Perspectives

Summer 2014

KANSAS STATE UNIVERSITY

Message from President Kirk Schulz and Vice President for Research Karen Burg

Kansas State University researchers found that 98 percent of people who live in rural areas work and shop in a larger community nearby. This creates "food deserts," or large rural areas where people don't have easy access to healthy food.

To confront this challenge, the university took an interdisciplinary approach. Professors from agricultural economics, human nutrition and marketing have teamed with K-State Research and Extension specialists for the Rural Grocery initiative. In June, the university hosted the fourth national summit on the topic.

Kansas State University is fortunate to have nine colleges and almost 70 departments where such new ideas and innovations can take shape. When your institution is home to experts in fields as varied as children's literature and nuclear engineering, yet unimagined cross-disciplinary collaborations wait to surface.

We know that becoming a Top 50 public research university by 2025 will take more than working in academic silos. Our faculty know this, too. They are reaching outside their disciplines and touching fields they could never have imagined.

It's hard to find a better example of the concept of arts and sciences than the three-part "Glass Ballet." A collaboration between physics and dance, this piece breathes artistic expression into molecular motion and heating crystals to create glass (page 6).

The greatest challenges facing us this century, from food to water to energy, are multifaceted and complex. They're about more than just agronomy or ecology or engineering. Most important, they're about people.

Some of our most robust research projects haven't forgotten this. Our research teams that study water use — the depletion of the Ogallala aquifer (Summer 2013), watersheds throughout the center of the nation (page 3) — include sociologists, political scientists and other experts who delve into what these challenges mean for people and communities.

With numerous resources to pull from, it's no wonder Kansas State University has experts in many areas tackling the same subject. Just look at our research that touches on autism (page 14). Cynics might see this as inefficient. Researchers know that approaching challenges from multiple angles spawns innovation.

Interdisciplinary research like this doesn't just happen. As a university, we have been deliberate in creating an environment where working across disciplines is the norm.

It starts at the top, with encouragement and expectations from the administration. It continues with the quest to increase our extramural funding. Many grants now require an interdisciplinary aspect. It's probably no coincidence that in fiscal year 2013 we saw our largest-ever extramural funding total.

Kansas State University's support of interdisciplinary research stretches all the way to the classroom level. As you read about our stormwater research (page 16), note that it began with an undergraduate class integrating future engineers and future architects.

And that "Glass Ballet" we mentioned earlier? These professors met through K-State First, an interdisciplinary program designed to put our first-year students on a path to college success.

Even Kansas State University's internal communications spawn research across disciplines. Our faculty have told us they find potential collaborators and ignite ideas by reading about what their colleagues are doing in our faculty and staff newsletter.

As the 21st century unfolds, we see the challenges that await us: feeding a growing middle class; procuring clean and affordable energy; protecting and maximizing our water resources. Kansas State University is stepping up to face these problems, unhindered by artificial disciplinary boundaries.

President:
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Strength in numbers

Early-career faculty find connections, confidence during research funding trip

Kansas State University researchers recently visited the nation's capital to pull back the curtain on what is often an intimidating process — obtaining research funding. Faculty and administrators left a lasting impression on federal funding agencies in Washington, D.C., while making valuable connections.

Noel Schulz, associate dean for research and graduate programs in the university's College of Engineering, was one of the organizers of the 2013 pilot trip. In April 2014, more than 50 faculty members traveled to the District for the second time to increase funded research at the university and encourage faculty to apply for funding.

"Early-career faculty have a chance to see that funding agency program officers are real people," Schulz said. "Researchers go from 'if I get funding' to 'when I get funding.' These trips create an excellent peer network for our early-career faculty with colleagues across campus."

Beth Montelone, associate dean of the College of Arts & Sciences, helped organize the trip. She said it is important to increase funded research at all levels to achieve Kansas State University President Kirk Schulz's goal of becoming a Top 50 public research university by 2025.

"We wanted to demonstrate that funding agencies are not intimidating or complex," Montelone said. "As administrators, we prepared the faculty to represent their research interests in a concise manner."

Faculty members from seven Kansas State University colleges met with agency representatives from the National Science Foundation, the National Institutes of Health, and the U.S. departments of Agriculture, Energy and Defense. Ernie Minton, associate director of the Agriculture Experiment Station and trip organizer, said these visits showcased the university's commitment to research.

"When you have to find a meeting room for 50 people at the National Science Foundation, you can't help but give the impression that this institution is very serious about competing for federal research funding," said Minton.

Participants from the 2013 trip also were offered opportunities to serve on funding review boards to gain an understanding of what agencies are looking for in the review process. This year, some faculty members were even invited to serve on panels while on the NSF visit.

"We're focused on changing the research culture at Kansas State University," Minton said. "It's imperative to provide faculty with the tools they need to be successful in a competitive federal grant environment."

Linda Thurston, associate dean for the College of Education, was another primary organizer of both the pilot and secondary trips. As a former NSF program officer, she assisted faculty members and provided guidance in arranging meetings.

While data from the 2014 trip will not be compiled until 2015, Thurston's data from the pilot trip found that 85 percent of the group submitted proposals following the trip, and 20 percent of those proposals were successfully funded. More than 90 percent of the group continued to meet about research and proposals with colleagues, while 44 percent reported collaborative proposals or research. She added that several faculty members commented that meeting colleagues from other colleges was extremely beneficial from a mentoring perspective, as well.

"Participants reported significant increases in confidence, knowledge and enthusiasm for seeking external funding for their research," Thurston said. "This data demonstrate the positive effect of the trip in developing proposals for external funding, as well as the opportunity to get to know their Kansas State University colleagues."

— By Megan Saunders, Division of Communications and Marketing

"By coordinating fish biodiversity sampling in the Smoky Hill River with geomorphology, hydrology and land use, our research team will better understand how humans impact aquatic systems. This information can be combined with human surveys of use and value to advance science and increase the efficiency of conservation efforts."

*— **Martha Mather,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*

Martha Mather

Melinda Daniels

Marcellus Caldas

Matthew Sanderson

The interdisciplinary team includes researchers from:

College of Arts and Sciences

Principal investigators from the **College of Arts and Sciences** include:

- ***Marcellus Caldas,** associate professor of geography*
- ***Melinda Daniels,** adjunct professor of geography at Kansas State University and associate research scientist at the Stroud Water Research Center in Pennsylvania*
- ***Dave Haukos,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*
- ***Martha Mather,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*
- ***Matthew Sanderson,** associate professor of sociology*

"From a social science perspective, this project has the potential to significantly advance knowledge of the human-environment nexus because it explicitly incorporates the natural systems component of the relationship in the models — something that is not very common in the social sciences."

*— **Matthew Sanderson,** associate professor of sociology*

"Variations, impacts or loss of water in Great Plains water systems have the capability of producing cascading effects. Humans and other biota are constantly adapting to these effects, but there is likely a threshold where the aquatic and wetland systems start to fail and this will have negative impacts throughout the Great Plains. Our goal is to quantify these thresholds."

*— **David Haukos,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*

Principal investigators from other institutes include:

- ***Joseph Aistrup,** dean of Auburn University's College of Liberal Arts and Sciences and former professor of political science at Kansas State University*
- ***Kyle Mankin,** senior hydrologist with the U.S. Fish and Wildlife Service and former professor of biological and agricultural engineering at Kansas State University*

College of Agriculture

The principal investigator from the **College of Agriculture** is:

- ***Jason Bergtold,*** *associate professor of agricultural economics*

Jason Bergtold

"Our project should help the members of the Kansas community better understand the social, economic, biological and environmental linkages between ourselves and the environment and how we can manage our natural resources to enhance our quality of life while protecting our environment and biodiversity in the state."

*— **Jason Bergtold,** associate professor of agricultural economics*

Sustaining the plains

Collaborative project helps Great Plains stay afloat of water problems

Central Great Plains water systems are a complicated puzzle that an interdisciplinary Kansas State University team is solving piece by piece.

The eight-member team is studying how human activity, climate change and land use interact and affect water systems in the Central Great Plains. The researchers, who include geographers, engineers, biologists, economists and sociologists, are collaborating to prevent future water scarcity and water quality problems.

"These are the kind of problems you cannot solve in just one discipline," said Marcellus Caldas, associate professor of geography and project co-leader. "One factor affects another. Each person is connected in his or her own field and contributing a piece to solve this puzzle."

The researchers want to accomplish two goals: understanding the connection between humans and their environments and developing policies that can help Central Great Plains water usage. A three-year $1.4 million grant from the National Science Foundation's Dynamics of Coupled Natural and Human Systems program is supporting them.

The team is focusing on the Smoky Hill Watershed as a case study. The watershed extends from eastern Colorado to near Manhattan, Kansas, where it joins the Kansas River. It is a narrow basin that stretches across Kansas' strong east-west precipitation gradient, which is drier in western Kansas and gets wetter further east. Other watersheds north and south of the Smoky Hill are similar, which makes it a good model for other Great Plains watersheds.

The Great Plains region has longstanding water quality and quantity concerns from extreme climate variability, intensive water uses and land uses. Through collaboration, the researchers can study related components.

For example, they can understand how crop pricing influences land cover, which influences water runoff and groundwater recharge.

College of Engineering

"The integrative policy optimization models will be large-scale, complex mathematical representations of the entire water system. My hope is that our research will lead to advances in the extent to which local culture and decision objectives can be represented in models of this type. The goal is to identify water system management strategies that simultaneously support a healthy ecosystem and rural livelihoods."

*— **Jessica Heier Stamm,** assistant professor of industrial and manufacturing systems engineering*

Jessica Heier Stamm

Principal investigators from the **College of Engineering** include:

- ***Jessica Heier Stamm,** assistant professor of industrial and manufacturing systems engineering*
- ***Aleksey Sheshukov,** assistant professor of biological and agricultural engineering*

"We expect to get a better understanding of how dynamics between climate variation, human land- and water-use decisions, and aquatic ecosystem affect surface runoff, hill slope erosion, groundwater recharge and stream flow regimes."

*— **Aleksey Sheshukov,** assistant professor of biological and agricultural engineering*

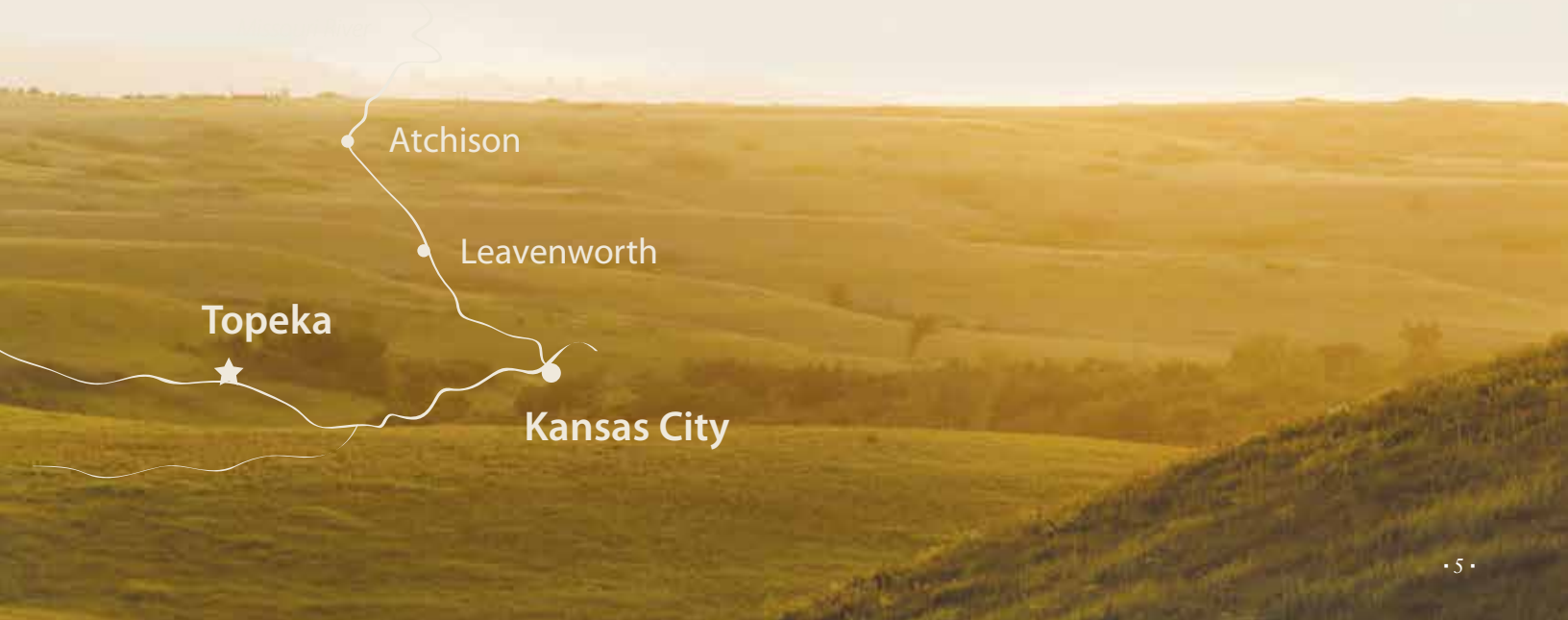
This affects the amount of water flowing to the rivers, which influences how fish are able to reproduce that year, said Daniels, project co-leader and adjunct professor of geography.

"Our project ties together the factors that drive land-use decisions and water-use decisions in an attempt to build resiliency in both human and natural systems so that the region can thrive economically and culturally, and still produce invaluable ecosystems services like drinking water supply, groundwater recharge, biodiversity and recreation," Daniels said.

The project includes four parts:

- **Hydrosystems.** Researchers are measuring how climate, human activity and land use affect water quantity and water quality. They are developing watershed models to integrate aspects such as surface runoff, hill slope erosion and groundwater recharge.
- **Aquatic ecosystems.** These systems provide stream water, water recharge and flood control. Aquatic ecosystems also provide fish and wildlife that are important for migratory waterfowl, fishery support and recreation. Biologists are investigating how water level changes affect fish, plants and wildlife in streams and wetlands of the Smoky Hill basin.
- **Land- and water-use decisions.** By interviewing landowners and water users, researchers are understanding how humans respond — through land- and water-use decisions — to climate-induced changes in water supply, water quality and ecosystem. For example, researchers want to understand why and when a farmer may switch from rain-fed crops to center-pivot crops. Social scientists also are modeling how water quality and availability influence community members' use of water at home and influence recreation in the region's rivers, streams, ponds and reservoirs.
- **Policy modeling.** Researchers are combining the water, ecological and human components of the study to understand how they are linked and how different policies may benefit all components. Engineers are applying simulation models to explore policy-making processes that achieve sustainability.

— By Jennifer Tidball, Division of Communications and Marketing



Open to INSPIRATION

Researchers demonstrate the beauty of science through artistic expression

Watch the crystals dance: ***bit.ly/crystaldance***

If beauty is in the eye of the beholder, perhaps the beholder should have an eye for science. Two Kansas State University researchers are breathing artistic expression into molecular motion through dance, proving that the two worlds are as multifaceted as crystals.

Laura Donnelly, assistant professor of dance, and Amit Chakrabarti, head of the physics department, are working together on the three-part "Glass Ballet," which demonstrates the process of making glass by heating crystals and then suddenly cooling them. The first piece of the three-part ballet was performed at the university's 2013 SpringDance.

Chakrabarti said he and Donnelly's collaboration started with an idea to express scientific ideas through artistic forms.

> This is cutting-edge research expressed through dance. You can study nature in so many ways — it's much more beautiful than writing equations or memorizing a few facts.
>
> *— Amit Chakrabarti*

Molecules in the crystals move and change their state and location based on temperature and environment. Donnelly said she immediately saw similarities in dance.

"These things can all be used in movement," Donnelly said. "The geometry of ballet also fits the crystal structure. It's like building — you have a lot of pieces and you fit them all together."

Donnelly said ballet was chosen as the dance medium because of its grid patterning and formalism. "Glass Ballet" features 18 dancers and is a contemporary-style ballet with modern dance influences.

"Movement is about communication, and dancing is life — it can happen anywhere," Donnelly said. "When you do something that crosses the boundaries between science and art, it's a reminder that humans are very multifaceted, like the crystals."

The first piece of the ballet demonstrates a simple crystal ordered in a grid. While the temperature rises, the solid crystal molecules begin to dance while keeping their general place. In the second piece, which will be performed in fall 2014, the temperature will continue to rise and the crystals will melt, losing their structure. The heated molecules bounce together and back apart, which will be demonstrated with movement.

Chakrabarti said as the molten crystal liquid is quickly cooled, it gets stuck between a liquid and a solid, turning to glass. This process will be explored in the third and final ballet piece in 2015.

"Glass looks like a solid but is actually a liquid," he said. "If we wait long enough, the liquid starts to flow, creating cracks."

The researchers plan to use this project as a tool to encourage future collaborations, secure research funding and to expose students to new areas of study. The ultimate goal is to bring pieces of this ballet — or future collaborations focused on other scientific processes — to junior and senior high school students.

Chakrabarti and Donnelly are currently writing a grant proposal to make these visits a reality. A school visit could include a short lecture on glass transition or the double helix structure of DNA, followed by a small troupe of dancers demonstrating the same process.

"You express the same beauty and complexity, but in a different medium," Chakrabarti said. "Interdisciplinary work brings together people with different backgrounds but equal passion. The real big splashes can only happen this way — when you think totally outside of the box."

The researchers also worked with music director Bryce Craig, a former Kansas State University student and current graduate student at Central Michigan University.

— By Megan Saunders, Division of Communications and Marketing

Daniel Phillips, senior in physics and mechanical engineering, was involved with dance long before he found physics.

"I have always been intrigued with physics, but I didn't begin studying it until I came to K-State," Phillips said. "It's been incredibly interesting to have these two worlds combined."

As one of the dancers in "Glass Ballet," his physics background gives him a distinct perspective on the physical process being expressed through movement. Phillips said he has enjoyed using his physics background to interpret Donnelly's choreography.

"I'm able to tell this story using only the language of movement, but there's more to the story — it's science," he said. "I see it not only as dancer, but also from a scientific viewpoint. It's a story that means something special to me."

Although he said his physics knowledge might give him a clearer understanding of the physical process, he added that he doesn't believe he has any advantage over other dancers.

"Dance is art, and art is expression," Phillips said. "If the other dancers are enjoying the piece and feel like they are able to tell the story, then we're on a level playing field."

Charting internal maps

Exclusive biomedical instrument capable of safely imaging animal physiology set to advance medical treatments

Don't let their beady eyes, large incisors and tail fool you: Rodents may hold the keys for medical breakthroughs in treating cancer and other infectious diseases in animals and humans.

That's the focus a team of chemists, veterinarians and an electrical and computer engineer at Kansas State University are taking in a multidisciplinary approach to biomedicine. The researchers designed a one-of-a-kind biomedical instrument that heats specific cells in the body using a process called radiofrequency hyperthermia, which mimics how the body uses fever to fight infections. As the targeted cells are heated, the instrument produces high-resolution images of cells and internal organs. This enables researchers to monitor the heat's effects on inflamed cells and tumors in real time.

"By applying hyperthermia to a specific area of the body, we can really see what's happening at a very fine cellular level," said Stefan Bossmann, professor of chemistry and project lead. "When we see the physiological effect and heat distribution pattern in real time, we can tailor our techniques accordingly as we treat small animal patients with infections, cancers and other diseases."

Those small animal patients receiving personalized biomedicine will be rodents.

As the rodents are treated of their diseases, the techniques and information will be applied to help larger animals with similar illnesses. The research also may usher in personalized hyperthermia treatment for humans, Bossmann said.

High-tech approach

The National Science Foundation's Major Research Institute is funding the $1.9 million biomedical instrument — a modified wide-bore 600-megahertz magnetic resonance imaging spectrometer with a custom imaging probe. Because it is the first of its kind, parts are being crafted in Switzerland and France before the device is assembled in Germany and then shipped to Kansas State University.

Leila Maurmann, nuclear magnetic resonance/instrumentation manager in the chemistry department, will oversee the instrument after its installation at the university.

Rodents up to the size of a guinea pig are put inside what looks like a small spaceship, which is filled with air and an anesthetic gas so that they fall asleep. The craft travels up an elevator of compressed air and into a chamber of coils. The coils and custom imaging probe scan the rodent and computer software maps the rodent in 100-by-100 micrometer sections to produce a 3-D voxel-based image of the body, internal organs and any tumors.

Rodents are not harmed at any point in the process or the exam.

The instrument's software is being written by Punit Prakash, an assistant professor of electrical and computer engineering who researches radiofrequency hyperthermia. He also is developing the unique magnetic resonance imaging probe that makes it possible to produce high-resolution images and conduct targeted thermal cell therapy at the same time.

Studies with the device are expected to begin in October.

Divide and conquer

Deryl Troyer, a professor of anatomy and physiology who specializes in developmental defects and stem cell biotechnology, is collaborating with Bossmann and others on using hyperthermia and nanoparticles to treat cancer. Stem cells from the Wharton's jelly of umbilical cords as well as defensive cells are used to cloak magnetic nanoparticles and traffic them to tumors. A radio-frequency field heats the nanoparticles, overheating the tumor and killing it.

"The key is that as we get feedback from the instrument, we can fine-tune it and refine this treatment method to a greater extent," Troyer said.

Sanjeev Narayanan, associate professor of diagnostic medicine and pathobiology, will use the instrument to help treat the infectious disease Fusobacterium necrophorum — a bacteria that causes necrotic lesions on cattle's livers and causes cattle to grow more slowly.

A more deconstructed system that uses radio-frequency antennas to generate a similar analysis will be built for use on cattle and other large animals in the field.

Additionally, Bossmann said the instrument's hardware can be adjusted so that researchers can work with heart disease and other cardiovascular diseases.

"With this technology we can then start building integrated therapies," Bossmann said. "We have heat therapy, chemotherapeutics, can recruit defensive cells, and now will have an integrated piece of equipment that will be a springboard to do integrated therapy using these methods. There is no golden bullet to make advanced infectious diseases and cancer magically go away. They are systemic diseases and they have to be beaten with systemic methods."

According to Bossmann, the project's interdisciplinary approach — from construction to conducting research — is imperative to success with the biomedical instrument.

"It starts the dialog and teaching of a common language that researchers can take back to their departments and translate for others in their discipline," Bossmann said. "For example, Deryl can talk to the veterinary medicine researchers and explain the project in their language and I can do the same with the people in chemistry. This allows us to get third parties in faster because we can translate to different groups of people."

— By Greg Tammen, Division of Communications and Marketing

A research odyssey

How researchers plan to keep astronauts healthy in outer space

One small step may be a giant leap for humankind, but it also may be a way to measure an astronaut's health.

An interdisciplinary Kansas State University group is studying how astronauts' movements on Earth — such as small steps, walking or climbing — can indicate their fitness level in space and prepare them for future missions.

The large group — made of kinesiology, engineering and textiles researchers — is working on two NASA grants totaling about $2 million for four years. The aim is to provide biomedical support for astronauts who engage in extravehicular activities as part of future missions to the moon, asteroids and Mars.

The work focuses on two areas:

- Kinesiology and electrical engineering researchers are working with a lunar obstacle course and exercise ergometers to measure astronauts' physical capacities before they go to outer space. Mechanical engineers are creating a support system to simulate reduced-gravity environments like on the moon or Mars.
- Electrical and computer engineers are working with kinesiology researchers to develop biomedical sensors appropriate for spacesuit use that can monitor astronauts' health wirelessly while using body heat to power the electronics. Apparel, textiles, and design researchers built a model spacesuit to facilitate this research.

A lunar obstacle course

Space travel is inherently dangerous. Microgravity environments weaken astronauts' muscles, bone strength and cardiovascular systems, and make it difficult to perform tasks, such as climbing ladders, collecting rock samples or even walking.

"The question is, 'What is the minimum level of conditioning that the astronaut needs to maintain so that they will be safe at their destination?'" said Thomas Barstow, professor of kinesiology and one of the project's principal investigators. "We need to know that they're going to be strong enough to perform a variety of tasks."

The kinesiology researchers consulted with NASA and watched Apollo mission footage to design an obstacle course that simulates lunar tasks, such as climbing ladders, traversing a rock wall, turning knobs and lifting heavy objects.

As participants go through the obstacle course, the researchers gather physiological measurements, including muscle activity, heart rate and breathing rate. Electrical engineering researchers, guided by Steve Warren, associate professor of electrical and computer engineering, are working with the kinesiology team to analyze data and relate results to ergometer experiments that assess and predict fatigue in targeted muscle groups.

A group of mechanical engineers, led by Dale Schinstock, associate professor of mechanical and nuclear engineering, is developing a support system to suspend participants like a marionette. The system can adjust to simulate gravity on the moon or Mars while researchers gather physiological data.

"We want a description of each person's muscle strength, muscle endurance and cardiovascular endurance, so that we can predict their performance during the simulated lunar tasks," Barstow said.

The research includes numerous graduate and undergraduate students.

Spacesuits of the future

By working with a model spacesuit, electrical and computer engineers are exploring how wearable medical sensors can keep astronauts healthy on future space missions.

Bill Kuhn, professor of electrical and computer engineering, and Warren are among those leading the engineering portion, which also involves four additional faculty members and more than a dozen students. The engineering team consults with Barstow's kinesiology team to understand the practical application of new engineering designs.

"This is a systems-level project where we bring together integrated circuit design, software design, biomedical sensors, wireless technologies and the biology of people," Kuhn said.

The engineers are developing spacesuit biosensors to measure vital data, such as breathing rate or muscle activity, and are creating a wireless communication network so the sensors can connect with each other or with a space station, with minimal modification needed to the spacesuit.

The engineers are using 3-D electromagnetic field simulators and a spacesuit model. Because a real spacesuit costs $13 million, researchers in apparel, textiles, and interior design built a replica that uses metalized fabric layers to model real suit construction techniques that protect astronauts from the cold and vacuum of space.

Batteries are too dangerous to place in a spacesuit's oxygen-rich environment, so the team is developing new energy harvesting methods that use the temperature difference between body heat and the spacesuit's cooling garment to power radios and the associated biosensor electronics.

"This project is a good example of how when you do something in space, everything needs to be rethought — human elements and nonhuman elements of the system," Warren said. "We have a lot to learn about human physiology and what happens to a person as they physically change in a reduced-gravity environment."

Other involved engineering faculty members include Don Gruenbacher, associate professor and head of the electrical and computer engineering department; Dwight Day, associate professor of electrical and computer engineering; Balasubramaniam Natarajan, professor of electrical and computer engineering; and Tim Sobering, director of the Electronics Design Laboratory.

— By Jennifer Tidball, Division of Communications and Marketing

Watch participants go through the lunar obstacle course:
bit.ly/NASAcourse

Prairie roots run deep

Researchers, artists establish a little slice of the prairie on campus

Digging in the dirt in the middle of Kansas State University's campus is one of the many reasons Katie Kingery-Page, assistant professor of landscape architecture, enjoys her newest project, The Meadow.

A fledgling prairie plant oasis, The Meadow is, at first glance, rough and sharp in contrast to the perfectly manicured lawns around the campus. But Kingery-Page and collaborators look deeper and see it as an opportunity to teach, explore and relax among native plants from the prairie.

"People often have unstated expectations about landscapes and they can run deep, tied to our emotions," Kingery-Page said. "Landscape is a complex and symbolic part of our human environment."

The Meadow, outside the university's Marianna Kistler Beach Museum of Art, merges art, landscape architecture and biology while serving as a multipurpose educational site.

"With more than 30,000 visitors through the doors every year, the museum has the incredible potential to expose people to the research we do at Kansas State University in a way that other places might not," Kingery-Page said.

She and colleagues want to use The Meadow to coach researchers in visual thinking and learning to explain their research to public audiences. The Meadow also is a valued addition to the museum's educational program.

"When we do programs, especially for young people, we want to establish a common skill set of close observation and critical thinking," said Linda Duke, director of the Beach Museum and creator of The Meadow concept. "Science and art have a lot in common. Looking very carefully at things, thinking about what you see and wondering about connections are important practices in both science and art."

Along with Duke and Kingery-Page, the site's planning group includes Dede Brokesh, staff member in landscape architecture; Rhonda Janke, associate professor of horticulture; Zac Ratajczak, doctoral graduate in biology; Joe Myers, facilities and grounds maintenance; and the university's Division of Facilities and other collaborators from across the campus and in the Manhattan community.

The planning group began the project with help from university grounds staff members to mechanically scrape off the existing turf. Community volunteers seeded the site and planted more than 600 seedlings that were grown in the university's greenhouses. Once fully established — an average of five years from seed — the need for herbicides and water usage other than rainfall should be minimal or nonexistent.

"Using the scraping method, we reduced the amount of herbicide that had to be used to an application on only about 10 percent of the site," Kingery-Page said. "One of our goals was to have an example of a less chemical- and water-dependent landscape on campus."

While The Meadow's above ground appearance will soon resemble a patch of prairie, microbial conditions in the soil will take many years to become similar to an actual prairie. For this reason, the team is careful not to refer to this landscape as a "prairie," instead referring to it as a curated collection of prairie plants.

"Native prairie plants tend to have deep roots and are very drought-hardy," Kingery-Page said. "Prairie plants are adapted to varied conditions such as heavy clay, rocky soils and limited available nitrogen, so fertilizing and overwatering can actually favor the weeds."

According to its creators, The Meadow is an example of a sustainable and educational environment that doubles as an area where people can relax and enjoy their prairie roots.

— By Stephanie Jacques
Division of Communications and Marketing

The Meadow making process:

The prairie plants in The Meadow were selected by the planning group based on three criteria: The plant had to be native to Kansas or the Great Plains region; it added color or interest; and it wasn't too tall or invasive.

Seeds were donated from local collections or purchased from companies specializing in prairie plants. Some seeds required 30-60 days to stimulate as though they'd been through a winter, then two to four weeks to germinate.

The Meadow was made possible through donations from the Hummel family in memory of William Hummel, Kansas State University professor, and his wife, Sara Hummel. A Green Action Fund grant from the university's Office of Sustainability and Student Governing Association enabled a second wave of planting and the kick off of interpretation activities. The university's Division of Facilities, the College of Architecture, Planning & Design, the horticulture, forestry and recreation resources department and numerous community members have made in-kind donations.

The Meadow contains more than 40 species of native grasses and wildflowers. Some of the most dominant species include:

Little bluestem,
Schizachyrium scoparium

Sideoats grama,
Bouteloua curtipendula

Woodoats,
Chasmanthium latifolium

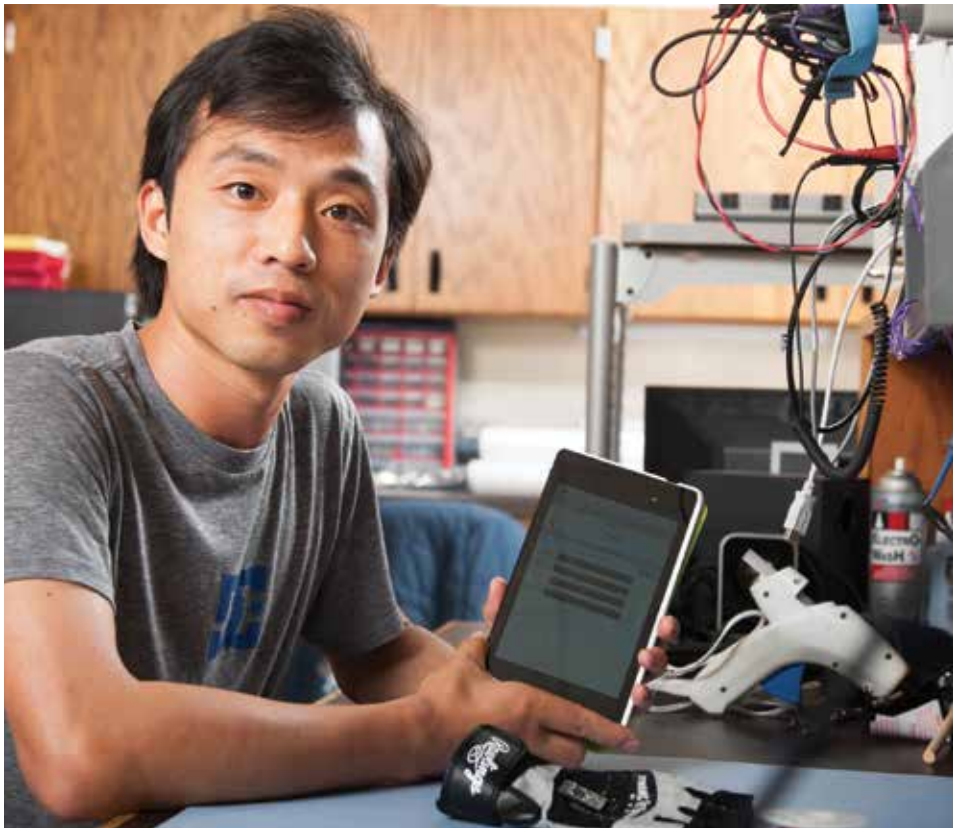
Brown-eyed Susan,
Rudbeckia triloba

Purple coneflower,
Echinacea purpurea

Plains coreopsis,
Coreopsis tinctoria

Rose verbena,
Glandularia canadensis

Bee balm,
Monarda fistulosa



FOR THE SAKE OF THE KIDS

Faculty meet in the middle to help children with disabilities

Faculty members at Kansas State University are leaping academic boundaries to help kids overcome disabilities. In one interdisciplinary project they are teaching magic tricks to help children develop skills and retain knowledge learned during the school year. In another project they are developing tools to help children with daily life.

Magic materializes when communities join forces

Sally Bailey, professor of theatre and director of the university's drama therapy program, is part of a magical initiative to conjure up executive functioning skills in children with developmental and social delays.

Executive functioning skills are a set of abilities that allow a person to plan, organize, strategize, pay attention and remember details, and manage time and space.

Bailey; James Teagarden and Marilyn Kaff, associate professors of special education, counseling and student affairs; Terri Holmberg, music therapist in the School of Music, Theatre, and Dance; Todd Holmberg, director of McCain Auditorium; The Friends of McCain; and the Manhattan-Ogden school district are working together to add magic to the Flint Hills Summer Fun Camp for children. They are testing whether learning magic tricks will enhance the campers' executive functioning skills.

"Learning how to do a magic trick affects more than just focusing and social skills; it affects all of the executive functions of the brain," Bailey said. "Magic involves sequencing, observation, impulse control and a lot of decision-making."

Aside from entertaining the campers, the magic activities will provide scientific data that may support anecdotal evidence that teaching magic helps children on the autism spectrum or with attention deficit hyperactivity disorder.

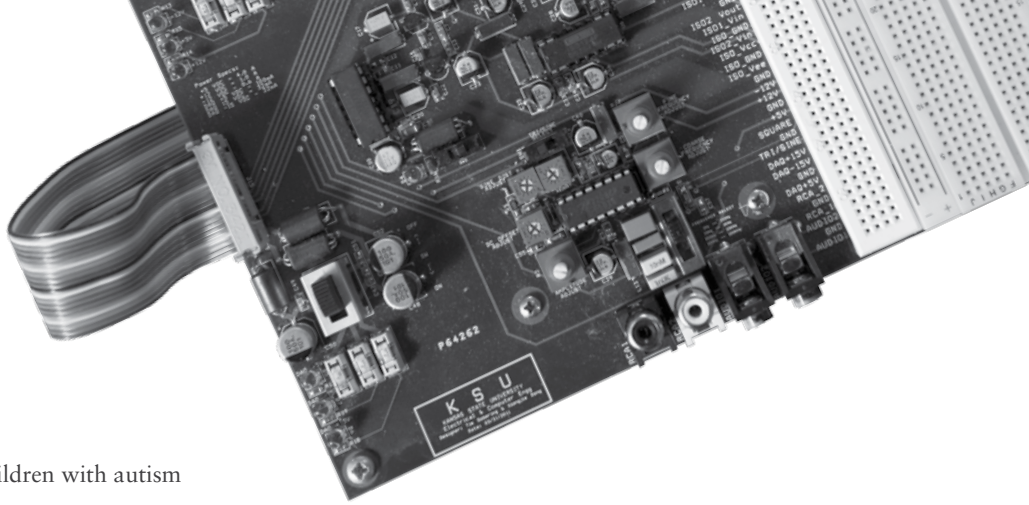
Kevin Spencer, international illusionist, developed the camp's curriculum, which is called Hocus Focus. He approached Todd Holmberg to help him provide scientific data to support his theory that teaching magic tricks improves children's developmental skills.

"Some of the greatest challenges children on the autism spectrum or with ADHD have are with social interactions and impulse control," Teagarden said. "The activities of the camp are designed to allow each student to resist the tendency to react, but rather plan their action."

Teagarden and Kaff will review the children's developmental achievements using Behavior Rating Inventory of Executive Function, or BRIEF, which is an assessment to determine if the child performs a task. They also are using a measure of social skills development and a measure of persistence to determine

if learning magic tricks has had an impact.

"We believe that the children will be motivated to learn how to do the magic tricks because not only will learning the skills be something new, but they also will be enjoyable," Bailey said. "We believe that the process of practicing and performing the magic will improve their executive functioning."



Developing technology with a heart

Electrical and computer engineers at Kansas State University are developing systems to help children with autism spectrum disorders and other special needs.

Steven Warren, associate professor of electrical and computer engineering, and Punit Prakash, assistant professor of electrical and computer engineering, are collaborating with Heartspring Inc. The Wichita-based nonprofit organization is a therapeutic residential and day school program that utilizes evidence-based and emerging best practices to serve students who often have multiple diagnoses, including autism spectrum disorders, cerebral palsy, speech and language impairments and other developmental disabilities.

The collaborative work is supported by a five-year $125,000 grant from the National Science Foundation's General and Age-Related Disabilities Engineering program.

The professors are using the grant to teach senior design courses where engineering students develop customized devices and software to help children at Heartspring.

Among the student-developed projects, one project involves a musical toothbrush that tracks brushing activity and plays different songs so children know how long to brush the different areas of their mouths. Another project has developed mattress and bed sensors that track breathing rates, heart rates and movement of children while they are sleeping and potentially can alert paraeducators of seizures and bedwetting.

"The intent of this program is to pursue a specific design for a specific child when possible," Warren said. "When we are finished with a design, that individual would then get to keep and use a copy of the design. This is research where you can add immediate benefit to these children's lives."

— By Stephanie Jacques and Jennifer Tidball, Division of Communications and Marketing

Inclusive research

Several recent student projects have focused on helping children and adults with autism.

- Apparel design students have developed special vests to help children with autism and with sensory integration disorders. These children often have difficulty with or responding to sensory stimulation from multiple sources, such as sights, sounds and movement. The vests provide a calming effect by using small weights placed at various points on the torso.
- Elizabeth Decker, a landscape architecture master's graduate, recently developed a toolkit to help designers and planners make cities more inclusive for adults with autism. The toolkit focuses on six needs for adults with autism: vocational training, life skills, mental and physical health support, employment, public transportation and affordable housing.
- By incorporating therapies and activities, Chelsey King Raymer, a landscape architecture master's graduate, created a school yard for elementary schoolchildren with autism. The school yard aims to help children feel comfortable by providing several aspects: clear boundaries, a variety of activities and activity level spaces, places where a child can go when overstimulated and a variety of ways to foster communication between peers.

— By Jennifer Tidball, Division of Communications and Marketing

Preparing for the storm

By designing sustainable drainage, researchers find common ground

Two Kansas State University projects show that when the collaborations reign, the results pour in.

The projects are improving stormwater management systems by bringing together students and faculty in numerous disciplines: landscape architecture, engineering, biology and agronomy, among others.

One project re-envisions the university's Campus Creek as a living laboratory for green, sustainable stormwater management.

Another interdisciplinary project involves the Environmental Protection Agency's Campus RainWorks Challenge competition. This successful collaboration landed Kansas State University multiple national winners in the 2014 competition.

"It comes down to communication, which is key to collaboration," said Jessica Canfield, an assistant professor of landscape architecture who is involved in both projects. "Finding common ground is important for a successful project. We want to initiate these early cross-disciplinary dialogues because students will never escape them in their professional careers."

Campus Creek

As part of the 2025 University Master Plan, students and faculty are improving Campus Creek. The creek runs through the Manhattan campus and receives most of the rainwater that falls on campus. It will serve as a research model for sustainable stormwater management methods.

The project uses sustainable improvements to make Campus Creek the core of campus, from education to recreation and research.

But there's another goal: to help students see interdisciplinary work as the core of successful research and application.

Canfield and Tim Keane, professor of landscape architecture, are combining their skills to lead the project. Keane's specialty is fluvial geomorphology and natural channel restoration, while Canfield is an expert in creating socially engaging, design-oriented landscapes.

Project collaborations include:

- Ryan McGrath, instructor of civil engineering, and graduate students are surveying the creek and creating elevation maps and hydrologic models.
- Landscape architects are creating vegetation maps that geo-locate trees and green space.
- Biological and agricultural engineers are analyzing water and soil samples with Philip Barnes, associate professor of biological and agricultural engineering.
- Campus planning and facilities management staff members, including Ryan Swanson, associate vice president, are helping the researchers address real design situations on campus.

Canfield and Keane will use the data when co-teaching more than 14 students in a fall semester course focused on restoring Campus Creek. Keane will help students develop a stable stream channel that floods less frequently. Canfield will guide student-designed creek improvements, such as new trails, outdoor classrooms, informal gathering spaces and additional vegetation.

Canfield and Keane see the project as a way to integrate different perspectives of engineers and landscape architects. While engineers often focus on efficiency, safety and numbers first — such as channel capacity or storage capacity — landscape architects often focus on visual aspects and ecological functions first.

"Engineers and landscape architects do similar things, but do them in different sequences," Keane said. "They can work independently, but when you put them together you get a much stronger product and a much more resilient stream system."

The project is receiving support from a university Green Action Fund, the provost's office and a university Academic Excellence Award. The landscape architecture program is dedicating a year of study to the creek as a gift to the university to celebrate the program's 50th anniversary.

RainWorks Challenge

Engineers and landscape architects also are collaborating on stormwater projects through the Environmental Protection Agency's annual Campus RainWorks Challenge competition.

The challenge encourages students and faculty to increase green infrastructure on campuses. More than 50 teams nationwide participated in the 2014 competition and Kansas State University was the only university to have multiple winners.

A Kansas State University interdisciplinary team of students and faculty placed first in the site design category for re-envisioning the campus area south of Hale Library. Another university team took honorable mention for redesigning the area next to the Beach Museum of Art, adjacent to the Hummel Family Meadow.

The redesigned sites include sustainable aspects, such as stormwater gardens, wet meadows, drainage canals and vegetation that need no supplemental irrigation once established.

The projects were part of a third-year landscape architecture design course that Canfield and Lee Skabelund, associate professor of landscape architecture, taught.

"The project allowed students to explore pressing issues related to integrated stormwater management with the twin goals of improving water quality and ecological performance — while providing beautiful and diverse systems that are quite different from what has been the norm on campus," Skabelund said.

For the projects, landscape architecture students worked with faculty advisers and graduate students in biology, agronomy and environmental design to create sustainable stormwater management. They also received support and guidance from Mark Taussig, associate director of campus planning and facilities management. Each team included a civil engineering student advised by McGrath.

"It is good for the students to see that other people have priorities that might be completely different from their own," McGrath said. "Between communication and being able to compromise, the students learned to find common ground to move toward the solution."

— By Jennifer Tidball, Division of Communications and Marketing

Great grains

A cross-disciplinary team is developing a nutritious, sorghum-based porridge for impoverished children in Tanzania

Malnutrition affects an estimated 195 million children worldwide and is the underlying cause of death in nearly 3 million children under 5 years of age

"We're trying to make nutritious products that will be useful in preventing malnutrition," Lindshield said. "Young children are especially vulnerable, and many problems they experience early in life are irreversible, meaning meeting their nutrition needs is critical."

A collaboration between five academic departments will be one for the recipe books.

Researchers in the Kansas State University colleges of Agriculture and Human Ecology are developing a series of novel, sorghum-based blended foods that use two cups of hot water to form a high-protein porridge. These food products can be used globally for supplemental feeding and nutrition programs for infants 6 months of age through children up to 5 years old.

Malnutrition affects an estimated 195 million children worldwide and is the underlying cause of death in nearly 3 million children under 5 years of age, said Sajid Alavi, professor of grain science and industry in the College of Agriculture. Alavi, who serves as the project's principal investigator, is an expert in extrusion processing and value-added uses of biological materials.

The university project is receiving $5 million in funding from the U.S. Department of Agriculture's Micronutrient Fortified Food Aid Products Pilot initiative, and is part of a joint initiative of the USDA and the U.S. Agency for International Development to improve effectiveness of their nutrition and food assistance programs around the world. The sorghum-based porridge mixes also could be used by other global agencies that have fortified blended foods in their emergency and supplementary feeding programs.

"Every year the U.S. ships about 200,000 metric tons of these fortified blended foods and spends about $700 million in food aid," Alavi said. "Currently, these commodities are corn-based and corn is not very sustainable. Sorghum, though, is sustainable and offers a lot of benefits over corn."

For example, sorghum is drought tolerant, largely resistant to fungal diseases, not genetically modified and takes less water to grow than corn, Alavi said. Sorghum also is one the major crops grown in Africa, and Kansas is the largest sorghum producer in the U.S.

Additionally, these sorghum-based porridge mixes developed by the university researchers are processed using extrusion — a technology commonly used for manufacturing common food products such as breakfast cereals and expanded snacks. Extrusion leads to efficient and complete cooking, ensuring the mixes use less energy and fuel to make into porridge in the homes than current fortified blended foods.

The Goldilocks principle

To find porridge mixes that are just right, researchers are studying various blends of sorghum with soybeans, cowpeas and corn-soy.

Since the project began in January 2013, 33 prototypes have been developed through these different blends and extrusion processing methods. Physical, nutritional and sensory analysis tests have helped the team narrow the prototypes to 17. The final five prototypes will be field-tested in Tanzania by 2,000 youth for 20 weeks.

For the field-testing portion, the team is collaborating with Project Concern International — a nonprofit, humanitarian organization — to reach out to families and children in Tanzania.

Edgar Chambers IV, university distinguished professor and director of the Sensory Analysis Center and an expert in food quality, is testing the physical and sensory aspects of the blends — such as consistency, texture and shelf life.

Brian Lindshield, an assistant professor of human nutrition in the College of Human Ecology who specializes in micronutrient fortification, is testing to ensure that blends contain absorbable iron and vitamin A.

Researchers also are evaluating the blends from a practicality standpoint.

For example, Tanzanians cook food aid products in the morning and store them in thermos-like vessels for the remainder of the day. This means that rather than requiring users to change their lifestyle, the sorghum-based porridges cannot break down over a day and must remain food safe for a long time period, said Sandy Procter, assistant professor of human nutrition whose research focuses on infant and childhood nutrition.

"We want to make sure these are food products that people would choose to eat if presented with other options because they not only taste good, but also fit into their lifestyle," Procter said.

Nina Lilja, an associate professor of agricultural economics and director of International Agricultural Programs, specializes in project monitoring and evaluation on a global scale. She is working on analysis of the whole farm-to-processing delivery chain in the U.S. and in Africa to understand the economic feasibility of these new food aid products.

"It's a very comprehensive project in that we're doing all the things a company would normally do," Chambers said. "We're looking at the research and developments components, the manufacturing and economic aspects as well as marketing the final products."

"We're trying to make nutritious products that will hopefully be useful in preventing malnutrition," Lindshield said. "Young children are especially vulnerable, and many problems they experience in early in life are irreversible meaning meeting their nutrition needs is critical." Researchers say they designed the project to be comprehensive for good reason.

The project will conclude in 2016.

— By Greg Tammen, Division of Communications and Marketing

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A new approach

Bioengineering expert at the helm of Kansas State University's research strategy

"I look forward to working with faculty, staff and students to further the research, scholarly and creative activities, and discovery mission. Together we will fulfill the K-State 2025 vision."

— Karen Burg

As a bioengineer, Karen Burg's footprint shows how her work is helping nature do what comes naturally — only better.

Her research has centered on absorbable polymers, biofabrication and tissue engineering. Three books, more than 30 book and encyclopedia chapters, nearly 90 refereed journal publications and nearly 120 conference proceedings are evidence of her research experience.

Not to mention more than 30 academic awards, including the Presidential Early Career Award for Scientists and Engineers in 2002 and a National Science Foundation Faculty Early Career Award in 2001. She is one of seven members of the 2014 inaugural class of American Association for the Advancement of Science-Lemelson Invention Ambassadors.

Beginning in August, her laboratory will encompass nine colleges and more than 90 research centers. Burg is Kansas State University's next vice president for research and will lead the university's research mission in support of the goal to become a Top 50 public research university by 2025.

Burg also will be a professor of chemical engineering in the College of Engineering. Darren Dawson, College of Engineering dean, has known Burg for nearly 20 years.

"Karen is exceptionally qualified and well-known, and has been highly respected during her time at Clemson University," Dawson said.

At Clemson University, Burg was the Hunter endowed chair, a professor of bioengineering and director of the Institute for Biological Interfaces of Engineering. From 2007 to 2011 she was Clemson's interim vice provost for research and innovation. Before that, she directed several of Clemson's laboratories.

She earned a bachelor's degree in chemical engineering from North Carolina State University, followed by a master's degree and a doctorate in bioengineering from Clemson University. Her postdoctoral fellowship at Carolinas Medical Center in Charlotte, North Carolina, focused on tissue engineering.

"Her energy and vision will help support our productive faculty as we expand one of the university's core missions," said Kirk Schulz, Kansas State University president.

— By Erinn Barcomb-Peterson, Division of Communications and Marketing