A wave of natural color

Natural fibers and dyes come together to create the stunning colors of these fabrics, which are made of a linen and rayon blend.

Kansas State University researchers fashioned the vibrant colors of these fabrics using dried cochineal insects, marigold heads, madder plant roots and coreopsis flower heads.

Researchers in the interior design and fashion studies department are making textile production more sustainable by using flowers, plants, nut hulls, sawdust, tree bark, food waste and leaves to naturally dye fibers instead of using synthetic dyes. Typically, natural dyes are used on natural fibers such as wool, silk, rayon, cotton, linen and hemp.

See page 20 to learn more about the natural dyes and other sustainable research across a variety of disciplines.
I am both excited and proud to share this latest issue of Seek magazine with you, highlighting just some of the research, scholarly work and creative activity at Kansas State University. K-State is a leading land-grant university, a public research university with rich history of exceptional teaching, research and service to Kansas and to Kansas. It is through our research and discovery that we make our greatest impact. We create new knowledge and new understanding. We change minds and we change the world. We facilitate learning, discovery and engagement through our research. And we help to shape a future that is more secure and more sustainable.

K-State is also an economic engine for Kansas and has been for generations. With the launch of our Economic Prosperity Plan for Kansas in December 2021, we boldly and intentionally committed to extending our traditional land-grant mission to explicitly include economic development. Research and economic development go hand in hand. Whether basic — fundamental — research or applied research, lab-based or field-based, physical or computational, incremental or transformational, the value of research lies in its impact. Indeed, this is the best destiny of any great research. Impact can take many forms, from extending the state-of-the-art and changing our understanding of the world in which we live, to the creation of new technologies, products and companies.

As always, we highlight research activity across the entire university in Seek magazine. However, in this issue you will also notice references to the different parts of our Economic Prosperity Plan: food and agriculture systems innovation, digital agriculture and advanced analytics, biosecurity and biodefense and K-State 105: Every Town to Gown, which seeks to connect our economic development work to all 105 counties in Kansas.

This issue of Seek includes expansive features on research — being conducted by faculty members and K-State teams that cut across departments and colleges — in sustainability, cybersecurity, digital humanities and our nation’s economy. This issue also includes features describing two of our many important research centers, the Chapman Center for Rural Studies and the Johnson Cancer Research Center. And as always, we feature a graduate scholar and undergraduate scholar and their research.

Finally, we share a recent example of a technology transfer/economic development success story. Please enjoy the beautiful new issue of Seek and thank you for your interest, your engagement and your support of research at K-State. We are proud to be Kansas’ land-grant university, a great public research university, an engine of discovery and economic development and a point of pride for Kansans.

D. Rosowsky, Vice President for Research

See more
Learn more about the Economic Prosperity Plan.
k-state.edu/economic-prosperity
A plan for economic prosperity in Kansas

You can plan on it: Kansas State University has launched a new strategic initiative to help people and businesses in Kansas.

The university’s Economic Prosperity Plan will add thousands of jobs and billions of dollars into the Kansas economy by leveraging K-State’s strengths in four key areas: food and agriculture systems innovation; digital agriculture and advanced analytics; biosecurity and biodefense; and extension and outreach.

“Our Economic Prosperity Plan will allow K-State to create 3,000 new jobs and $3 billion in additional investments into the state of Kansas in the next 10 years,” said David Rosowsky, vice president for research. “This new initiative will allow K-State to truly demonstrate the value that universities provide to local, state and national economies through job growth and economic expansion and contracts.”

Throughout the magazine, look for these icons to learn more about each area.

Seek more
Read more about the Economic Prosperity Plan and to read more about research in each area.

Understanding economic prosperity

Food and agriculture systems innovation

Researchers are working with producers to translate, sustain and adapt food and agriculture research worldwide to create jobs in Kansas and bring billions in national and international investment to the state.

Digital agriculture and advanced analytics

K-State is leading the global food system in creating and embracing leading-edge methods that are driven by data analytics and decision-making in near real time.

Biosecurity and biodefense

University strength in biosecurity and biodefense are making K-State the foremost U.S. resource for private-public research collaboration on pathogens of global significance.

K-State 105: Every Town to Gown

The university is leveraging its statewide K-State Research and Extension presence to assist businesses and communities in all of the state’s 105 counties and to help them access K-State innovation, talent and training through local, targeted and coordinated resources.

A K-State-developed product called CHAMP is used in veterinary classrooms to help students learn how to handle needles and syringes properly.

Researcher develops a model market CHAMP

Vetinary students can now get a leg up on learning clinical skills thanks to a new tool created by Susan Rose, clinical education technician in the Kansas State University College of Veterinary Medicine, and commercialized with help from K-State Innovation Partners.

After recognizing a need for more accurate and robust models for veterinary teaching, one of Rose’s latest models has been transformed into a product called CHAMP. The company specializing in human/anatomical teaching models, produced in collaboration with REMEDY Simulation Group, a Pennsylvania-based company specializing in human/anatomical teaching models. “CHAMP provides an opportunity for many students to learn how to handle needles and syringes properly for the first time,” Rose said. “Additionally, it gives them the opportunity to develop muscle memory and hand skills they need to use traditional syringes and needles, butterfly catheters or vacutainers for obtaining blood samples, or how to insert and secure IV catheters.”

Telling the story of Black westward settlement

A Kansas State University collaborative project is bringing the history of Nicodemus, Kansas, and the Ellis Trail to life through an interactive website.

The project, “The Ellis Trail to Nicodemus: Revealing Stories in the Landscape of Black Westward Settlement,” is one of 208 humanities projects across the country to recently receive prestigious funding from the National Endowment for the Humanities.

La Barbara James Wigfall, associate professor of landscape architecture and regional & community planning, is leading the project, which also includes researchers from the College of Architecture, Planning & Design and the College of Arts and Sciences. K-State collaborators include Kent Krueger-Page, professor of landscape architecture and associate dean; Kristen Epp, associate professor of history; and Erin Wiersma, associate professor of art. The team will work closely with community partners and project consultants Angela Rivas and Robert Alexander, both of the Nicodemus Historical Society.

Nicodemus is the only continuously settled African American town west of the Mississippi River and is a national historic site. The researchers will create an interactive website to describe the Ellis Trail journey that the first Nicodemus settlers took from the train by wagon and on foot to reach their townsite.

Wagon ruts are still visible on the Nicodemus wagon trail in Graham County. (Image credit: Nicodemus Historical Society and Museum)
From plastic sticker to laser printer

Researchers at the Kansas State University Olathe campus are looking at replacing the plastic sticker on fresh produce with a laser-printed QR code onto the food itself. This would reduce environmental waste and improve food traceability.

Scientists in the Postharvest Physiology and Food Safety labs are testing the quality and safety of using a laser-based engraving technology to “print” on apples, cucumbers and green bell peppers. In a matter of seconds, the laser engraves a QR code on the surface of the food. Tests are resolving if this exposed surface area affects produce freshness or is more susceptible to microbial contamination.

“The first step was determining whether a laser that’s made for metal, plastic and wood engraving could also work on fruit and vegetable surfaces,” said Manreet Bhullar, research assistant professor of horticulture and natural resources. “We then need to know whether the QR code stays readable until the end of the product’s shelf life and does not increase the chance of microbial contamination on the etched surface. If we can meet those criteria, we can move forward with the technology on commodities that make sense for it.”

While grocers use price look-up, or PLU, stickers primarily for inventory purposes, the QR codes also could better track produce throughout the food supply chain. The potential to quickly trace contaminated produce, and to lower large-scale disposal of uncontaminated produce during an outbreak mark critical advantages to using QR codes while protecting public health and reducing food loss, researchers said.

Sensory and Consumer Research Center researchers are evaluating the economic feasibility of the technology by looking at consumer acceptability of QR labeled food.

“We can develop a method that’s environmentally sustainable, reduces food loss and addresses the French ban on noncompostable stickers — impacting millions of dollars in U.S. exports,” said Elam Plakon, associate professor of urban food production and postharvest handling. “But if consumers don’t want to buy food with a printed QR code on it, then it’s not viable technology.”

The K-State Global Food Systems seed grant program is funding the project.

Improving vaccine stability

Researchers at Kansas State University are expanding an industry partnership to increase stability in mRNA vaccines — including those against COVID-19 — during transport and storage.

The agreement, coordinated by K-State Innovation Partners, is an exclusive license and option agreement and research collaboration with Tonix Pharmaceuticals.

Through the partnership, researchers will develop zinc nanoparticle, or ZNP, mRNA vaccines that replace the lipid nanoparticle, or LNP, technology in current COVID-19 vaccines.

“The LNP technology of current mRNA COVID-19 vaccines limits our ability to deploy these vaccines in many parts of the world,” said Robert DeLong, associate professor at the Nanotechnology Innovation Center of Kansas State. “The technology we have developed uses zinc to replace LNPs and results in more temperature stable mRNA vaccines.”

Developing new treatment options

Progress continues on a potential COVID-19 treatment based on a series of protease inhibitors developed, patented and licensed by Kansas State University.

Kyeong-Ok “KC” Chang and Yunjeong Kim, both virologists in the College of Veterinary Medicine, developed the protease inhibitors, which can help fight against coronaviruses, including SARS-CoV-2, the virus that causes COVID-19. The work is a collaboration with William Gorenstein at Wichita State University and Stanley Perlman at the University of Iowa.

Cocrystal Pharma Inc., a clinical-stage biotechnology company, is advancing their intranasal lead antiviral candidate, based on technology licensed by K-State Innovation Partners, with plans to begin phase 1 clinical trials in 2022.

Photos above: Durga Khadka, master’s student in horticulture and natural resources, uses a laptop to create QR codes that are then etched onto fresh produce with a standing laser. Scanning the QR code with a phone displays information about when the produce was etched. Other photos show the laser-made QR code on cucumbers, red apples and green bell peppers.
What happened?

Flip the calendar back to March 2020. Economic activity went to zero and the country experienced a shutdown. Unemployment rose and people stayed home and didn’t go about their normal routine of buying things. To try and rebound the economy, the Federal Reserve issued several rounds of stimulus checks.

“The economic decisions that we saw in March 2020 were driven completely by the fact that we were shut down,” said Eric Higgins, research director and the von Waaden Chair of Investment Management in the College of Business Administration. “Once the country opened back up, those issues began to go away and the economy came back.”

Fast forward two-plus years. Every day we hear about inflation, unemployment and the volatile market. The economy is experiencing an increased labor shortage because of retirements or decisions not to return to the workforce, Higgins said.

But Higgins wanted to know: Is the economy really bad or are we still experiencing the aftereffects of March 2020?

Higgins and several collaborators tried to find the answers by analyzing and comparing 2020 to the 2008 Great Recession. Their research shows that 2020 was not a repeat recession, but was the result of financial issues and decisions directly correlated to the pandemic. As businesses began to reopen and people left their homes, we began to see increased growth and demand for products.

“If there is a shortage of labor and people want to purchase things, that means the price of labor is going to go up and the price of stuff is going to go up,” Higgins said. “The economy isn’t bad. I think the economy has rebounded, but it hasn’t rebounded in terms of what the new normal looks like and that might take a while.”

The economy is a broad term that is all encompassing. Basically, the economy is a result of what every person produces and consumes. It is a factor in having a job and how much goods cost. To have a growing economy, society needs a strong and sustainable overall growth rate, but when growth is not sustained, it creates uncertainty.

Kansas State University researchers say the economy’s struggle to rebounds goes back to a chain reaction that involves the workforce, inflation and supply and demand. It’s a volatile cycle that has been felt across the 105 counties of Kansas and throughout the country and world.

Resilient. Adaptable. Unpredictable. Economists have used many of these words to describe the state of the economy since the COVID-19 pandemic began more than two years ago. The economy has faced countless hurdles, and no one knows what — or if — it will return to normal.

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ANALYZING THE EVER-CHANGING ECONOMY

By Courtney Roszak-Moore

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The role of inflation

Consumers are feeling part of the normal world when they buy goods and services and see increased price tags, driven by the highest level of inflation in decades. Daniel Kuester, director of economics undergraduate studies in the College of Arts and Sciences, has taught courses on the principles of microeconomics and economic theory for a variety of reasons. One of those reasons, according to Thomas Kelemen, assistant professor of management in the College of Business Administration, is job design.

“Job design is how organizations construct an employee’s position, which includes their peers, co-workers, the tasks they are assigned, the physical space and the emotional space that they’re working in,” Kuester said.

It’s a pretty broad term and it kind of encompasses all aspects of how the organization creates the job for employees.

The COVID-19 pandemic changed the layout of the job force—it taught employees flexibility and their employers could be productive from home. Kelemen’s own research shows that organizations must look at how to design jobs so that potential employees want to work for them. As organizations start to make changes, it can cause a domino effect in industries.

“I think organizations are going to have to look at lots of different things—and how we attract employees or what is attractive to employees,” Kuester said. “And we said the Great Resignation, so now, what might be coming in the Great Hiring. People are likely going to come back to work. The question is what have organizations learned and are they going to apply that knowledge to ensure the organization better match what employees want?”


Tracking inflation

The consumer price index measures the change in prices for goods and services. The graph shows how the average price of goods has changed during the past 10 years for urban consumers in the U.S. By comparing the percentage change in goods and services year to year, the Bureau of Labor Statistics is able to determine the inflation rate.

The areas shaded in green indicate periods of recession.

Out of the office

The Great Resignation is an ongoing phenomenon where employees have been leaving their jobs during the pandemic for a variety of reasons. One of those reasons, according to Thomas Kelemen, assistant professor of management in the College of Business Administration, is job design.

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“Today, people are aware of inflation, and once people become aware of it, they think about it, they start to transact it in their hands and it starts driving self-sustaining inflation,” Kuester said.

Inflation looks at the rate of change in the overall price level on an annual basis. The price of an item can increase or decrease depending on several components, including supply chain factors, the response to global pandemics and monetary policy, among other factors, Kuester said.

“If you have the same worker, price is being produced and you double the money supply and nothing else changes, prices will eventually double,” Kuester said.

Tracking inflation

The overall increase in the price level on an annual basis. The Bureau of Labor Statistics collects several different measurements of inflation every month, but the one that’s most often cited is the consumer price index.

Great Resignation

An ongoing phenomenon of employees quitting their jobs during the COVID-19 pandemic for a variety of reasons.

Job design

How organizations create a job that includes aspects such as the supervisor, co-workers, the assigned tasks, the workplace location and an employee’s title.

Supply chain

The relationship between supply and demand. It’s the process of how a product goes from an idea to a good that is purchased.

Decisions, decisions

The economic inflation and resignations all connect to supply and demand. The relationship between supply and demand is described with an all-too-familiar term: supply chain.

Ashesh Kumar Sinha, assistant professor of industrial and manufacturing systems engineering in the Carl R. Ice College of Engineering, researches the supply chain in manufacturing and transportation—one of the hardest hit industries experiencing labor shortages. Sinha has been studying how the job designs of truck drivers play a part in the supply chain.

“If a single driver quits, disruptions occur to the entire network, not just in one area,” Sinha said. “Today, drivers are quitting because of the demands of being on the road all the time. To help with this issue, the logistics and planners need to find a way that the drivers won’t be away from home as much.”

Sinha is partnering with the grain science and industry department in the College of Agriculture on a U.S. Department of Agriculture grant focusing on the supply chain. From 2017-2020 he collaborated with Schneider National, a logistics firm, to research different ways to improve current operations. Sinha has been studying how the job designs of truck drivers play a part in the supply chain.

“The public health supply chain differs from consumer chains because it integrates emergency and decision-making increases complexity. Ashesh Sinha and this provides an opportunity for researchers to address these factors in their modeling. Insights from the models can help build more robust, resilient systems to ensure communities have enough supply to meet demand.

“It is really looking at what are all of these scenarios and what capabilities do we need to build,” said Heier Stamm, a George and Wrenn Kenneth Corbette teaching scholar and a Steve Hsu Keystone research scholar. “In reality, we can talk about preparedness all day, but until we build some of these practices into the everyday operations of our systems they won’t work, which is a big risk.”

Heier Stamm is partnering with the Kansas Department of Health and Environment Preparedness Program, which focuses on supply chain topics such as improving disaster preparedness and a National Science Foundation project on the impact of the public health supply chain contributions on the effectiveness of disaster preparedness.

Thomas Kelemen, assistant professor of management, studies how job design influences an organization’s retention rate.

Ashesh Kumar Sinha, assistant professor of industrial and manufacturing systems engineering, researches how labor shortages in transportation affects the supply chain.

Economy

What everybody produces. The economy is driven by two forces: the ability to get a job and how much the goods being produced will cost.

The market

Where consumers are purchased sold, also known as the stock market. The market moves up or down and is influenced by a variety of causes and numbers, including inflation.

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Ashesh Kumar Sinha, assistant professor of industrial and manufacturing systems engineering, researches how labor shortages in transportation affects the supply chain.
The Chapman Center for Rural Studies aims to preserve and promote the stories and culture of Kansas with a specific focus on rurality. It is a center of excellence in the Kansas State University College of Arts and Sciences. Mary Kohn, director of the Chapman Center since August 2020 and associate professor of English, outlines three major responsibilities of the center:

• Give students high-quality, hands-on learning experiences.
• Serve local — especially rural — communities.
• Equip faculty to productively work with students and communities.

“We encourage collaboration between communities, students and faculty to answer the hard questions about what it means to be rural, how we support rural communities and how we preserve their stories,” Kohn said.

The future looks bright, too. Recently, the Chapman Center, in partnership with the English department, received a $20,000 Digital Infrastructure Challenge grant from the National Endowment for the Humanities. The grant will allow the center to create a new digital platform, refresh past online exhibits and create platforms for new projects, all to further the center’s mission.

“Wehn the Chapman Center offers a platform for students, faculty and the community to come together in ways we don’t always see in other educational experiences,” Kohn said. “This faculty and students witness the real impact of their work and showcase it to a larger audience, and the work gets used by communities in real ways. To me, that’s the magic of the Chapman Center.”

The following research projects attest to the wide scope and influence the Chapman Center has at the university, in local communities and across the state.

Wildfire and landscape conservation

Wildfire events have increased in size and frequency in the southern Great Plains region over the past few decades. Hundreds of square miles of Kansas land burned in 2021 alone. Audrey Joslin, assistant professor of geography and geospatial sciences, leads the Wildfire and Landscape Conservation project, the Chapman Center’s flagship program that recently received a $466,000 National Science Foundation grant.

Joslin works alongside Marcellus Caldas, professor of geography and geospatial sciences, and Jason Bergtold, professor of agricultural economics in the College of Agriculture, to conduct research on regional perceived wildfire risks and land management.

Often the first to respond to wildfires are rural farmers and ranchers, who call upon their informal network of neighbors and friends to help them until firefighters arrive. According to Joslin, these are the same people who make decisions about land management.

“My collaborators and I hope that increasing knowledge about the dynamics of land management and emergency response in fire-prone landscapes will help rural communities and land managers strengthen their efforts to address wildfire while continuing to support land stewardship activities,” Joslin said.

The research team is interviewing emergency workers and members of wildfire response networks to gain insight on their experiences and identify patterns of collaboration. They also are collaborating with the Farm Service Agency and the Kansas Forest Service to collect data on land use and wildfire events.

In addition to journal publications, Joslin’s team anticipates developing outreach materials to report their findings back to participating communities.

The Chapman Center for Rural Studies strengthens communities while advancing student learning

By Malorie Sougéy

Chapman Center for Rural Studies strengthens communities while advancing student learning

By Malorie Sougéy

Wildfires and CRP in Southern Great Plains

This map shows patterns of wildfire from 2005-2018 and Conservation Reserve Program, or CRP, enrollment per county from 2020.

(My map credit: Noel Guzman)
The layered history of Kansas land treaties

We all know a spot in Manhattan that we love well full, but do we know the layered histories of the land K-State calls home? Lisa Taronem, professor of English, is leading the Kansas Land Treaties project with Mary Kohn, associate professor of English, to shed light on the topic.

Students and faculty are conducting interviews and place-based research for this project, which tells the story of the treaties between the Kanza, or Kaw Nation, and the United States. The project is supported by a Kansas Humanities grant.

As part of the project, the treaties — which governed land for K-Kansas' land grant, among other interests — are being annotated as part of an online exhibit. Taronem's team is creating educational materials to promote understanding of these key land cessions, which dispossessed the K-Kent people of their traditional homelands.

"This project makes us confront the layered and complicated histories of the land we stand on," Taronem said. "To our own surprise and education, to recognize and share the knowledge of our ancestors, they could be forced to relocate their entire nation to present-day Oklahoma. Having educational tools available that blend primary documents with video clips, timelines and maps to convey to people and acknowledge and share this important history."

Perhaps most importantly, this project has built strong relationships with folks who can share knowledge about both these 19th century treaty encounters and the perspectives of present-day Kaw people.

Supporting bilingualism in rural Kansas

Alisa Garcia, associate professor of sociology, and Mary Kohn, associate professor of English, are leading the Prairieview project, which investigates bilingualism in rural Kansas — particularly in those towns, given the pseudonym Prairieview to protect residents' privacy.

The researchers are interested in how bilingual teams in rural communities create echoes to support each other and their families. An important factor in that conversation is immigration. "Many people consider Prairieview to be a 'the real immigrant destination,' but it is part of a region with the oldest migration history in the country," Garcia said. "Recent immigration to the town occurs an unusual 40 year hall in a history of immigration that is thousands of years old."

Garcia and Kohn want to know how recently arrived bilingual youth in Prairieview navigate the ideological monolingualism stemming from the rural area, and how multiculturation and multilingualism might take root in the future.

The team began ethnographic research on Prairieview, including participant observation and in-depth interviews with bilingual youth.

When the COVID-19 pandemic forced the team to remain local, they incorporated new technology to virtually conduct these studies. Undergraduate students on the team were trained to conduct interviews, and they are examining both barriers and support systems that affect rural towns during their online education experience.

Autographed by Kansas

You might not think there’s much you can learn from an autograph, but Kim Westcott knows otherwise. Westcott, senior in history, leads a project where she analyzes, digitizes and preserves Kansas autograph books from the late 19th century.

These books — donated by Rosalea Postma-Carttar and others — are being annotated as part of an online exhibit. They contain handwritten signatures and inscriptions, which include sharing memories, personal and professional encouragement, poetry and more. Each autograph book was kept primarily by women as a way to stay connected to friends and family, and they have been evaluated as a predecessor to modern social media.

Not only do these books reveal snippets of general history, but they also uniquely highlight the moment young women began to enter college for the first time in Kansas.

Westcott is investigating other historians’ work on autograph albums, researching the albums’ original owners and finding the narratives within the signatures, which often contribute to a narrative about women’s progress.

Future plans for this project include the addition of an autograph album archive, which will include a literary analysis of the narratives demonstrating the importance of autograph albums and their significance in assessing gender roles.

"My hope for this project is that it will be accessible for people to learn about these amazing everyday women and their impacts on history," Westcott said.

Students support the Chapman Center for Rural Studies

The Chapman Center for Rural Studies gives students high-quality, hands-on learning experiences. Learn more about some of the undergraduate researchers working on current projects.

Michael A. Pont, senior in agricultural economics and global food systems leadership, works with agricultural soils frames on the Wildlife and Landscape Conservation project.

Chester Hubbard, senior in geography and geospatial sciences, interviews scholars and creates maps for the Kansas Land Treaties project.

Kinsley Searles, senior in English, works on the Kansas Land Treaties project and conducts research on oral histories to provide context to the primary texts.

Thad Lopez, senior in English, transcribes and analyzes interviews for the Prairieview project.

Mary Kohn is the director of the Chapman Center for Rural Studies and an associate professor of English. She has led the Chapman Center since 2020.

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Helping the Body Fight Breast Cancer

The body’s immune system helps fight infections and diseases, including cancer. But cancerous cells can escape or evade the immune attack and develop into tumors. Immunotherapy treatment can boost the immune system so that it can find and attack cancer cells.

Anna Zolkiewska, professor of biochemistry and molecular biophysics in the College of Arts and Sciences, is developing and improving immunotherapies for breast cancer. She studies immune cells that infiltrate and help destroy breast cancer cells. Her research is supported by more than $1.65 million from the National Cancer Institute and more than $350,000 from the Johnson Cancer Research Center with support from the Flossie E. West Memorial Trust.

Immunotherapies are very effective against some types of cancer but are less successful against breast tumors. Triple-negative breast cancer, a particularly aggressive form of the disease, is especially hard to treat with any method. A new immunotherapy called immune checkpoint blockade offers hope, but it is effective for only a portion of patients. Zolkiewska is getting closer to finding out why.

She has discovered that a cell-surface protein called ADAM12 is important to triple-negative breast cancers. When she disabled the ADAM12 gene, tumor growth slowed down. Most importantly, tumors lacking ADAM12 contained more cancer-fighting immune cells, especially T cells and B cells.

Zolkiewska also showed that eliminating ADAM12 in breast cancer cells made tumors more responsive to immune checkpoint blockade therapy. This clue could improve immunotherapy efficacy for more patients, but there is evidence that the response may be temporary and followed by acquired resistance. Zolkiewska plans to investigate this effect further. She also is exploring if other proteins from the ADAM family may play a role in recruiting immune cells to breast tumors.

Fighting Cancer with Interdisciplinary Science

By Marcia Locke

Kansas State University researchers are searching for answers to these questions and more through the interdisciplinary Johnson Cancer Research Center in the College of Arts and Sciences. The center’s faculty members span 20 departments in five colleges. They work to better understand cancer and find ways to prevent it, detect it earlier and treat it more successfully, while also training the next generation of scientists.
SEEKING ANSWERS IN THE TUMOR’S ENVIRONMENT

Some researchers are seeking clues from the tumor’s environment to improve cancer therapies. The Johnson Cancer Research Center has established the Cancer Research Collaboration of Excellence in Tumor Microenvironment and Radiation, with the University of Kansas, Kansas State University, Bethel College, Benedictine College, Newman University, and the College of St. Mary.

Real Behnke, professor of kinesiology and associate dean of research and graduate studies for the College of Health and Human Sciences, is leading the multidisciplinary collaboration. The members’ international network represents a broad array of disciplines involved in radiation research and therapy.

“When conventional cancer therapies fail due to factors related to the tumor’s microenvironment,” Behnke said, “we need to identify microenvironment changes that cause cancer growth and therapy resistance, and devise methods to counter them.”

Other researchers involved are Amir Bahadori, associate professor in the College of Veterinary Medicine; David Poole, university distinguished professor of Biomedical Engineering in the Carl R. Dyer College of Engineering; Carl Ade, associate professor of radiology in the College of Health and Human Sciences; Daryl Poole, university distinguished professor of kinesiology in the College of Health and Human Sciences and of anatomy and physiology in the College of Veterinary Medicine; Chieko Azuma, clinical associate professor of radiation oncology in the College of Veterinary Medicine and Mike Mollina, associate professor of statistics in the College of Arts and Sciences.

These esteemed experts have received individual research support from the National Institutes of Health, NASA, the American Cancer Society, the American Medical Association, and the National Foundation for Cancer Research, among others.

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ATTACKING A KILLER VIRUS

Human papillomavirus, or HPV, causes nearly all cervical cancers — more than half a million worldwide each year. But many people don’t know that some humans get HPV at some point in their lives and that it can cause cancers of both men’s and women’s genitals as well as the throat, skin and other body parts.

Nicholas Wallace, associate professor of biology in the College of Arts and Sciences, wants to reduce the suffering caused by HPV by learning more about its biology. He studies how HPV converts normal cells into factories that make more of the virus and how this leads to the cells’ uncontrolled and rapid growth — cancer.

“Typically, HPV infections, and the changes associated with them, are quickly cleared by our immune systems,” Wallace said. “But if the virus escapes the immune system and the changes become permanent, a tumor will form.”

By learning how HPV proteins manipulate cells, we can learn more about cancer and potentially develop new drugs to help patients with the disease.

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A farmer in western Kansas worries his well will be dry in 30 years. More than 9 million tons of clothing — some items only worn once — go to U.S. landfills each year. Globally, 79% of all consumer plastics end up in landfills or as litter and can take hundreds of years to decompose.

These are a fraction of the sustainability challenges the world faces. If current behaviors and practices are left unchanged, experts say the consequences to our livelihoods and for the environment are bleak.

But all is not lost: A variety of measures and practices can help overcome these challenges. Kansas State University researchers are working across disciplines to engage in sustainability, which meets today’s needs without compromising the ability of future generations to do the same. It’s a balancing act.
For engineer Vaishali Sharda, providing tools and information to make science-based decisions is what drives her work to protect and sustain the food production system.

Much of Sharda’s research focuses on the effects the changing climate has on food systems and, most extensively, on preserving water. She uses computer modeling to simulate modified crop management practices and study their impact on crop yields and the sustainability and resilience of water resources. These hydrologic and crop models take into account historic, yield data, along with crop management practices such as planting dates, soil types and climatic factors, including temperatures, precipitation and wind speed.

“One of your models are robustly calibrated, you can play with these components to study present conditions and the future,” said Sharda, associate professor in the Carl R. Ice College of Engineering. “It gives you a lot of flexibility and a lot of power in your hands to simulate scenarios that would be difficult to create physically.”

Sharda and her collaborators are using $6 million National Science Foundation Established Program to Stimulate Competitive Research, or EPS-CR, RII Trail-2 grant to develop a spray-on biopolymer ground cover that acts as a weed barrier and fertilizer source and provides natural fertilization through decomposition.

Current management practices cover soils with sheet plastic to prevent weed growth, erosion and moisture loss during the growing season. But using large amounts of plastic sheeting is not eco-friendly, is costly and is not economically sustainable for field crops.

“New, locally sourced types of bioplastics that fully break down into safe byproducts can provide farmers with a green way to manage their fields.”

During the summer months, heat stress on the animals by adding sun shades on the pens during the summer months to reduce the water needs and improve animal comfort.

“By measuring crops consumed and methane and carbon dioxide produced from grazing beef cows, Roll and the research team will be able to use these phenotypes, or observed traits, to build prototypes genetic evaluation systems. Roll and those new prototypes would provide a blueprint for the inclusion of these traits into genetic evaluation systems so that producers might be able to select cattle based on traits such as methane produced or metabolic rate in the future. Over time, this could lead to increased sustainability through long-term genetic increases in production efficiency.”

The livestock industry is an integral part of global food systems as a source of nutrition, income and biodiversity. Balancing demand and improving production practices are needed to make the industry more sustainable.

Dale Blasi, professor of animal sciences and industry, and A.J. Tarpoff, associate professor of animal sciences and industry, are examining how precision feeding practices and reducing heat stress in post-weaned calves improve a broad range of sustainability factors.

Limit feeding was first introduced 40 years ago and is a practice of feeding calves nutrient-dense, low-roughage feed once a day. For a recent study, the College of Agricultural and Life Sciences used corn gluten feed made of byproducts from the ethanol and beverage industry. It is a highly digestible, high-energy feed that is proving to be more sustainable and healthier for the animals.

Rini and Tarpoff found that limit feeding reduces mean output per calf by 40-45%, which reduces emissions, fuel usage and labor needed to clean and dispose of the waste.

“The diet they are fed, as opposed to the high-roughage ad lib diet, or grazing diet, is more thoroughly digested and as a consequence, there is less manure output,” Blasi said.

“Calves produce less because they utilize more of it in their bodies to create a more thoroughly digested and as a consequence, there is less manure output,” Blasi said.

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“New, locally sourced types of bioplastics that fully break down into safe byproducts can provide farmers with a green way to manage their fields.”

Sharda said these new materials could provide farmers with a green way to contain weeds, fertilize crops, protect soil and water resources, and work with nature to better manage their fields.

Seek more Watch a video about Vaishali Sharda’s research.

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In the textiles and apparel industry, better sustainability practices are needed, from production to selling to consumer behavior. Researchers in the interior design and fashion studies department in the College of Health and Human Sciences use science, art, education and outreach to create change and awareness.

Kim Hiller, the Barbara Weigand professor in apparel and textiles and fashion studies, is the principal investigator on a project with Melody LeHew, professor of fashion studies. The researchers are using a three-year Sustainable Agriculture Research and Education grant from the U.S. Department of Agriculture to host a hands-on Farm to Fashion camp. The camp is one impact of their research focused on regenerative and circular fiber, textile and clothing systems.

At the camp, middle and high school youth collaborate with the K-State Sheep and Meat Goat Center and other fashion studies faculty to learn about the fashion supply chain, sustainable fibers and sustainable sheep farming. The goals are to create interest in more sustainable and natural fibers, to change consumer behavior and to spark an interest in the fashion or wool industry in Kansas.

“Our focus in the Farm to Fashion camp is on educating young people to gain an appreciation for where fibers come from and how they are made into textiles and garments,” Hiller said. “They already accept the fact that climate change is a concern and that it is necessary to change behaviors. There’s been such a drastic shift in the mindset of high school and college students in the last ten years. In a lot of ways, it’s easier to change their fashion consumption behaviors if we can help them to understand what the problems are.”

LeHew said the camp uses learning activities based on science, technology, engineering and mathematics, or STEM, to introduce sustainable fashion products and processes, which is the basis of a circular economy.

Natural dyeing is a practice and technique that the industry had largely forgotten, except in historical reference, until about 10 years ago when the industry really started looking at sustainable business practices.

“Natural dyes are a way to bring together fashion, agriculture and communities in a way that is sustainable for everyone,” said Doty, also the Verna Sullivan-Marler professor in fashion studies.

Sustainability is integrated throughout fashion studies curriculum. For example, in one project students used fabric purchased from and produced by Guatemalan weavers. Students created aprons that were naturally dyed and designed with native flowers and will be auctioned off to sustain the purchase cycle.

“Students also learn about sustainable choices in industry and throughout the fashion supply chain.

“We need to educate this generation on how to be better because they are going to be the change-makers to help their companies be sustainable,” Haar said. “They’re going into companies, and they’re asking, ‘What are your sustainability policies?’ and ‘What are you doing?’”

Above left: “These marigold and coreopsis flowers can create natural dyes with yellow and orange tones. (Photo credit: Kelsie Doty) Above right: Fashion studies researchers Kelsie Doty, assistant professor, left, and Sherry Haar, professor, create fabric designs using natural dyes. To make textile production more sustainable, Sherry Haar, professor of fashion studies, and Kelsie Doty, assistant professor of fashion studies, research and create designs using natural dyes. They investigate colorfastness, natural color fixatives, alternative dyes from waste, all natural plant dye transfer, natural dyes and natural plant extracts, natural dyes and natural plant extracts, natural dyes and natural plant extracts, natural dyes and natural plant extracts.

Bottom: A farm to fashion camp participant uses a loom to weave wool. (Photo credit: Kelsie Doty) Right: Dried leaves can create natural dye imprints and brown, gold and dark purple tones.
Understanding how nanomaterials can help build better energy supplies is a research focus for Jun Li, professor of chemistry in the College of Arts and Sciences. Li works to develop more efficient fuel cells and increase the energy capacity of lithium batteries, both of which can help reduce the carbon footprint.

Fuel cells convert more energy into electricity with fewer emissions than combustion engines, which makes them a more sustainable option. Li is working to improve the electrocatalysts—the key element in accelerating the electrochemical reactions that convert fuels into electrical energy—in fuel cells. Current technology uses the noble metal platinum as the catalyst, which is costly and unsustainable to produce.

“With funding from the U.S. Department of Energy and the National Science Foundation, Li is testing the use of carbon nanomaterials in fuel cells to reduce the amount of platinum needed and make them more active and stable, leading to more efficient and sustainable energy production,” Li said. “We can help to improve the electrocatalyst—a critical component in the fuel cells so that they will run more efficiently, be more stable and have a longer lifetime.”

There is also a unending demand for lighter, longer-running batteries.

To build a better battery, Li is researching the use of nanomaterials in emerging lithium-sulfur batteries to improve the capacity and safety. His work replaces the solid lithium metal electrode with a porous, carbon nanomaterial. Lithium is electroplated into the carbon materials’ open space, making it more reversible and safer during the battery charge-discharge process.

“All with the success in powering portable electronics with lithium-ion batteries, there is a strong, unending demand for lighter and better operating batteries,” Li said. “The future demand for batteries or fuel cells as power sources for larger-scale applications is even bigger—electric cars, electric boats or forklifts in warehouses. All of these can benefit from better batteries or fuel cells.”

Top: Jun Li, professor of chemistry, is improving the efficiency of batteries and fuel cells to make the technology more sustainable.
Bottom left: Tiny coin cell batteries undergo testing.
Bottom right: Researchers are developing more efficient fuel cell and coin cell batteries.

As climate change creates more severe weather episodes—such as floods, drought and high winds—healthy soils are critical for sustainable soil ecosystems.

Charles Rice, university distinguished professor of soil microbiology in the College of Agriculture and a world-renowned researcher in carbon cycling and climate change, is driven to learn how agriculture production systems can be as resilient and efficient as the tallgrass prairie. As part of his work, he was a member of the United Nations Intergovernmental Panel on Climate Change that received the Nobel Peace Prize in 2007.

The three key elements to soil health are carbon, microbial activity and soil structure. The three key elements to soil health are carbon, microbial activity and soil structure. Each element relies on the other elements for good soil health, leading to good plant growth, water retention and resiliency during climate change events.

“These elements are intertwined,” Rice said. “The carbon is providing food for the microbes. The microbes are cycling the nutrients and making nitrogen and other nutrients available for the plants, which is important for plant productivity. Finally, soil structure provides air and water movement in and out of the soil.”

One aspect of his research portfolio is carbon sequestration, or practices that remove carbon in the soil. These practices include no-till farming and agriculture diversification, such as cover crops.

According to Rice, soil can absorb carbon dioxide from the air during photosynthesis, and as no-till farming and cover crops, can help restore carbon in the soil. Sustainable agricultural practices, such as no-till farming and cover crops, can help restore carbon in the soil.

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Kansas State University cybersecurity researchers want you to know the difference between the stereotype of cybersecurity and the reality of it.

The stereotype: Cyberattacks are committed by hooded hackers cracking code to infiltrate our security systems.

The reality: Cyberattacks certainly can happen that way, but it’s much more likely to come in the form of vulnerable and outdated hardware and software, social engineering, phishing scams and ransomware.

That reality can be a pretty scary place. An outdated piece of software can make an autonomous vehicle susceptible to cyberattacks. Clever social engineering can cause an unknowing employee to provide access to sensitive documents. Terrorists can take advantage of weaknesses in our infrastructure, such as power grids and water treatment plants. The things that make our life easier, such as smart doorbells or home security systems, also have the potential to be misused.

As the world becomes more computerized, we also become more vulnerable.

“A great example of the risks we face can be seen in Ukraine where several types of destructive malware aimed at government and financial organizations were deployed in the hours leading up to the invasion,” said Scott DeLoach, head of the computer science department in the Carl R. Ice College of Engineering.

That’s why K-State researchers are working behind the code to navigate the new world of cybersecurity and to keep our data, our infrastructure and our world safe.
Safety and security
Arslan Munir, associate professor of computer science, takes a novel research approach by involving both safety and security — two key areas to addressing cybersecurity.

While security involves stopping an adversarial attacker, such as a hacker, safety involves addressing something unintentional, such as autonomous vehicle electronics failing.

“My research targets both safety and security because the end effect is similar,” said Munir. “This is a novel area, where I have to prepare for both.”

Munir’s team focuses on four areas of cybersecurity research:
• Autonomous vehicles. Munir works to help autonomous vehicles operate safely and securely while adhering to real-time constraints — such as braking at a red light or responding to changing road conditions.
• Hardware-based security for lightweight applications. The team is designing circuits that communicate securely and efficiently with other circuits, which is key for devices — such as smart doorbells, home security cameras or building access control — connected through the internet of Things.
• Artificial intelligence. Munir is helping make AI circuits that are both artificial intelligence — such as autonomous vehicles — more secure and less susceptible to cyberattacks on the artificial intelligence of the device.
• Situational awareness. Munir’s research has applications for the U.S. military, which uses sensors and devices for situational awareness to understand an environment and take action. For example, a video-camera sensor is providing data on an area; it is important that the sensor provides accurate data and cannot be hacked by an adversarial player.

Munir’s work has been supported by organizations such as NASA, the National Science Foundation, the Air Force Office of Scientific Research, the Air Force Research Laboratory and Semiconductor Research Corporation. His hardware security research has generated two patents through K-State Innovation Partners.

The privacy of social networks
How much information we do and don’t share online through social media and social networks plays a key role in privacy and cybersecurity. “How people reason about digital security is very different from how they think about their physical safety and security,” Vasserman said. “We have millennia of experience in instinctive subconscious reasoning about the physical world, but these ‘mental shortcuts’ can malinger online. By drawing clear parallels between the physical and the digital, we can encourage people to use existing mental processes to more accurately evaluate digital risk.”

Vasserman is collaborating with George Amariucai, associate professor of computer science, on several projects related to digital literacy. The work involves social media monitoring and disinformation and the privacy of social networks.

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Opportunities for students
K-State’s work in cybersecurity includes educational and research programs for undergraduate and graduate students. Through university initiatives and nationally funded programs, K-State is helping produce high-quality graduates to meet national, state, local and tribal government demand for skilled cybersecurity personnel. The K-State Center for Information and Systems Assurance has offered the CyberCorps®: Scholarship for Service and Systems Assurance has offered the program for more than 10 years. The National Science Foundation supports a more than $3 million renewal from the program. The K-State Center for Information and Systems Assurance has offered the CyberCorps®: Scholarship for Service and Systems Assurance has offered the program for more than 10 years. The National Science Foundation supports a more than $3 million renewal from the program.

The Korea Research Institute of Industrial Science and Technology is collaborating on a project.

High-stakes cybersecurity
A high-stakes element of cybersecurity involves military- and defense-related systems. Two K-State researchers are up for the challenge. John Hatcliff, university distinguished professor of computer science, and Robby, professor of computer science and Don and Linda Glaser — Carl and Mary Sue Kersten research scholar, work to make U.S. military operations more secure. Their research has received funding from the U.S. Army, the U.S. Air Force and the Defense Advanced Research Projects Agency, or DARPA. They also have collaborated with Collins Aerospace.

The technology that Hatcliff and Robby have developed has been successfully used in DARPA demonstrations to provide cyber assurance for the mission control software on CH-47 Chinook helicopters.

Through a partnership with Adventium Labs, they are using an Air Force Phase II Small Business Innovation Research award to make aircraft more secure. They are addressing information security vulnerabilities in complex cyber-physical systems. Research from Hatcliff and Robby centers on important military-related topics, such as ways to better secure systems on fighter planes or ways to rapidly update the software on a tank with new capabilities without interfering with the vehicle’s existing functionality.

But their work has applications beyond the military as well. While their U.S. Department of Defense-funded projects are improving important military technology — such as self-driving cars, tanks and unmanned aerial vehicles — the same computer architecture can apply to aerospace, precision agriculture and automated farming.

“The same technologies we are working on for military control systems and information systems can be applied to the automation of experiments or agriculture,” said Hatcliff, also the Lucas-Rathbone professor in engineering. “There is an opportunity to take a holistic view to automation controls where the platforms and architectures we are working on can be applied broadly to automated agriculture, advanced manufacturing and biosecurity.”

The social science of cybercrime
Many cybersecurity incidents start with a social engineering element. Think deceptive phishing emails with links to steal personal information or a cybercriminal using a false identity to trick someone into giving up information. Criminologist Kevin Steinmetz, professor of sociology, anthropology and social work in the College of Arts and Sciences, is studying how and why social engineering works and how to prevent it. He also is collaborating with law enforcement to better understand cybercrime.

For one project, Steinmetz is using a three-year, $150,000 National Science Foundation grant to study social engineering and online fraud. Through 14 interviews with information technology professionals and social engineers, Steinmetz collected tips for developing and implementing policy recommendations to improve cybersecurity at organizations.

“Effective policies are those that are adequately communicated to organizational members,” Steinmetz said.

On another three-year, nearly $500,000 NSF grant, Steinmetz is working with law enforcement to better understand cybercrime. The researchers are interviewing cybersecurity law enforcement who investigate internet crimes against children, network intrusions or cyber fraud. While previous research has been more survey-focused, interviews and his collaborations took a different approach and have conducted 40 in-depth interviews with people at six different policing units at the local, state and federal level. They are now finalizing the data for publication.

“We wanted to get more of a boots-on-the-ground perspective of what are the challenges that law enforcement dealt with in grappling with cybercrime investigations,” Steinmetz said. “We are also interested in how this type of work affects how they view themselves as police, because this is very different work than what we stereotypically associate with law enforcement.”

Steinmetz also is working on updates to “Cybercrime and Society,” a book he co-authored with Majid Yaz. It is one of the leading textbooks on the social science of cybercrime.

Tips to prevent social engineering
K-State criminologist Kevin Steinmetz has developed the following tips to help organizations develop policies that help prevent social engineering:

- Educational programs, such as security awareness training, are key to communicating effective policy to organizational members.
- Policies should be effectively written.
- Policies should be tested to measure their effectiveness.
- Technology security measures, such as automated email warnings from console organizations, should be implemented to support policies.
- Organizations should invest sufficiently in human resources to support policies and social security.
- Leadership merits and organizational administration should champion security.
- Organizations should be intentional to support security through a diffusion of responsibility.

Read more about cybersecurity research at K-State.

k-state.edu/seek
Graphene and hydrogen research leads to new company HydroGraph
By Jennifer Tidball
It's a research success story that starts with an explosion and continues with the formation of a company based on the K-State University research.

As physicist Chris Sorensen calls it: serendipity.

“We discovered graphene serendipitously in the lab when we were using controlled explosions to make an aerosol gas,” said Sorensen, Cortelyou-Rust distinguished professor of physics and university distinguished teaching scholar. “I wasn’t expecting to make graphene.”

But make graphene they did. And that’s just the first chapter of the story.

Now, the groundbreaking graphene and related hydrogen research has turned into a successful international company: HydroGraph Clean Power Inc. The company recently went public on the Canadian Securities Exchange as a result of its initial public offering in May. The company also has been designated for the New York Stock Exchange in the near future, Sorensen said.

“On the horizon, we can see many uses, and this year alone we will make hundreds of kilograms of graphene,” Sorensen said. “We believe in partnerships and the partnership we have with K-State has been very productive,” Davidson said. “The world of nanomaterials is going to open up to us and the process we have. We’re using digital methods with our precisely controlled detonation technology, in order to create what we feel are going to be the nanomaterials required for the fourth industrial revolution.”

Sorensen soon engaged Stephen Bossmann, university distinguished professor of chemistry, to assist in the chemical side of the collaboration. Bossmann applied a cold oxidation method to the graphene to make a high-quality graphene oxide, which maintains the integrity of the graphene and creates a new material with numerous possibilities.

“Our process is completely novel and our surface modification methods are also advanced,” Bossmann said. “We use the explosive graphene and we modify only the outer layer, which means we maintain all other layers and their properties. That’s enough to connect them into layers to really any other matrix through well-established organic and inorganic chemistry.”

The team of researchers also includes Arjun Nayak, research assistant professor of physics, Stephen Correll, research engineer in physics, and numerous graduate students and undergraduate students.

Some of the recent patents from the collaborative research team include:

• A method to create hydrophilic graphene in a provisional patent titled “Process for synthesis of graphene.”
• A device for upscaling graphene production in a patent application titled “Device and process for mass production of particulate materials.”
• A process for developing turbostratic graphene oxide in a provisional application titled “Graphene/graphene oxide core/shell formations and methods.”

The K-State detonation method of creating graphene checks all the right boxes. The process is safe, clean, environmentally friendly, cheap, consistent and faster than other methods. Also, it is scalable and can produce high-quality graphene in mass quantities.

Sorensen’s research team had spent several years developing and testing an experimental lab, but recent results demonstrate that their explosion synthesis method also could produce nanographene—a dark and incredibly lightweight material.

Sorensen recently founded the K-State Research Foundation patented Sorensen’s new detonation technology to mass-produce graphene.

Sorensen’s work caught the eye of Harold Davidson and Barry Hearnshaw, entrepreneurs from Vancouver, British Columbia. Davidson reached out in 2017 to start a collaboration with Sorensen to build up and automate the graphene-making process to an industrial scale. Davidson and Hearnshaw created a start-up company called Carbon-2-D Graphene Inc. and worked hard to secure venture capital for Carbon-2-D to fund Sorensen’s research.

The investment paid off. The research not only led to a pilot-scale graphene production device, but another discovery: an environmentally benign, inexpensive method to make hydrogen. This is a significant advancement because hydrogen will be an important energy source in the future, Sorensen said.

Carbon-2-D Graphene Inc. soon became HydroGraph Clean Power Inc. and the collaboration has expanded to involve other K-State researchers and Kjirstin Breure, who became HydroGraph’s chief operating officer.

“This research and commercialization partnership with HydroGraph is an excellent example of how K-State is actively working with companies to bring new businesses and jobs to the state of Kansas,” said David Rosowsky, K-State vice president for research.

The multi-institutional research team continues to expand on the detonation method to create graphene and hydrogen-rich syngas. They also are developing devices for more efficiently producing the unique graphene and graphene oxide.

“It’s a collaboration with big plans for future growth and development,” Sorensen said. “All of this started as curiosity-based research,” Sorensen said. “Land-grant universities were founded on the idea that research and creative ideas formulated at the state university would yield useful technology. That is exactly what happened here. Moreover, the type of intellectual property collaboration could be the future for K-State.”
Wayne Goins brings music to life, whether playing, composing or writing about it.

“My passion for performing and writing about music is what keeps me moving forward, looking for the next magic moment — both on the stage and on the page,” said Goins, university distinguished professor of jazz in the College of Arts and Sciences.

An acclaimed jazz guitarist with 26 albums and numerous original compositions and performances to his credit, Goins also is a prolific writer about all things jazz, soul, blues, pop, folk, reggae, and rhythm and blues.

“My writing is one of the most significant forms of active research that I do — it’s a result of having had experience in so many genres of music,” Goins said. “I am constantly integrating, processing, reviewing and reformulating all the things that I think I know and then releasing my creative energies out into the world.”

Goins is the author of books about music legends — including Jimmy Rogers, Charlie Christian and Pat Metheny — and tips on teaching jazz. He also regularly writes for leading music magazines and journals. Goins currently is writing a 10-piece series on rock music for Power of Music and Audio, or PMA, magazine and also recently interned with interviews with some of the greatest jazz guitarists in the country for Jazz Guitar Today magazine. He writes critiques and reviews and analyses blues albums for Living Blues magazine and also writes music reviews for Kansas City Jazz Ambassadors. He even has written liner notes for some highly acclaimed albums.

“The writing process fuelled my inner need to constantly deliver something that was only an idea until it came into fruition,” he said. “It is my way of giving birth — and it keeps my mind sharp, too.”

Goins particularly enjoys delving into biographical and historical material about music for his writing.

“My love for exhaustive research,” he said. “The process of learning how nano- seconds when you come to the comprehensive study of any given artist and their entire musical output really energizes me. I’m what I call a completist — I like having when it comes to the comprehensive study of any given artist and their entire collection of things.”

When it comes to inspiration for his music and writing, Goins looks to music for Kansas City Jazz Ambassadors. He even has written liner notes for some highly acclaimed albums.

“A constant curiosity, creative and caring mind is what keeps me inspired,” Goins said.
A pesky pest

Entomologist uses AI to spot tiny insect

By Pat Melgares

Ivan Grijalva considers the sugarcane aphid a big headache.

Strange, perhaps, since it would take about 14 of the pear-shaped, soft-bodied, leaf-sucking insects — lined up end to end — to measure 1 inch. In a farm field, aphids are rarely visible at first glance, even though hundreds or thousands may be present.

Tireless? Not for Grijalva, Kansas State University doctoral student in entomology, who is using machine learning to detect and classify sugarcane aphid populations on sorghum leaves without the use of manual labor.

“Using digital cameras, we collect images of the aphid on leaves while scanning farm fields, then we create computer algorithms that are able to detect and classify different densities of the sugarcane aphid on leaves,” Grijalva said.

Technology is key to bringing all the pieces together.

“Nobody likes to count aphids,” said Brian McCormick, entomology department head in the College of Agriculture and Grijalva’s advisor. “It’s tedious, and we need ways to standardize and simplify the process as much as possible.

We can provide growers with all the information needed to manage a field, but we need to make decision tools accessible. A lot of the time, it comes down to a number. How many bugs are in my field, and what do I do about it?”

The more images researchers take of infested leaves, the more libraries they can develop to identify different densities of the sugarcane aphid on leaves,” Grijalva said.

By Pat Melgares

The more images researchers take of infested leaves, the more libraries they can develop to identify different densities of the sugarcane aphid on leaves,” Grijalva said.

That is in line with what is known as Integrated Pest Management, or IPM, which is an environmentally sensitive approach to pest management that relies on a combination of cost-effective control tactics.

“Pest identification and monitoring, use of economic threshold levels and applying insecticides only when justified are current practices in IPM that we need to use to make a case to growers toward increasing food production for a growing world population,” Grijalva said. “Our project will enable scientists to provide management recommendations to growers to maximize the efficiency of insecticides while minimizing the negative impacts on the environment.”

Grijalva also is involved in a project with Ayesha Sharda and Dan Flippo — both associate professors in the Carl R. Ice College of Engineering. Sharda is a Patrick William — Carl and Mary Ice Keystone research scholar and Flippo is a Patrick William — Carl and Mary Ice Keystone research scholar.

The researchers are using machine learning to recognize aphids under sorghum leaves, which then triggers a ground robot to spray it.

“The impact of digital agriculture on today’s farms is tremendous,” Grijalva said. “With the ability of information and tools provided by digital agriculture, farmers can be more efficient in food production. We can save time and production costs, while guaranteeing the safety of our food supply. We need to continue research in this area to increase our ability to transform our current management practices into the new, digital area of agriculture.”

See page 20 to read about other K-State research related to sustainability.

By Beth Bohn

Jill Brostremann is hungry to take on the challenge of feeding a growing world, whether by ensuring food products are safe to consume or by making foods more nutritious.

Originally an engineering major when she entered Kansas State University in fall 2019, Brostremann soon switched to food science and industry, offered through the College of Agriculture. The college is home to the Food Science Institute, which facilitates the university’s food science programs and provides research and technical assistance to the food industries.

“I was drawn to the real-world applications of food science and I love the chemistry and biology behind it,” said Brostremann, now a senior. “I also was very interested in learning the research and development opportunities that this degree has to offer, so my advisor recommended that I do undergraduate research to gain experience and substantiate my lab skills.”

Brostremann currently is working with milk proteins — casein and whey — and microparticulation — a way to control particle size — in the lab of Jayendra Amamcharla, professor of animal sciences and industry, who has a research emphasis on dairy foods.

“Casein, for example, has the high protein content that consumers want, but the protein micellar structure has an increased thickness or viscosity,” Brostremann said. “Consumers want the higher protein content but still expect the same mouthfeel and consistency of regular yogurt. This poses a challenge for the dairy industry: microparticulate casein while attempting to maintain the consistency.”

Altering the casein and whey protein interactions through microparticulation is one of the ways to control the viscosity.

“Whey proteins can be microparticulated, which limits the casein-whey protein interactions, and then used as an ingredient in acid gel-type products, including some dairy foods like yogurt,” Brostremann said. “Microparticulation may be a potential solution for the dairy industry to give consumers dairy products with high protein content and with the desirable mouthfeel, texture or viscosity.”

Brostremann presented on her milk protein research at the K-State fall 2021 Annual Sciences and Industry Undergraduate Research Symposium.

With the world’s population expected to exceed 9 billion people by 2050, it is projected that farmers will need to produce 70% to 100% more food. This challenge is why Brostremann chose to pursuit her food science major with K-State’s secondary degree in global food systems leadership.

An honors student, Brostremann plans on completing her bachelor’s degree in spring 2023. She wants to get her master’s degree but may consider working in the food industry first as a quality assurance or research and development specialist.

Original credit: Beth Bohn
Seek Spring 2022 k-state.edu/seek

Hansin Bilgili, assistant professor of management in the Kansas State University College of Business Administration, explains, in fewer than 100 words, what triple bottom line is and why it is important for sustainability.

Triple bottom line, or TBL, is an expansion of the traditional understanding of measurement of firm performance, which focuses on financial performance or profit. The TBL approach demands managers pay equal attention to additional performance metrics: environmental and social performance.

Under a TBL approach, managers not only need to pursue profitability, but also vigorously consider the cumulative impact of their strategies on people — employees and communities — and the planet or natural environment. When adopted, the TBL approach not only holds managers responsible to a broader group of stakeholders, but also provides a foundation for sustainable organization management.

See page 20 to read more about sustainability research and see page 8 to learn how researchers are analyzing the ever-changing economy.

The science of computing

The computers of today are vastly different from the first-generation computers that filled a room. Kansas State University’s first computer, built by engineering professors W.H. Ford and J.E. Wolfe from 1954-1956, helped researchers solve complex calculations in minutes instead of months. In the top photo from 1975, Linda Shapiro, assistant professor of computer science, and Earl Harris, hardware analyst, work on computers in the department’s hardware room. The bottom photo from the 1980s shows the Nichols Hall computer machine room, which held large computers that connected to terminals in a nearby computer lab. See page 28 to learn how K-State computer scientists continue to improve cybersecurity and keep our data safe.

Photos courtesy of the K-State computer science department.
Innovating our state

K-State Innovation Partners is the Kansas State University unit that connects the university with industry and communities. Read more about K-State success in corporate engagement, technology commercialization and economic development.

Nearly

$6.2 million

Value of K-State technology commercialization in fiscal year 2021

$3.7 million

K-State licensing revenue in fiscal year 2021

24 companies

Number of companies K-State Innovation Partners has assisted in establishing or expanding their presence in Kansas since 2009

$55.4 million

Total annual payroll of the jobs that have been generated by K-State Innovation Partners’ clients

201 companies

Number of companies advanced through K-State Innovation Partners since 2009

$7 million

Value of the total equity held by K-State Innovation Partners since 2009

1,299 jobs

Total number of jobs created by K-State Innovation Partners’ clients since 2009

Seek more

Learn how K-State is building economic prosperity in Kansas.
k-state.edu/seek

Source: K-State Innovation Partners

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