project-based work, research opportunities and connections to industry," Fitzsimmons said. "We are ready to take that tradition into the next 50 years, and identifying ourselves as a polytechnic campus perfectly represents who we are and the experience our future students will have here."

During the investigatory phase of how to best position

Hello! My name is...

KANSAS STATE POLYTECHNIC

A new name, yes; however, the transformation taking place on Kansas State University's freshly minted polytechnic

ampus is less about the label itself and more about what it represents

the Salina campus for success, the committees examined a variety of variables: the high school population within the state of Kansas; magnet schools across the country that are hubs for aviation and engineering technology; and the distinctiveness or comparability of its programs against other universities. That information confirmed an imminent need to engage students on a national level, which involved creating a way to market the campus not for its location but its for signature education.

"The Salina community has always lent its loyal support to our cause and we are thankful for how the city has invested in the growth and change of the campus," Fitzsimmons said. "We are at a juncture, though, where we have to demonstrate our uniqueness within the K-State system as well as what makes us different from other institutions with similar programs of study. In order to be competitive, we must show how our students learn, not where they learn."

The idea of changing the campus name to demonstrate a polytechnic identity was then presented to faculty and staff at large, advisory board members and campus industry partners. The transformation was gauged with students and alumni, and even counselors and admissions representatives at state community colleges were asked to weigh in. When explained the reasoning behind the proposed change, it was evident that becoming "polytechnic" is a step in the right direction.

The decision to transform from K-State Salina to Kansas State Polytechnic was first approved at a Kansas Board of Regents meeting in September 2015 by the Council of Chief Academic Officers. A month later, the proposal went before the Council of Presidents and the Kansas Board of Regents where it passed and went into effect immediately.

Polytechnic in motion

From curriculum overhauls to newly acquired research



projects and special opportunities with industry experts, Kansas State Polytechnic is working to give its students an even better innovative and fully engaged education. The new campus motto, "The experience matters," reflects how the polytechnic way of learning is more than memorizing theory and listening to lectures in a classroom.

In the engineering technology department, computer systems technology faculty members have completely revamped their program: what students study and when, and how they work with one another and outside companies. The curriculum change puts more responsibility on the students — still providing them with the muchneeded foundation in technology, but also giving students an expanded opportunity to apply what they've learned to present trends.

"Things are always evolving in this industry, and while it's virtually impossible to anticipate, we can quickly adapt to these changes because our reorganized curriculum structure is set up in a way to make students prepared and relevant," said Troy Harding, computer systems technology professor.

Starting in fall 2016, students are required to enroll each semester in studio classes where they will work in







a group on projects related to a local company's need. For freshmen and sophomores, the studio time is worth one credit hour, while it equals out to six credit hours for juniors and seniors. The idea is to introduce the younger undergrads to applicable learning and communication skills early so they can build upon their experience every year. These studio classes also integrate knowledge from other electives such as management, business, math and speech.

In the unmanned aircraft systems program, students illustrate polytechnic education through building their own drone and integrating components on it such as a control link, receiver and autopilot. Students master mission-planning software and fly unmanned systems in the field, all while troubleshooting the process.

Also provided are ample opportunities for UAS students to engage in professional research projects in the mapping and surveying, agriculture, energy inspection and airworthiness certification fields. Kansas State Polytechnic's ambitious UAS program is collaborating with entities such as the Bureau of Land Management, Federal Aviation Administration and Westar Energy to integrate unmanned technology into commercial applications and help develop standards for the future of unmanned flying.

"Anyone can purchase an unmanned aircraft and fly it, but that's not what industry needs," said Andi Meyer, UAS research program manager and senior researh engineer. "Our UAS students know how to fly safely and collect quality data that clients need for a variety of applications. That means selecting the right aircraft with the right camera and gimbal, flying it at the right altitude and speed and then taking the gathered data and putting it into a model that provides the right information."

The idea of a hands-on education isn't lost on Trevor Witt, a junior in UAS. As a student employee in the UAS lab, Witt has worked side by side with faculty and staff acquiring various approvals and exemptions from the FAA for the program as well as processing and analyzing data from research projects. Witt's experience on campus even has encouraged him to start his own business offering low altitude aerial photography and external test piloting.

"My favorite part of the polytechnic education is connecting the dots — when you go from an idea or a theory to seeing it in motion, actually working," Witt said. "Employers are looking for experience, and this counts." Kurt Carraway, acting UAS program manager, couldn't be more proud of Witt and all of the students in the inno vative field. He says potential employers pick up on their determined spirit.

"Our students are eager to learn — and that attitude

becomes infectious," Carraway said. "They want to gain a perspective that isn't typically achieved outside of the classroom, and this translates into marketable experience."

Elsewhere around the polytechnic campus, professors are ensuring the connection between the classroom and a career is always being made. In the airport management program, students have been

united with a variety of aviation professionals from across the state, engaging in everything from airport rescue firefighter training to land development and architectural design. In the digital media program, students are tasked with leaving behind the traditional term paper to use editing and producing skills on a visual project. And in mechanical engineering technology, students are divided into design teams to create an actual product or solve an actual problem for a local company.

Polytechnic on the horizon

About a week after the Kansas Board of Regents approved the Salina campus's request to transition into the polytechnic campus, a celebration was held for all

> students, faculty and staff. The event commemorated a significant turning point in the campus's history and served as a kickoff for an exciting new era.

In December 2015, an executive director of enrollment management was hired to advance the polytechnic brand and implement a national recruiting strategy. Campus committees continue to facilitate details of establishing the

School of Integrated Studies. And assisting the university as a whole to become a Top 50 public research institution by the year 2025 remains a priority.

"I know there has been a lot of change on this campus over the years, however, we believe the polytechnic name will stand the test of time," Fitzsimmons said. "The name truly represents who we are — our offerings, our expertise and the experience. And in the end, for students, that's what it's all about.



"Anyone can purchase an unmanned aircraft and fly it, but that's not what industry needs." – Andi Meyer

See Faculty Focus

The Art of Curating

Elizabeth Seaton, curator at the Marianna Kistler Beach Museum of Art, brings a variety of art to the K-State campus

By Taylor Manges

Prints, ceramics and textiles in the Marianna Kistler Beach Museum of Art's "Art for Every Home: Associated American Artists" exhibition at Kansas State University can take one back in time.

"The exhibition spans much of the 20th century, and people seem to enjoy entering the '50s, the war era or the Great Depression through the art. They get very nostalgic," said Elizabeth Seaton, lead curator of the exhibition.

The American Associated Artists, or AAA, established in New York in 1934, sought to bring art over the threshold of an economically and regionally diverse group of Americans, according to Seaton. The business published prints by regionalist artists Thomas Hart Benton, John Steuart Curry and Grant Wood that were sold by mail-order catalog. AAA artists also made ceramics, textile designs and paintings for corporate advertising.

For seven years, Seaton worked with a team of scholars across the country to research AAA and choose works for display in the exhibit. Prints from Kansas State University's art collection join objects from more than 25 museums and private collections.

"It was a process of selecting works that were historically important and visually compelling to help others understand the richness of the material," Seaton said.

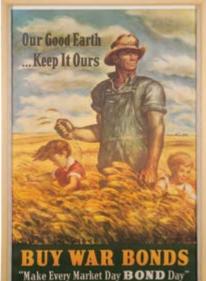
Organizing an exhibit of 136 works was no easy task, but it was one Seaton was eager to take on with Beach Museum of Art staff.

"If you're going to do it right, it's going to be a longterm project," Seaton said. "I'm the type of person who doesn't mind spending hours in an archive, digging into an artist's files."

Seaton said technology has changed the way she and other art historians research for exhibits, especially for large undertakings like "Art for Every Home."

"We couldn't have produced the exhibition without the Internet," Seaton said. "A relative of an artist might have

created a website and I



"Our Good Earth...Keep It Ours" 1942- John Steuart Curry Associated American Artists and its stable of artists worked with the U.S. government and private companies to create imagery in support of the war effort during World War II.

could contact him for further leads. We could review the art collections at other museums before traveling to them. Quite a bit of the material in the exhibition was discovered on the Internet art market."

Seaton, from Winfield, Kansas, received her undergraduate degree from Harvard University and a doctorate in American art from Northwestern University. She returned to Kansas and joined the Beach Museum of Art in 2003, becoming curator in 2013.

"I was so happy to bring my training back to Kansas; to study the work in my own backyard," Seaton said.

"Art for Every Home: Associated American Artists" concluded at the Beach Museum of Art

Jan. 31. It moves on to New York University's Grey Art Gallery, April 19-July 9, and Syracuse University Art Galleries in New York State, Jan. 12-March 26, 2017. A major catalog for the exhibition is distributed by Yale University Press.



K-State professor of English Don Hedrick shares his passion for Shakespeare with students

Often, the first question Kansas State University professor Don Hedrick is asked is, "Which of Shakespeare's plays is your favorite?"

"My favorite play is whichever the play one of my students — even after we've analyzed it to pieces — has just fallen in love with," is Hedrick's response.

As a professor of English, he has shared his passion for Shakespeare, drama and theater with countless students since joining the university in 1976.

He loves that his passion has extended to future teachers and then to their own students, making Shakespeare their own rather than elite culture, and to helping them discover what's hilarious, moving, bawdy and profound in the works.

"What a delight to find that I'm now myself learning from former students who have themselves become Shakespeare scholars," Hedrick said.

In February, Hedrick served as the university's project director for "First Folio! The Book that Gave Us Shakespeare," a national traveling exhibition of one of 233 original copies of the Shakespeare First Folio.

See Faculty Focus



"Half of Shakespeare's plays would have been lost except for the printing of this book, an original copy of which sold recently for \$6 million," Hedrick said. "But more importantly, it was just voted by publishers as one of the five most important printed books in world history."

The nearly 400-year-old book's visit was part of "Shakespeare in the Little Apple," a monthlong celebration of Shakespeare-related events in Manhattan, Kansas. Hedrick said experiencing the folio with his students, colleagues and Manhattanites alike was a joy from the "afterlife" of Shakespeare. The celebration featured Shakespeare's work through performances, readings, musical adaptations, children's activities and more.

"Shakespeare in the Little Apple' was the most exciting, wide-ranging and popular humanities event across campus and the community in decades that led to tripled attendance at the Beach Museum of Art, where the First Folio was displayed."

Raised in Topeka, Kansas, Hedrick received his undergraduate degree from the University of Kansas in English and German, his doctorate from Cornell Uni-

versity and his passion for Shakespeare from both.

He was the founding director of the English department's cultural studies program and teaches courses in language, film and horror film, popular culture and gender. Hedrick also studies the history of the entertainment industry of London.

"My research focuses on the political economy of the first entertainment industry and seeing the part Shakespeare's theater played among the enormous variety of entertainments available in London," Hedrick said.

Hedrick has held visiting professorships at noted institutions across the country - Cornell University, Amherst College, Colgate University and the University of California, Irvine, and was a Fulbright Scholar at Charles University in Prague but said his heart is in his home state of Kansas with his students at Kansas State University.

He publishes widely in top journals in fields of Shakespeare, cultural theory and the arts, and his list of many accomplishments includes directing Shakespeare's "The Winter's Tale" for the Manhattan Arts Center.



See Undergraduate Research

A CULTURE FOR RESEARCH

K-State students initiate study of how TAOS PUEBLO NATIVE AMERICANS ARE SAVING AN ANCIENT CULTURE



Young Taos Pueblo partygoers cheered as water flowed through an acequia, a 500-year-old irrigation system, to a field planted with heritage seeds.

Among guests at the irrigation party — where people work to clean out the irrigation ditches and enjoy food, music and companionship — were two Kansas State University anthropology students, Jordan Thomas and Kenzie Wade. The students, both seniors and involved in undergraduate research at Kansas State University, are interested in how the Taos Pueblo Native Americans in New Mexico are able to attract youth to traditional agriculture and save an ancient culture.

"This is the perfect place to do fieldwork on the sustainability and importance of native preservation," Wade said, "because this group is taking charge of its sovereignty and growing something amazing with the youth."

The majority of the partygoers in their early 20s already own farmland — a vast difference from the lifestyle Thomas and Wade have experienced. The fields were planted with Taos heritage seeds: varieties of corn, beans or squash not found anywhere else and passed down for generations.

For more than 1,000 years, the Taos people have inhabited the Pueblo, a multilevel adobe structure and a cultural site on UNESCO's World Heritage list. Many of their deeply rooted cultural practices involve agriculture.

"The Taos Pueblo have been farming the land for more than a thousand years, which has shaped their culture, religion and language," Thomas said. "When colonization happened and money came in, things started to change. For two generations, it became backward to grow your own food or speak your own language, and they saw a lot of people leaving the community or abandoning the culture." Oppression and cultural abandonment drove younger generations away, according to Wade. Without the next generation, some feared the ancient culture, which had survived colonization, oppression and introduction of disease, might be lost.

"Multiple organizations tried to help the community get on its feet and be sustainable, but it wasn't working," Wade said. "The organizations would lose interest or the funding would run dry because they didn't take into account what people wanted."

Today's Taos Pueblo youth understand the community's heritage. They started the Taos Pueblo Young Growers to engage the next generation in ancient agriculture practices and reconnect them to their ancestors.

"In Taos, there's a resurgence of pride for growing with the more traditional methods," Thomas said. "We saw kids out there working with their grandmothers, planting corn and telling stories. The youth were attending the traditional ceremonies, speaking the language and taking pride in it."

With assistance from the Taos County Economic Development Corporation and Red Willow Cooperative, the youth are learning to preserve and strengthen the culture while making their traditions cost-effective.

"Food systems can improve health, heritage and community cohesion but for those to happen, it has to be economically viable," Thomas said. "It's not possible to isolate yourself from the rest of the world, so they had to adapt."



The community has solar-heated greenhouses; an FDA-approved kitchen so growers can turn their produce into value-added products, such as salsa or jam; and a farmer's market.

"Some people have taken their products to the regional scale," Thomas said. "They can keep the same agricultural traditions while still having the channel to the economy."

Thomas and Wade are working on a short documentary, "Cultivating Culture," that is a cursory view of the oppression, traditions and culture of the Taos Pueblo people and how the community has been able to sustain itself in recent years.

"I feel like I'm on to something that really hasn't been explored much in academia — how agriculture can correlate to indigenous language and culture maintenance," Thomas said.

The trip to Taos was funded through a few scholarships provided by K-State's anthropology program and an internship with the Taos County Economic Development Corporation. To save money the two students camped in a national forest outside the Taos Pueblo reserve and used a weed sprayer as a makeshift shower.

"Jordan and Kenzie have a deep faith in humanity that is present in their every move," said Michael Wesch, K-State associate professor of anthropology and adviser to Thomas and Wade. "They want nothing more than to immerse themselves in this other life and find its richness. They accept others as they are so everywhere they go they make friends with strangers." Thomas and Wade will use their work in Taos as a starting point for further investigation of the benefits of food systems and are writing a research article to the documentary as a more in-depth account of Taos Pueblo community.



See Research Scholar

Seeking the bést and brightest By Beth Bohn

New scholarship program provides competitive advantage

Enhancing the graduate scholarly experience is a key goal of Kansas State University's plan to become a Top 50 public research university by 2025. One way the university is working to meet this goal is by becoming more competitive when it comes to attracting highly talented, diverse graduate students.

Scholarships, increased travel support to present research at national and international conferences, and more professional development opportunities are all factors that Carol Shanklin, dean of the Graduate School, says played a role in the school's enrollment increase this year, particularly in doctoral students.

One of the competitive advantages the university began offering this school year is the Presidential Doctoral Scholarship Program, which was established through funding allocated by Kirk Schulz, university president. It's designed to bring top doctoral students to Kansas State University who will conduct interdisciplinary research, particularly in water resources/water quality; energy; food and feed safety; infectious diseases-select agents; nonmaterial and supramolecular synthe-

sis; genomics/lipidomics/proteomics; and global food systems.

"Interest in the scholarship has been strong and we expect it to get stronger,"

Shanklin said. "It has made a difference in recruiting outstanding doctoral students. The increased travel support from the offices of the president and provost also has had a positive impact."

Seven students received the \$7,500 Presidential Doctoral Scholarship for the 2015-2016 school year; it is renewable for a second year if the student meets certain program requirements.

The doctoral scholarship program complements the university's Timothy R. Donoghue Graduate Scholarship Program, which provides scholarships of \$3,000 to master's students and \$5,000 to doctoral students.

Matthew Harder, doctoral student in biology, attended a biology undergraduate research experience at Kansas State University the summer before applying to graduate school. It sold him on the university; getting the scholarship sealed the deal. "At the summer Research Experience for Undergraduates, I had an amazing experience working with Dr. Michael Veeman," said Harder, who earned his bachelor's degree from Hope College in Michigan. "That relationship, combined with the opportunity to gain a large amount of teaching experience in the biology program, made K-State a clear first choice to me."

Corey Carpenter, doctoral student in animal science, said receiving the scholarship was pivotal to his decision to attend Kansas State University.

"The university has an internationally respected applied swine nutrition research program," said Carpenter, who has earned degrees from California State University, Chico and Oklahoma State University. "I have been directly involved in the swine industry my entire life. The applied swine nutrition team has given me the opportunity to be trained as a swine researcher and nutritionist by some of the best in the business."

The scholarship is allowing Brittany Drew, doctoral student in physics, to concentrate fully on her studies.

"This scholarship made it possible for me to be able to attend graduate school without having to get a second job," said Drew, who earned her undergraduate degree from Slippery Rock University of Pennsylvania. "Being able to focus completely on my schoolwork was a big opportunity for me."

Innovator, teacher, mentor, friend: Meet Jim Edgar

By Sarah Caldwell Hancock

University distinguished professor James Edgar is no stranger to surprising innovations.

In 2015, he received a patent for a process to improve semiconductors, materials that are crucial to all devices that are computerized or use radio waves — think cellphones and satellite television boxes — by removing defects that can degrade efficiency. Another of his projects is generating ultraviolet light-emitting diodes, or UV LEDs, that can purify water or sterilize instruments with bacteria-destroying UV light. The National Science Foundation has supported his research for almost 25 years, and his work has brought him many publications and international recognition.

But what's most surprising about Edgar, professor and head of Kansas State University's chemical engineering department, is his ability to help others think through problems.

Former student Jason Schmidt puts it this way: "I owe him a lot as a wonderful mentor. Jim cares and sees the potential in everyone."

Peng Lu, another of Edgar's former students, said Edgar changed his life and made him who he is now.

Schmidt and Lu are founders of Nitride Solutions, a Wichita company that makes aluminum nitride, a high-value material with applications in power electronics, acoustic electronics and UV LEDs. The company has 10 employees and boasts customers in Asia and the U.S.

Lu and Schmidt both worked in Edgar's lab for several years in the early 2000s. Lu obtained a doctorate in chemical engineering, and Schmidt graduated from K-State with a degree in electrical engineering before heading to Poland to get a master's in chemical engineering from Warsaw University of Technology and a master's in business administration from a program through Warsaw University in partnership with other European institutions.

Both credit Edgar's mentoring style with giving them the skills they needed to succeed. Schmidt said Edgar always took time to discuss projects with his students.

"He wants to know what you think and why you think it," Schmidt said. "He never said, 'I'm right, do it this way, you don't know what you're talking about.' It's more of a guiding hand. He asks good questions."

Lu said that Edgar is fully committed to his students. "Edgar will try everything he can to help you, to improve you, to mentor you to the best you can be. It shows how nice he is as a human, a professor, as an educator," he said.

Edgar has seen the stature of his research grow. The first project he worked on at K-State was gallium nitride, a semiconductor that is now found in many electronic applications.

"I had envisioned a career where I worked in a small corner on this material, but it turns out the material became very important," Edgar said. "It was used in LEDs and replaced green lamps in traffic lights, and it is



now replacing all general illumination. It's been exciting to follow how it has developed so dramatically over my career."

That growth led Edgar to examine UV LEDs.

"I've gone back to my original model of working on an obscure material in a small corner," he said. "I like that in a certain sense, because if one of these obscure materials takes off, maybe we'll see the cycle start again. Maybe they'll install these UV lamps in every refrigerator in the country to kill bacteria and help food stay fresher longer."

Regardless of whether he helps achieve another breakthrough, Edgar will continue to ask new questions and train students to do the same. He employs five or six students at a time and says he strives to be encouraging, to appreciate their ideas and to aid their intellectual development by giving them a lot of freedom.

"I think research is very important to teaching. It gives you a fresh perspective; you can see what's the next thing and expose students to that," he said. "Research is a good way to teach, too. In the classroom, there's a more definite answer. In research, you explore different facets and you make the decisions. It's a different way of thinking that is more applicable to the world and to general things like persistence and thinking deeply about things."

See Patent Spotlight



Patented laser technology by Kansas State University researchers could be used to transmit information or high optical power through the Earth's atmosphere or to sense harmful agents in the atmosphere.



Researchers develop a first-of-its-kind laser

Consider this now patented discovery in the field of physics an illuminating one.

In 2011, Kristan Corwin and Brian Washburn, associate professors of physics, along with Andrew Jones and Rajesh Kadel, both Kansas State University physics graduates now working as industry research scientists, began developing a new kind of laser — one that is fiberbased and uses various molecular gases to produce light at difficult-to-reach wavelengths.

"Because it's a fiber laser technology, it may ultimately prove to be very portable," Corwin said. "Also, because it's based on a gas-lasing medium, it's inexpensive to produce."

Kansas State University researchers in

collaboration with the University of New Mexico designed the laser technology from a hollow-core photonic crystal fiber that is about half the width of a human hair. This optical fiber is filled with a molecular gas, such as hydrogen cyanide or acetylene. The gas is excited with another laser, causing a molecule of the excited gas to spontaneously emit light. Other molecules in the gas quickly follow suit, resulting in light.

"The technology that led to this is remarkable," Corwin said. "The complex structures in the micro-structured optical fiber we use are micron-sized and uniform down many meters of fiber. By using the hollow fiber, we can have very high intensities of light even with relatively low

powers. This reduces the lasing threshold with respect to free-space traditional systems and makes more portable applications accessible."

This lack of traditional systems makes the lasers a viable candidate for new communications and sensing technologies, Corwin said. Possible uses include transmitting information or high optical power through the Earth's atmosphere as well as sensing harmful agents in the atmosphere.

The laser received U.S. patent No. 9,106,055 in August 2015.

Since its patent, recent breakthroughs in fiber design and fabrication by collaborators in Limoges, France, have made the lasers more efficient in emitting light.

Chromatograph Chro-mato-graph \kro-'ma-tə-'graf, krə-\

How scientists sniff out what's in a smell

Kadri Koppel, assistant professor of food, nutrition, dietetics and health, explains, in under 100 words, what a gas chromatograph is and how researchers at Kansas State University's Sensory Analysis Center use this key piece of equipment.

See Explain It

"In food and other product analysis, understanding the composition of aroma is often important. A gas chromatograph is an analytic instrument that enables measurement of aromatic volatile compounds. In order to measure what the aroma consists of, we need to capture the aroma compounds and inject those in the gas chromatograph's column. The compounds are separated out with a carrier gas pushed through the column. A detector in the end of the column helps us identify the aromatic compounds, thus helping us understand what causes our sample to smell the way it does."



THESE BOOTS WERE MADE FOR ... ENGAGENENT By Stephanie Jacques

Richard Potter, Kansas State University's director of corporate engagement, is kicking the university's collaborative potential into high gear with faculty boot camps.

Potter helped to develop a series of "Working with Industry Boot Camps" in 2015 as part of a collaborative project with the Kansas State University Foundation, the university's Institute for Commercialization and the Office of the Vice President for Research. The workshops, available via video archive on the Office of Corporate Engagement website, provide faculty and staff with tools to establish mutually beneficial industrial collaborations and develop strong strategic partnerships.

"We can play with industry but we need to do it in the right way," Potter said. "In other words, there are ample opportunities to work together with industry that are in sync with our mission as a land-grant institution."

The workshops cover many topics, including why corporate engagement is important, where to find valuable resources, how to initiate and formalize relationships, how faculty can promote themselves and their research, how to manage expectations, how to disclose and protect intellectual property, and tips and tools for meeting contractual obligations.

The university has many areas of expertise that corporations would find very useful, Potter said. The workshops were designed to encourage faculty to consider the potential of future corporate partnerships and build on existing partnerships.

"We bring to the table something that is of great value to industry," Potter said, "including specific strengths related to well-being, human and animal health and nutrition, sensory analysis and grain science — all in tandem with global food systems."

K-State is the only university with a grain science and industry department and, according to Potter, that means significant corporate interest and opportunities are available. The university established the Bulk Solids Innovation Center at the Kansas State Polytechnic Campus in 2015, which is the first center in the nation to study the science of handling bulk solids, such as grain, sugar or minerals. For industries using bulk solids, the center can provide a wealth of knowledge, he said.

The university also is the western anchor of the Kansas City Animal Health Corridor, a concentration of more than 300 animal health companies. According to Potter, the corridor provides numerous opportunities for finding corporate engagement partnerships, such as the PetFood Innovation Workshop. K-State faculty work with industry professionals in conjunction with the annual Petfood Forum in April at the K-State Olathe campus to experiment with different techniques in making pet foods.





Hog heaven

When it comes to swine research, Kansas State University is a national leader. It's a reputation cemented by decades of work, as evidenced in this photo taken in 1934 at the university's ag experiment station. Described as "three pigs looking over fence," the photo came about through a request by Cliff Aubel, associate professor of animal husbandry and swine investigations officer at the ag experiment station. Aubel taught Elements in Animal Husbandry, Swine Production and Animal Breeding. Read more about K-State's many contributions to swine research on Page 24.

Photo courtesy of the Kansas State University archives



105 Anderson Hall Manhattan, KS 66506 Nonprofit Organization U.S. POSTAGE PAID Permit #525 Manhattan, Kan. 66502

Electrified art "Devotee" is one of the prints created by Kansas State University's Jason Scullia, associate professor of art, using a contemporary printmaking method called electrolytic etching. The nontoxic method uses electricity and a saltwater solution rather than harmful chemicals to burn the negative image of a print into copper plates, which are used to transfer ink to the paper. In spring 2016, Scullia will show his electrolytic-created prints in a solo exhibition in Venice, Italy. It will be Venice's first exhibition comprised entirely of prints created through electrolysis.