New Frontiers

Research and Creative Activity at the University of Nebraska at Kearney

Concrete Idea

MAHMOUD SHAKOURI
The 2020 New Frontiers recognizes a new era of collaborative research and creative activity at UNK, displaying the ways our amazing faculty continue to expand the impact of their work beyond the walls of their personal labs and studios.

UNK has always been a community where disciplinary walls are suggestions, where partnerships are the backbone of a unique culture of inclusion and out-of-the box thinking. Students and faculty solve problems with all available tools, including colleagues and methods from across our beautiful campus.

The faculty within these pages represent the very best of this spirit of community and collaboration. They take their work beyond typical boundaries, creatively solving complex problems with partners from across campus, other institutions and industry.

Jacob Rosdail, associate professor of communication and UNK's resident documentary filmmaker, perfectly captures this spirit of collaboration. His work and service aim to give voice and opportunities to those often overlooked. Through his partnerships with faculty from history, biology, modern languages, and the library, he is utilizing storytelling to highlight important issues for rural communities.

Dr. Mary Harner's very position, associate professor of communication and biology, is one of collaboration between two very distinct departments. This is reflected in her work, where she has partnered with photographers and a documentary filmmaker from UNL to better understand the changing watershed. Her exploration of new methods of analysis for photographic data has the potential to revolutionize the ways we study climate change.

Utilizing the environment to solve complex societal issues requires ingenuity and openness to new methods and ideas. Dr. Mahmoud Shakouri, assistant professor of industrial technology, is exploring how corn stover ash can potentially make new and better concrete from a renewable source. Working with faculty from chemistry, he aims to finds ways for a primary infrastructure material to last longer, cost less and be more ecofriendly.

Dr. Kate Heelan, professor of kinesiology and sport sciences, has always been a partner of the community. Her work on rural obesity interventions for children has spanned almost two decades in Nebraska and been implemented in communities across the state. Through her collaborations with UNMC Public Health faculty, she recently secured the largest federal research grant in UNK history, bringing significant resources to these community partners.

What do communication research with autistic children and astronauts have in common? For Dr. Philip Lai, assistant professor of communication disorders, their communicative behaviors have similar questions to be answered. Lai works to understand communication, behavior and cooperation, which sheds light on the ways both autistic children and astronauts communicate.

The Life in the Lab feature engages with the research of four women scientists, exploring the ways their work is changing the world and lives of students.

Dr. Kim Carlson, professor of biology; Dr. Surabhi Chandra, associate professor of biology; Dr. Annette Moser, professor of chemistry; and Associate Professor of Chemistry Dr. Kristy Kounovsky-Shafer use bench methods to answer questions that could have profound impacts on public health. Students are the foundation of these state-of-the-art labs, assisting these amazing scientists as they characterize viruses, the intersection of diabetes and breast cancer, understanding how much pesticide remains in harvested crops, or elongating DNA for analysis.

Finally, Jacob Hillesheim is the first student to grace the pages of New Frontiers. The 2018 winner of UNK's Outstanding Thesis Award, he hopes his research brings clarity to the ongoing free speech debate. A high school history teacher in Elk River, Minnesota, Hillesheim has reconstructed the 1969 U.S. Supreme Court case Brandenburg v. Ohio. The Office of Graduate Studies submitted his thesis for the Midwestern Association of Graduate Schools Distinguished Master's Thesis Awards competition.

New Frontiers 2020 celebrates the work of faculty from across campus and displays the ways these faculty are making a difference locally and globally. It has been a pleasure working with these faculty and seeing their work break boundaries and change the world. These faculty represent UNK’s collaborative and innovative spirit and community. I hope you enjoy the issue.
Without a doubt, the publication of New Frontiers magazine is a highly anticipated event on campus. And as you page through this, our 12th annual magazine, you’ll see why.

The faculty at the University of Nebraska at Kearney are the heart of the institution. You will see that their talents – collectively and individually – are astounding, but also nearly matched by their enthusiasm for their research and creative activity. You also will understand their passion for scholarly activity that they eagerly share with UNK students, their peers in the academe, the greater Nebraska community and beyond.

UNK is known best for its people and the experiences faculty and our students have as we pursue scholarship and explore new heights of creativity.

We work very hard on the day-to-day responsibilities of a vibrant regional public university, and there are times we should remind ourselves of the work being done by faculty and student researchers. These stories may not have been featured in the news, though they are indeed noteworthy. I hope you enjoy them and remember to tell these tales of impact and the people behind them as you visit with your friends, neighbors and colleagues.

Again in 2020, there is so much to be excited about: a new STEM building, great progress at University Village, new and renewed academic programs such as cyber systems and health communications, and a bold emphasis on growing our enrollment as an investment in the future of Nebraska.

Let’s continue to celebrate our pride in these scholarly activities and all that UNK does to make Nebraska great.

Douglas A. Kristensen, J.D.
Chancellor
CONTENTS

28 PROTECTING FREE SPEECH
Jacob Hillesheim

33 LIFE IN THE LAB
Surabhi Chandra

36 CAUSE AND EFFECT
Philip Lai

5 DOCUMENTING HISTORY
Jacob Rosdail

10 THE WATER’S EDGE
Mary Harner

16 CONCRETE IDEA
Mahmoud Shakouri

22 BUILDING HEALTHY FAMILIES
Kate Heelan

28 PROTECTING FREE SPEECH
Jacob Hillesheim

31 LIFE IN THE LAB
Kim Carlson

33 LIFE IN THE LAB
Surabhi Chandra

34 LIFE IN THE LAB
Annette Moser

35 LIFE IN THE LAB
Kristy Kounovsky-Shafer

36 CAUSE AND EFFECT
Philip Lai
DOCUMENTING HISTORY

Rosedail uses filmmaking to enhance UNK projects
By TYLER ELLYSON

Jacob Rosdail has always been a cinephile. As a high schooler, the central Iowa native was constantly looking for a reason to bust out his parents’ video camera. If a teacher wanted a report on Colombia, Rosdail filmed himself talking about the Central American country. When William Shakespeare was the topic, he gathered a few buddies and recreated a scene from one of the writer’s famous plays.

“I always liked making movies with my friends, and some of them were more serious than others,” said Rosdail, who grew up about an hour southeast of Des Moines. But he didn’t view this affinity for filmmaking as a potential career until he attended an electronic media camp at Wartburg College.

“That totally opened up my world,” Rosdail said. It also convinced him to enroll at Wartburg, where he double majored in electronic media and public relations with a goal of landing a job as a video editor in a medium-sized market.

As a senior, Rosdail interned with Mudd Advertising in nearby Cedar Falls, Iowa. The internship turned into a part-time job, then a full-time gig as an audio engineer and, within one year, he was a video editor producing automotive advertisements for markets in all 50 states.

“I was doing what my five-year goal was,” Rosdail said, but he wasn’t happy.

“I was part of an assembly line. I didn’t have any ownership in any of the ads.”

Inspired by public radio and programs such as “This American Life,” Rosdail set out to do something more creative with his life. He wanted to be a storyteller.

NEW PATH

Rosdail got his first taste of documentary filmmaking while working for the Communication Research Institute of William Penn University, a private, liberal arts school in Oskaloosa, Iowa.

In addition to teaching students about video production, Rosdail produced stories for the university-affiliated news outlet. Oftentimes, he would profile interesting or important people in a documentary style to accompany this work.

His first full film – “Historic Measures: Preserving our Future” – highlighted the renovation of a historic building in downtown Oskaloosa. That project led to a partnership with Iowa Public Television that allowed him to produce more documentaries, including a historical piece on Buxton, Iowa, a former coal-mining town with a predominantly African-American population that flourished in the early 20th century, as well as a film focusing on Alexander Clark, who filed the landmark lawsuit that desegregated Iowa public schools in 1868.

Inspired by his passion for documentary filmmaking, Rosdail enrolled at Wake Forest University in 2011 to learn more about the craft.

“I want to stir a passion in students, and hopefully that passion leads to a career.”

During his time at Wake Forest, where he earned a Master
of Fine Arts in documentary film, Rosdail was director of the school’s graduate student-run video production company, Wrought Iron Productions, and served as a teaching assistant.

“I liked making my films, but I also liked helping other people make their films,” he said. “A lot of documentary filmmaking is problem-solving. You want to have a plan going in. You want to shoot going toward that end, but this isn’t a scripted film. You don’t know what your ending is. You can’t predetermine it.”

Much like the filmmaking process, graduate school took Rosdail down an unexpected path.

He fell in love with teaching, started a family with his wife Ashley Weets, and decided he wanted to be a college professor.

UNK COLLABORATIONS

An associate professor in the department of communication, Rosdail has spent the past five-plus years teaching University of Nebraska at Kearney students the ins and outs of video production – from the basics of operating a camera to editing and creating their own films or news packages.

“I want to stir a passion in students, and hopefully that passion leads to a career,” said Rosdail, who works with students pursuing degrees in advertising/public relations, journalism, multimedia, sports communication and other majors.

His students have partnered with local nonprofits to produce advertisements, they create news content that’s uploaded to YouTube, and many of them have worked in production assistant roles for Rosdail’s films – shooting b-roll, transcribing interviews, creating promotional materials and handling various other tasks.

“I want to get students involved with my films whenever possible,” he said.

Rosedail also uses his talent to enhance his colleagues’ research. As the only documentary filmmaker among the UNK faculty, he’s often sought out for collaborations that benefit from his creativity.

“I love working with other faculty members because I don’t have to be an expert on anything. That’s the best part,” Rosdail said with a smile. “I learn a lot from them about their methodology, and I hope they learn from me how to promote their research in more accessible ways.”

Many researchers write papers for academic journals, Rosdail noted, but “most of the people who will read them are academics.” By creating a short documentary or film, that audience is expanded to other demographics.

One of Rosdail’s first projects at UNK was a partnership with associate history professor Jeff Wells that examined the history of the Kearney Army Air Field and Kearney community during World War II.

The project, which also involved several UNK students, digitized items from the Buffalo County Historical Society Trails and Rails Museum to create a website dedicated to this local history. These items included hundreds of photographs, thousands of pages of Kearney Army Air Field government documents and audio files from an air field reunion in 1988, when historical society volunteers conducted interviews with veterans.

Rosdail’s portion of the project, called “Kearney Goes to War,” was a documentary film that utilized historic photos and audio files, as well as interviews with people who had connections to the air field. The venue was filled to capacity during two screenings of the documentary at The World Theatre in downtown Kearney.

FRANK MUSEUM

The 37-year-old took a similar approach when he produced “Stone Mansion on the Prairie,” which tells the story of the G.W. Frank Museum of History and Culture during two significant periods – as the private home of George Sr. and Phoebe Frank in the late 1890s and as part of the Nebraska State Hospital for Tuberculosis from 1912 until 1972.

Rosedail spent about two years creating the 50-minute documentary, which premiered in April 2018 as part of a...
reveal event for the reinvented museum, located on the west side of the UNK campus.

The first half of the film focuses on the rise and fall of the Frank family and their vision for Kearney.

Local architect George William Frank Jr. designed the lavish house – one of the earliest in the Great Plains with electricity when it was completed in 1890 – for his parents, George Sr. and Phoebe Frank.

George Sr. earned his fortune investing in real estate. His company built the Kearney Canal, which began producing electricity in 1887 and triggered an industrial boom in the community.

The second half of Rosdail’s documentary features stories from the Nebraska State Hospital for Tuberculosis, which operated in Kearney for 60 years and included the Frank house and several other buildings on what is now UNK’s west campus.

Rosedail worked alongside then-Frank Museum Director Will Stoutamire to collect firsthand accounts from people impacted by the hospital, including family members of former patients and employees.

His film, which involved more than a dozen UNK students, also captured the process as Stoutamire led a project that reinvented the museum by tackling much-needed restoration work, adding new displays and technology and reviving the building’s history as part of the state tuberculosis hospital through a permanent exhibit.

Rosedail produced a second documentary, “A Plague on the Plains,” that focuses entirely on the Nebraska State Hospital for Tuberculosis. It aired in February and March on NET.

RIVER EXPLORATION

When Rosdail wanted to venture outside his comfort zone, he reached out to Mary Harner, an associate professor in the departments of communication and biology.

They worked together in 2016-17 to film and produce “Life on the Gila,” a documentary highlighting New Mexico’s Gila River and its importance to the region. It was Rosdail’s first “nature film.”

Nestled in southwestern New Mexico in the headwaters of the Colorado River system, the Gila is one of the most dynamic and natural-flowing rivers in the U.S.

“Because of that, it has a very diverse ecosystem,” Rosdail said. “Very unique types of wildlife are attracted to the river.”

The 25-minute film focuses on residents’ connections to this river and their visions for its future, exploring both the pros and cons of proposed projects that would alter the river to support agriculture and development.

“I was really interested in a story that captured a lot of different perspectives,” said Harner, noting that Rosdail’s expertise helped them explain both sides of the issue.

“He didn’t have any preconceived ideas and could talk to people pretty openly,” she said. “I thought that was really valuable. We were able to capture a lot of different voices during this snapshot in time.”

“Life on the Gila” premiered at the Santa Fe Independent Film Festival in 2017 and was selected for the Docs Without Borders Film Festival and Colorado Environmental Film Festival. Rosdail and Harner also showed the film when they hosted the River Stories Media Festival at The World Theatre in 2018.

“Good storytelling adds value to all the work we do,” Harner said. “Collaborating with people who bring those skills as part of their background and professional training makes it possible for others to share their message in new ways.”

IMMIGRANT STORIES

Rosedail’s goal as a filmmaker is to take audiences on a journey that both informs and evokes emotion.

One of his most recent projects does exactly that.

For the past two-plus years, Rosdail has been working with UNK associate Spanish professor Michelle Warren and archivist Laurinda Weisse to document the stories of Latin American immigrants living in central Nebraska.

The project, which was conceived shortly after the 2016 election of President Donald Trump, is a response to the ongoing debate over immigration laws in the U.S.

“I definitely wanted to make a film about this moment in time and these people living in uncertainty,” Rosdail said. “This was a good opportunity to highlight a population I think a lot of people don’t feel empathy for.”

Titled “Coming to the Plains,” the project focuses on
nearly two dozen Latinos who immigrated to central Nebraska, including some who were brought to the country as young children.

The UNK team interviewed immigrants from all walks of life – students, parents, a high school custodian, meatpacking plant worker, immigration lawyer and grocery store owners, among others – asking them about their decision to come to the U.S., how they’ve acclimated and the obstacles they face. Each interview will be documented in English and Spanish, with help from UNK’s Spanish translation and interpretation program.

Their goal is to humanize the immigration debate, putting people in the shoes of those impacted by U.S. policies.

“Coming to the Plains,” which is in the editing phase, will debut this spring as an installation at the Frank Museum.

Other plans include podcasts, web videos, academic articles and a traveling exhibit that can be displayed in communities across the state.

“Hopefully you will come away from it having felt something,” Rosdail said. “If it doesn’t change minds, it will at least help people see the other side.”

Calling him an “immaculate professional and perfectionist,” Warren praised Rosdail for his work on the project.

“Shy to brag about any of his accomplishments, he passes himself off as a ‘videographer,’ claiming that ‘cinematographer’ sounds too fancy,” she said. “Jacob Rosdail is without any doubt a true cinematographer, and his work has raised our Latinx oral history project to a level where it will touch lives and influence public opinion on the reality central Nebraska’s immigrants face.”

“A lot of documentary filmmaking is problem-solving. You want to have a plan going in. You want to shoot going toward that end, but this isn’t a scripted film.”
THE WATER’S
The most interesting things seem to happen at the edges where two disparate entities meet.

A seed touches the soil; a city creeps into the country; a river rubs against the bank. The proximity triggers all sorts of reactions that scientists love to explore. They sometimes observe them in labs, manipulating environments in a test tube or predicting outcomes using computer models. But some systems are too big to study inside the lab – then maybe the lab goes outdoors.

A river system is like that.

A watershed that drains thousands of square miles is just too big to see what individual events can cause. But what if you could study river ecosystems over a long period of time, comparing changes you can see, trying to deduce what induced those changes? That’s what Mary Harner does. And this scientist adds a new wrinkle – she’s also an accomplished communicator, so she not only knows the science, she can tell others, too, using photographs and other visualizations to exchange knowledge and educate others about her favorite environment – rivers.

Kearney, Nebraska, Harner notes, is a great place for someone who likes to study rivers. The Platte River flows nearby, and the Platte plays a prominent role in her research. Harner came to Nebraska in 2008. Her husband, biologist Keith Geluso, had joined the University of Nebraska at Kearney faculty, and soon after she began a shared position as an assistant professor of biology at UNK and as wetland ecologist for the Crane Trust. In 2012, she was named director of science for the Crane Trust and in 2015 joined UNK as a research associate professor. Since 2016, she has been an associate professor in the departments of communication and biology. The dual appointment is unusual, she acknowledges, and is a recurring theme of those intersecting edges that fascinate Harner.

“What I have come to really appreciate about the Platte and other rivers is the edges, the ecotones,” she said.

Ecotones are a region of transition between two biological communities, such as the river and the shore. Ecotones often are richer in species and variations than either of the two habitats alone. Harner is especially interested in sloughs, the linear depressions on the edges of the river through which water periodically pulses – creating floods, drylands, wetlands. The slough’s boundaries constantly change as the river ebbs and flows. This, she notes, creates a lot of interesting situations for the plants and animals that live there.

Harner grew up on the banks of the Mississippi River in Alton, Illinois, near the Mississippi’s confluence with the Missouri River. While her family lived on the high bluff, her father’s pharmacy was downtown, near the river. And in 1993, when both the Missouri and Mississippi rivers experienced devastating floods, the town of Alton was hard hit, leaving an impression on Harner.

She later went to Tulane University in New Orleans (another river town, which she notes is also a recurring theme in her life), intending to study biomedical engineering. But
a class in ecology her sophomore year changed her trajectory. After earning her bachelor’s degree in ecology, evolution and organismal biology, she headed to the University of Montana to pursue a master’s in environmental studies. There, she studied a freely flowing river and had the chance to see how a river with dynamic flows interacts with its floodplain. After earning her master’s, she went on to earn her doctorate in biology from the University of New Mexico in an interdisciplinary doctoral program in freshwater sciences.

In her early research, she was particularly drawn to cottonwood trees, in part because they reminded her of home in Illinois. In Montana, she studied a dynamic river system that flowed near Glacier National Park and looked at cottonwood tree rings and historic aerial photographs showing the Flathead River floodplains. Later, she studied soil fungi that live among cottonwood roots, looking at how the fungi’s properties affected the soil biome and other plants. This, she notes, is another recurring theme – looking at what’s happening above and below ground and the interaction of edges. That work required taking photographs below ground to capture visually the changes occurring with roots. Those photos, she notes, were not very exciting for non-scientists to look at.

**PLATTE TIMELAPSE PROJECT**

The Rio Grande has endured centuries of human intervention and interactions, she said. It’s in some sense an urban river; with headwaters in Colorado it flows near Albuquerque, New Mexico, then veers into Texas. The river comprises part of the border between the United States and Mexico. The influence of humans on the river is unending as both indigenous people and European settlers have relied on the river.

Harner used historical aerial photos of the Rio Grande as it passes through Albuquerque to track changes in the river channel and human encroachment into a once wild river floodplain. “It was there I started to see the power of the historical context,” she said, “how things that are hard to see in real time can be seen when you compare data from an image. You get a more complete story.”

And, she notes, because we live in a visual society, images help reach different audiences.

While at the Crane Trust, Harner became involved in the then-emerging Platte Basin Timelapse Project, a long-term, multimedia documentary project focused on the Platte River watershed, which encompasses more than 90,000 square miles in Colorado, Wyoming and Nebraska. Platte Basin Timelapse, co-founded by Michael Forsberg and Michael

“People are searching for ways to manage rivers to meet societal and ecosystem needs as human populations and demands for freshwater increase globally.”
Farrell, is based at the Center for Great Plains Studies at the University of Nebraska-Lincoln. The hallmark of the project is the permanent placement of more than 60 cameras along key points in the watershed. Each camera takes one photograph per daylight hour, 365 days a year. The project has more than 2 million photos in its archives, which are ripe for study by scientists and others interested in how the river changes over time and how the environments through which the river flows are changing.

Harner realized the time-lapse methodology was a powerful tool for science and communication, and she is using its methods to study other river systems, particularly the Gila River, which like the Platte has sustained long-term human use, although it’s in a much more wild state.

In 2018, Harner received a National Science Foundation research fellowship, awarded through the federal Established Program to Stimulate Competitive Research (EPSCoR), to fund collaboration between UNK and the University of New Mexico to learn about river systems, and communicate rivers’ importance to public audiences. The Platte, Gila and Rio Grande rivers are the foci of the project. The project looks at historic and current influences on water-use decisions and the drivers of change across river basins, highlighting connections within and across these systems.

Harner and an early career researcher at UNK, Emma Brinley Buckley, are applying digital technologies such as time-lapse cameras and sound recorders to document the rivers’ ecosystems and collect ecological data. Harner and Brinley Buckley are using the information to help public audiences understand the importance of rivers, watersheds and floodplain systems. The project is expected to last about two years.

“People are searching for ways to manage rivers to meet societal and ecosystem needs as human populations and demands for freshwater increase globally,” Harner said. “Communication among diverse stakeholders is necessary for achieving solutions for how to simultaneously utilize and protect freshwater resources.”

The digital media produced will be shared with a range of audiences to determine how people respond to and learn from various forms of scientific content, with an ultimate goal of developing a deeper connection between people and river systems. Fellowship activities will transform ongoing research at the University of Nebraska and provide opportunities for students to access information, approaches and skills to understand and describe the changing world and prepare for careers that increasingly focus on working in teams across disciplinary – and watershed – boundaries.

The project will expand ongoing research and science communication activities taking place across University of Nebraska campuses, particularly with Platte Basin Timelapse. Harner and Brinley Buckley have a robust web presence at

See more creative collaborations related to watersheds at WitnessingWatersheds.com and PlatteBasinTimelapse.com
“We are so lucky to be in natural areas that are so awe-inspiring. Curiosity works quickly in such an environment.”
school students in classrooms across the state. Another led to a study of how birds and animals reacted to the 2017 total eclipse that crossed Nebraska.

Her most recent focus is to add sound to the images.

“Sound is a very powerful tool, and to add sounds to a presentation adds a new layer of information. You can see audiences respond as they perceive new things when sound is added to images.”

Adding sound to the time-lapse images will enrich the Platte Basin time-lapse data set, she said. Sound is a rich data source for scientists, allowing them to study the timing of animal activity. For example, sometimes one can hear cranes, waterfowl or frogs on the Platte in the springtime before the cameras actually photograph them.

While many digital media productions about rivers, prairies, mountains and the natural world seem to focus on beauty, Harner said that’s just one way to begin to engage audiences.

“We always start presentations with the question of why. Why care about rivers? About prairies? We may start with beauty, but sometimes the things that matter are not that captivating. But we are all connected, and it’s important to come to know that. As we make decisions, we need to know what the consequences might be if we sever those connections. We need to be cautious and informed in making those decisions.

“At the core of what we are doing is building relationships and understanding of ecosystem connections through interdisciplinary research, student training and public communication,” she said. “It’s a very rewarding intersection of fields.”
Shakouri believes corn can improve cement production

By TYLER ELLYSON

Concrete is the foundation of the future.
In 2016, when the Trump administration announced a plan that directs $200 billion in federal funding toward projects that repair or replace aging roads, bridges and other infrastructure. The goal was to spur at least $1.5 trillion in infrastructure investments after local, state, tribal and private contributions.

However, Shakouri believes the problem extends beyond financial commitments.

“The concrete we have now compared to 50, 60 years ago is not the same.”

Another concrete-related concern is its environmental impact.

Production of Portland cement – the most common type used in concrete – generates approximately 7% of greenhouse gas emissions worldwide. For every ton of cement produced, a nearly equal amount of carbon dioxide, a greenhouse gas linked to global warming, is released into the atmosphere.

“It’s a big topic of research from an environmental perspective,” Shakouri said.

These issues must be resolved to improve concrete production, according to the UNK researcher, who believes Nebraska’s most common crop could be part of the solution.

CORNCRETE

After studying architectural engineering and construction management at Azad University of Tehran and Universiti Teknologi Malaysia, Shakouri came to the U.S. in 2012 to attend Louisiana State University.

Shakouri was interested in construction but hadn’t yet narrowed his scope to concrete. He graduated from LSU

It’s an issue U.S. President Donald Trump targeted immediately after his election in 2016, when he announced a plan that directs $200 billion in federal funding toward projects that repair or replace aging roads, bridges and other infrastructure. The goal was to spur at least $1.5 trillion in infrastructure investments after local, state, tribal and private contributions.

However, Shakouri believes the problem extends beyond financial commitments.

“The concrete we have now compared to 50, 60 years ago is not the same,” he said. “We’ve made a lot of progress in automating the process, but I feel like the quality of the concrete is not as good as what we had before.”

Shakouri points to the Roman Empire as an example of this decline. While many of those structures – the Pantheon, Colosseum and others – are still standing nearly 2,000 years later, roads built today begin to crack and deteriorate within a year or two.

This is especially noticeable in cold-weather states such as Nebraska, where one of the primary causes of deterioration in concrete bridges and roads is the use of salt, deicers and anti-icing chemicals during snow and ice removal. When these chloride-based chemicals seep into concrete, they corrode the reinforcing steel inside, weakening the structure and shortening its life span.
with a master’s degree in industrial engineering, then enrolled in a Ph.D. program at Oregon State University, where he found a professor researching concrete.

“There are a lot of opportunities to do research in this field,” said Shakouri, whose dissertation looked at how chlorides impact the service life of concrete structures.

One of those opportunities focuses on supplementary materials that can replace a portion of the cement used in concrete, improving the product’s strength and durability, reducing production costs and lowering the environmental impact.

The most common supplementary materials added to cement are fly ash, blast furnace slag and, to a lesser extent, silica fume. However, fly ash – a byproduct from coal-fired power plants – is getting harder to come by as environmental regulations impact these power plants, many of which have been shut down or converted to use fuels other than coal.

The current supply of supplementary cementitious materials can only meet about 15% of the concrete demand worldwide, according to Shakouri.

Extensive research was already underway to identify alternative cementitious materials, including bioashes from rice husks and sugarcane mills, but very few people were looking at corn.

“When you look at the literature, maybe 90% of the researchers studying corn are from Nigeria,” Shakouri noted.

“When I got the job at UNK, everyone in Oregon told me, ‘You’re just going to see corn for the rest of your life.’ I didn’t believe them. But when I came here, I saw corn everywhere.”
A native of Iran, Shakouri admits he knew “nothing” about the crop when he earned his doctorate in civil engineering from Oregon State.

“When I got the job at UNK, everyone in Oregon told me, ‘You’re just going to see corn for the rest of your life,’” he said. “I didn’t believe them. But when I came here, I saw corn everywhere.”

Shakouri, who joined UNK’s Department of Industrial Technology in August 2017, also saw the potential to use the commodity in a completely new way.

He calls it “corncrete.”

SOLID PRODUCT
Corn is the most produced grain in the world, with more than 1 billion metric tons harvested each year.

The U.S. produces about one-third of that total, and Nebraska is among the top corn-producing states, with an estimated 1.8 billion bushels harvested in 2018.

About 252 million metric tons of corn stover – the cobs, stalks, leaves and husks left over after harvest – were produced in the U.S. that year. Corn stover is typically used as livestock feed or to make biofuels, but Shakouri believes it can be a sustainable source of supplementary cementitious material for the concrete industry.

In 2018, he launched a pair of research projects to support this theory.

One study, conducted by Shakouri and UNK chemistry professor Chris Exstrom in collaboration with Prannoy Suraneni, an assistant professor at the University of Miami, focused on whether corn stover ash can meet the industry standards to be used as a supplementary material in concrete.

The second research project, a collaboration between Shakouri and Exstrom, looked at whether corn stover ash can improve the durability of concrete and reduce its permeability.

In both projects, the UNK researchers tested three types of corn stover ash, which was produced in a high-temperature cyclonic furnace on campus. A compression testing machine
was used to measure the strength of each concrete sample, and Shakouri received $205,000 from the Nebraska Research Initiative to purchase state-of-the-art equipment for material characterization and corrosion assessments.

To test the quality of ash produced, Shakouri burned both raw corn stover and chemically pretreated corn stover. He found the ash from raw corn stover contains many unwanted chemicals that can adversely impact the quality of concrete. However, the ash from pretreated stover produced promising results.

The pretreated corn stover ash – mixed in cement at levels of 5% and 20% – improved the overall strength of the hardened concrete and made it three times more resistant to electrical currents. This means the concrete is less susceptible to chloride and other harmful compounds.

“That is very significant,” Shakouri said. “I think it’s a good selling point for this product.”

He also noted that the pretreated corn stover ash produced a higher silica content than fly ash, which improves concrete’s strength and abrasion resistance.

OTHER BENEFITS
In addition to boosting concrete’s physical properties, Shakouri sees several other reasons to consider adding corn stover ash to cement.

Unlike coal, which takes millions of years to form, corn is planted and harvested each year, making it a more sustainable option than fly ash. Corn stover also burns at about 400 to 500 degrees and requires no additional fuel, so the ash takes significantly less energy to produce compared to standard cement, a mix of limestone, clay and other materials burned at about 2,000 degrees.

By replacing a portion of the cement with corn stover ash, Shakouri believes the product’s environmental impact can be reduced.

He estimates half of the corn stover produced in the U.S. can offset 7% of the country’s cement production, reducing carbon dioxide emissions by 4.5 million metric tons annually. This leaves 50% of the corn stover for other uses, such as livestock feed and biofuels.

Adding plants to produce corn stover ash would create new jobs, boost the state economy and give farmers another revenue source, according to Shakouri.

“I think it’s a win-win situation,” he said. “There’s definitely an economic advantage.”

As far as commercial production costs, Shakouri said there are secondary products that would help outweigh the expenses.

“When you make corn stover ash, you’re not making a single product. You’re making several products,” he said, providing few details because the researchers are in the process of patenting these products.

On the construction side, Shakouri called his research results “very promising.”
Last fall, he shared his findings with officials at the Federal Highway Administration in Washington, D.C.

“They were very interested,” said Shakouri, who has already submitted two grant proposals through the National Cooperative Highway Research Program to expand his research and written three papers for publication. The previous projects were supported by a UNK Collaborative Research Grant and funding from Nebraska’s Established Program to Stimulate Competitive Research (EPSCoR), part of a National Science Foundation program aimed at strengthening STEM research.

Moving forward, Shakouri plans to look at whether different species of corn from Nebraska, Iowa and Illinois impact the quality of ash that can be used in cement.

“We’re still in the beginning stage,” Shakouri said, noting that a new type of cement must go through several years of research and testing before it’s approved.

“We still have a long way to go to make this material available for the public.”
Dr. Kate Heelan grew up eating right and staying active, became a high school athlete and earned a college soccer scholarship. When her own children started school, though, she realized why so many people have trouble staying healthy.

“I saw my daughter, who’s very smart, being fed everywhere she went. She would get A’s, she would get perfect attendance, and every reward she was given was a food reward,” Heelan said.

Even when coaching her children’s soccer teams, one of the first jobs was to fill out the sign-up sheet for snacks and drinks.

“I didn’t realize how much food influenced our environment. So even though we were an active family, everywhere you turned around you had to bring a snack for something.”

Her awareness of the barriers between children and a healthy lifestyle has informed Heelan’s work as an educator and researcher.

Heelan, director of UNK’s Physical Activity and Wellness Lab, has created programs to prevent and treat pediatric obesity for more than two decades. While quick to stress that she’s always been part of larger teams, Heelan has secured funding for and coordinated projects that affect thousands of Nebraska children.

Thanks to her largest grant so far – $2.5 million from the Centers for Disease Control and Prevention – Heelan and her team are packaging a long-running obesity treatment
program called Building Healthy Families for broader distribution. While eager to reach more families, she’s also taking care to keep the program’s focus where it’s always been: on the kids.

“I feel like I’ve always taken a more realistic view because my kids have always been so involved. I’m not a good cook, and it’s unrealistic that there’s going to be a healthy dinner on the table every night at 6,” said Heelan. “So how can we help other families figure out how to make better choices in a busy, fast-food-laden environment where as busy as we are, we can still be healthier.”

When Heelan began her research, as a UNK graduate student in 1993, the country’s obesity epidemic was already old news. The most recent CDC data shows about 20% of American children (one of every five) are classified as obese.
WALKING SCHOOL BUS

One of Heelan’s first efforts was a Walking School Bus program, in which UNK student volunteers walked children to and from their elementary schools as a way to increase physical activity and decrease excessive weight gain. In 2008, she began working with local schools on policies to increase physical activity and offer healthier food options, including limiting classroom celebrations and offering non-food rewards.

Her research on those changes, published in the journal Childhood Obesity in 2015, showed a 15.2% relative decrease in the prevalence of obesity at those schools between 2006-12.

Fifteen years ago, Heelan helped create the Nebraska Kids Fitness and Nutrition Day. The annual event brings fourth graders to UNK for two hours of nutrition education and two hours of physical activity.

“The first year we were hoping for 200 kids, and we got 400,” she said. Today, 800 students come to UNK, and programs across the state use the same curriculum. She estimates the program impacts 2,000 children annually.

The BMI Report Card is a web application that calculates body mass index and generates a “report card” that can be emailed to parents. Heelan formed a team to develop the app after working with schools that were going to end height and weight screening as part of their normal health assessment, due to budget cuts.

“I just didn’t think a nurse should tell a family their child has high blood pressure and not bring up weight as a way of helping their health,” she said.

Almost 30 schools across the state now use the application, with most using the parent notification system as well.

“So now in the schools, someone just has to stand there with an iPad, plug in the height and the weight and it will do all the calculations and then upload it into our web application,” she said.

SEEING THE DIFFERENCE

About 10 years ago, Heelan’s efforts shifted from obesity prevention to treatment with the creation of the Building Healthy Families program. She credits Dr. Kenton Shafer, who helped develop the BMI Report Card, with helping spark the change. A Kearney pediatrician, Shafer didn’t feel

“We’re not trying to get just anyone in the door. We want to work with families who want to be here.”
right about notifying parents their children were overweight without having a treatment program that could offer help.

Adapted from an evidence-based program, Building Healthy families is designed for children ages 6-12. Families meet for 12 weeks with education on nutrition, lifestyle modification and physical activity. Follow-up sessions last six months.

Heelan teamed with nutritionist Kaiti George and psychologist Nancy Foster on the project.

“Kaiti George developed and delivers the nutrition education, Nancy provides the lifestyle modification lessons, and I coordinate the program. We’ve had different people do the physical activity side of things over the years, but the three of us have stayed true,” Heelan said, adding the program has benefited the team as well as the families.

“You do feel good, and you see a kid who at the end of three to six months carries themselves differently, feels differently about themselves. The data definitely shows huge differences.”

A study of the first nine cohorts shows both adults and children not only decreased their body mass index significantly, but also lowered their blood pressure and improved their blood lipid health. The children also saw decreases in their fat mass and increases in their fat-free body mass.

Even before crunching the numbers, though, Heelan knew of the program’s effectiveness from the families themselves.

Two fathers, she said, no longer need blood pressure medications thanks to their lifestyle changes, and one also dropped his cholesterol medicine. One child, who no longer needs his asthma inhaler, asked his teacher if their class could have a “healthy party,” rather than the sugar-infused parties they normally had.

Then there was the boy who asked his grandparents if they could start going out to lunch at Subway rather than other fast-food places. He and his father, who had a heart attack at 35, began running 5Ks together after going through Building Healthy Families. They eventually ran the 10-kilometer Bolder Boulder race.

“What we’ve seen is these kids, 8- and 10-year-olds, absorb this Traffic Light eating plan. And then you’ll hear parents telling stories about how their child is the one saying, ‘No we can’t have that. That’s a red food. We need to do something different,’” she said.

**RURAL OUTREACH**

Heelan’s research was funded by a continuous flow of smaller grants until receiving the $2.5 million award from the CDC. She said the center’s call for proposals came when her team was looking for new ways to spread the reach of the Building Healthy Families program.

Several years ago, Heelan and her team packaged the curriculum for an experimental program in Holdrege, with instruction delivered by the YMCA staff there. Another grant allowed her team to deliver Building Healthy Families via distance education, with families in McCook and Broken Bow connecting to the Kearney classes.

“It worked OK. It was a way to get into rural communities, but it wasn’t as great as we had hoped. That’s what led to this big grant, which is to create a turnkey packaged program for other communities to deliver,” she said.

Communities have already applied for the program, and up to eight will implement the program in 2021.

Having communities apply, rather than recruiting towns to try the program, is key to duplicating the Kearney program’s success. People are referred to Building Healthy Families by their pediatricians and through the BMI Report Card, while others respond to newspaper ads. Heelan doesn’t track down referrals but waits for people to contact her because personal motivation is so important.

“Our most successful families were the ones who saw the advertisement, heard about it at the clinic or they got the BMI Report Card that showed this program, and they decided on their own to join it,” she said. “We’re not trying to get just anyone in the door. We want to work with families who want to be here.”

---

**KATE HEELAN**

**Title:** Professor and Assistant Department Chair; Director, Physical Activity & Wellness Lab

**College:** Education

**Department:** Kinesiology and Sport Sciences

**Education:** Ph.D., University of Kansas, 2002

**Years at UNK:** 18

**Areas of research/specialization:** Pediatric obesity treatment and prevention
PROTECTING FREE SPEECH
Grad student Hillesheim takes closer look at landmark Supreme Court decision

By TYLER ELLYSON

Jacob Hillesheim approached his master’s thesis the same way a police detective investigates a crime. He recognized the importance of the 1969 U.S. Supreme Court case Brandenburg v. Ohio, but he wasn’t satisfied with the scholarly articles — or lack thereof — focusing on this landmark decision.

“This case introduced the rubric the Supreme Court uses today to define what freedom of speech means and our limits on political speech,” Hillesheim said.

Yet, in his mind, it was a story that hadn’t been fully told. Hillesheim decided it was up to him to put all the pieces of this historically significant puzzle together.

“I knew from the get-go that I was going to tell the whole story, and that turned out to be a lot,” he said. “There was a lot of information out there, it just happened to be scattered all over the place.

“I needed to figure out how to reconstruct and tell that story in a way that gets as close to ‘the truth’ as possible.”

CRIMINAL SYNDICALISM

The basics of the case are well-documented.

Clarence Brandenburg, a Ku Klux Klan leader from Ohio, spoke at a rally for the white supremacist group in summer 1964. A Cincinnati television station covered the rally, and law enforcement from Hamilton County recognized Brandenburg’s voice in the footage.

He was later arrested and convicted under Ohio’s criminal syndicalism law. The statute, enacted in 1919 during the First Red Scare, made it illegal to advocate for political, social or economic change through violence or other unlawful means and prohibited people from assembling with any group formed to “teach or advocate the doctrines of criminal syndicalism.”

Brandenburg’s conviction was challenged by the American Civil Liberties Union, which argued that the criminal syndicalism law violated his right to free speech as protected by the First and 14th Amendments.

The case eventually reached the U.S. Supreme Court, which overturned Brandenburg’s conviction and struck down Ohio’s criminal syndicalism statute, ruling that the government cannot punish inflammatory speech unless it’s intended to incite an imminent violation of the law and is likely to produce such action.

The “imminent lawless action” test remains the standard used to define the limits of inflammatory speech.

“I want people to know that what the Supreme Court does matters. They make decisions that shape our history, our society and our everyday lives.”
Hillesheim: UNK online program ‘outstanding’

Jacob Hillesheim earned a Master of Arts in history through UNK’s online graduate program in May 2018. He’s currently in his 13th year teaching history at Elk River High School in Minnesota. His graduate thesis was submitted to the Midwestern Association of Graduate Schools Distinguished Master’s Thesis Awards.

Why did you choose UNK’s online master’s program?
“I had a colleague from the school district who was just graduating from the program. He talked about how good his experiences were, how good the professors were and how it was a real worthwhile experience,” Hillesheim said.

What makes this program stand out?
“The convenience was absolutely incredible. I was able to complete this master's program while continuing to work full time,” said Hillesheim, who has never been to Kearney.

“This was very intentional on the part of Justice Brennan to essentially sneak something incredibly speech protective past his colleagues,” Hillesheim said.

LASTING IMPACT
Hillesheim, who received the University of Nebraska at Kearney’s Outstanding Thesis Award in 2018 and presented at the Missouri Valley History Conference, hopes his research brings clarity to the ongoing free speech debate.

“Understanding freedom of speech, what imminent lawless action means and what our limits are today puts us in a better position to discuss and debate these things. I think that’s especially important since we’re dealing with a revived alt-right,” he said, referencing the white nationalist movement.

“In the 1960s, the alt-right was the KKK,” he added. “There are a lot of things we’re able to learn from how the alt-right of the 20th century intersects with the law and freedom of speech.”

Even if you don’t agree with someone’s message – Brandenburg’s KKK speech is one example – this case makes it clear Americans still have the right to express those opinions, Hillesheim said.

“I want people to know that what the Supreme Court does matters,” he said. “They make decisions that shape our history, our society and our everyday lives.”
Kim Carlson discovered her love of genetics as an undergraduate student at the University of Nebraska at Kearney.

She was inspired by her former biology professor, Doug Lund, who retired in 1999 after a 37-year career here.

“He encouraged me to pursue genetics,” Carlson said. “His advice was, ‘If you love it, then do it. You will be happy you did.’”

Now in her 17th year as a UNK faculty member, the professor and assistant chair in the Department of Biology takes the same approach with her students.

She views research as an opportunity to mentor and teach students while passing along the passion she has for molecular genetics.

“I love seeing their excitement when they succeed in the lab,” Carlson said of her students. “I like to see them grow as researchers, from the student who comes to my lab as a freshman and is just learning, to the senior who is on a stage in front of a room full of people presenting their research and doing it with confidence.”

Unsurprisingly, Carlson puts students at the center of her work, allowing them to experience every aspect of a project.

And they have a little fun along the way.

Her perfect day in the lab?

“I’m working with my students. The radio is on. And we’re talking and laughing. I love this. My students would say my perfect day is one when I didn’t do something wrong, like set the cabinets on fire. Yep, I did that. They made a taped square on the counter for me to put the Bunsen burner so that never happens again.”
How do you measure success as a researcher?

“For the longest time, I would have said peer-reviewed publications, invited presentations and grant funding. That is not true anymore. I seriously live vicariously through my students. When they get up and give a presentation, and do it with enjoyment, that is success to me. If my students publish a paper, that is success to me. When they get a good result and come to my office full of excitement, that is success to me. If they decide to have a career in science, that is success to me.”

What are your biggest discoveries?

“During my postdoc, I discovered a gene, OTK18, that regulates HIV infection of human macrophages. In human macrophages, we found that when we infected them with HIV then added an adenovirus expressing OTK18, the HIV infection was at non-HIV-infected levels. Essentially, we cleared HIV in a petri dish. I have two U.S. patents from this work.

“The second accomplishment is my Nora virus work. My students discovered Nora virus infection in one of our lines of fruit flies. At the time, the only group working on this was the team that discovered it in Sweden.

“This group was led by Dr. Dan Hultmark, one of the best and most prominent figures in the field of insect innate immunity and has collaborated with Dr. Jules Hoffman, who won the Nobel Prize for this area. When we found Nora virus, I contacted Dr. Hultmark. He called, and we have become collaborators.”

What do you want people to take away from your research?

“Fruit flies are fun! We use fruit flies in research because they share a large percentage of genes with humans, and what we learn from them can be translated to human research. We are doing high-level research here at UNK. My students are actively presenting and publishing their research. My group is actually considered a leader in Nora virus research, which is great for the students. When they go to scientific meetings and present, they are the experts.”

What qualities make someone in your position successful?

“You have to know your limitations. You have to know how to fail. When my students fail, I tell them, ‘If it worked the first time, we would call it SEARCH. Because it doesn’t, that is why we call it RESEARCH.’ I also think time management is very important. You have to be able to balance teaching, research, service, family and all aspects of your life.

“Lastly, you have to know how to be tenacious. I tell my female students, ‘Well-behaved women seldom make history.’ I have this on a board outside my office. I truly believe in this.

“As a woman in science, you can’t be afraid to put yourself out there and stand on your own two feet. You have to go for what you want and work hard for it. Don’t let anyone trample on your goals.”
Breast cancer is the second most common cancer in the world, with an estimated 2 million new cases diagnosed in 2018 alone.

In the United States, about 1 in 8 women will develop invasive breast cancer during their lifetime.

Like many other forms of cancer, there are certain factors that impact a person’s breast cancer risk and their chances of beating the disease. Diabetes is one of them.

Surabhi Chandra, an associate professor in the University of Nebraska at Kearney’s Department of Biology, is researching diabetes and its effect on breast cancer progression.

“Diabetes and cancer are closely related as cancer cells feed on glucose and thus worsen the prognosis of diabetic cancer patients,” Chandra said. “However, there is a gap in knowledge about the pathway that causes these effects. We’re working to understand the mediators involved in an effort to propose a therapeutic option.”

What’s your goal as a researcher?

“I want to understand and provide a molecular basis for diabetes-related diseases and eventually determine how these ailments can be prevented or treated. I would like to use a holistic approach by building up our body’s defenses, such as the microbiome, and make the immune cells stronger by using natural compounds.”

How do you involve students in your research?

“Students are an integral part of my research. In fact, they do most of the benchwork, and I give them opportunities to enhance their communication skills by writing manuscripts or presenting at conferences.”

Who has helped you the most in your research career?

What’s the best advice they gave you?

“I would like to acknowledge my Ph.D. mentor, the late Dr. Krishna Agrawal of Tulane University, who instilled independent thinking in all his students and helped us develop our own projects. A special thanks also goes to another mentor, Dr. R. William Caldwell of Augusta University, who constantly encouraged me, despite my failures, and helped me through my current position. I am lucky to have worked as a postdoc under his tutelage.”

What qualities make someone in your position successful?

“Perseverance, patience and hard work. Besides that, if you are a female, a good support system to balance family and work life.”

What’s the most enjoyable part of research?

“The most enjoyable part is getting our anticipated results and observing success through students’ achievements.”

And the least enjoyable part?

“The rejection of grants despite our best efforts.”

What stands out about UNK’s research programs?

“Being an undergraduate institution, I am quite amazed at the research opportunities available for faculty and students. The departments of biology and chemistry have cutting-edge instrumentation with assistance from Nebraska Research Initiative grants. Our sponsored program is also outstanding in terms of providing us with information about funding sources and helping us through the process.”

Surabhi Chandra

Title: Associate Professor
College: Arts and Sciences
Department: Biology
Education: Ph.D., Pharmacology, Tulane University, 2008; Master of Science, Microbiology, University of Mumbai, 2003; Bachelor of Science, Microbiology, University of Mumbai, 2001.

Years at UNK: 6

Areas of research/specialization:
Investigating the most common diseases affecting the U.S. population, including diabetes, cancer and chronic pain. Research focus is studying the effects of diabetic conditions in advancement of breast cancer. Also investigating derivatives of natural compounds as non-opioid suppressors of chronic pain.
Annette Moser grew up around agriculture. The University of Nebraska at Kearney chemistry professor was raised on a farm near Blue Hill. She’s also had a longtime interest in environmental issues. Her current research project lies at the intersection of those two areas.

Moser, an analytical chemist, is measuring the amount of glyphosate and its main metabolite in soybean tissues and soil samples using a liquid chromatography mass spectrometry (LC-MS) system recently acquired by the chemistry department. Glyphosate, one of the world’s most widely used herbicides, is the main ingredient in Roundup and other popular weed killers. It’s also a controversial product.

Thousands of lawsuits were filed against Roundup maker Monsanto, which was purchased by Bayer in 2018, alleging the product causes cancer. However, the U.S. Environmental Protection Agency says glyphosate is not a carcinogen and the product poses no risks to human health when used properly.

As part of a collaborative project, Moser will share her data with researchers at the University of Nebraska-Lincoln who will compare the amount of glyphosate residue present after standard applications of the herbicide and after a new application method.

How do you measure success as a researcher?

“My goal as a researcher is to train undergraduates. When my students are successful in reaching their goals, I consider that a win. It is great when projects work and we are able to get publications, but my main focus will always be my students.”

How do you balance research and teaching? Do they benefit each other?

“I tend to focus a little more on teaching since my primary goal is to help students meet their goals. I treat my research projects as tools to help my students learn how research works and give them hands-on experiences. While many of my students will not be conducting research once they leave UNK, I feel that their research experiences allow them to appreciate how scientific knowledge is achieved.”

What stands out about UNK’s research programs?

“One of the best things about UNK is our focus on the students, especially undergraduate students. In contrast to large, R1 schools, undergraduates are our focus, both in the classroom and in the lab. I generally have two or three students working with me every semester and I get to know them personally and help them pursue their goals, whether that’s going to pharmacy school, medical school, graduate school in chemistry or becoming a chemist in the industry. That personal interaction is what helped me when I was a student, and I want to pass it along to my students.”
Kristy Kounovsky-Shafer’s research is guided by a piece of advice she received as a doctoral student at the University of Wisconsin-Madison.

“For every question you answer, five more questions should arise. “That means you’re actually doing something interesting,” Kounovsky-Shafer said. “Because if you’re not doing something interesting, then you get no more questions out of the project.”

This is how the associate chemistry professor approaches her research at the University of Nebraska at Kearney. She’s always looking for new avenues to explore and unplanned experiments that could lead to the next big breakthrough.

“I think that’s when the coolest research actually happens,” Kounovsky-Shafer said. “That’s the fun part. You always have questions to ask, and you’re always trying to come up with new experiments to answer those questions.”

How do you measure success?

“Sometimes success is being able to do something no one else has done before. In my research group, we first start by putting cells into a gel that is similar to Jell-O to protect DNA while we break open the cells. Next, we put the Jell-O block with DNA into our 3D-printed device and apply an electric current to move DNA out of the gel and into solution. We use a roadblock to slow down the progression of DNA to concentrate it before it goes into another material. The current and roadblock material are juggled so a lot of the DNA concentrates on the surface of the material. This groundbreaking work was recently submitted for a patent.”

What are the qualities of a good faculty researcher?

“Organization is really important, at least for me. There’s been a semester when I had 13 students in my lab, so it was organized chaos trying to keep everybody’s research on track. That was challenging.

“The second thing is you must be OK with the mistakes students make, because everybody is going to make mistakes. You have to be a positive role model. It’s almost like I’m their cheerleader in some ways, except I never have pompoms.”

How do you balance research and teaching? Do they benefit each other?

“It depends on the week. I feel like research and teaching sometimes go hand in hand, and sometimes they fight for your attention. For the most part, I think the former is true. By conducting research, you’re also teaching students. It’s just a different type of knowledge, and they develop better problem-solving skills.”

Why is it so important to get students involved in your research?

“I came to UNK because I wanted to mentor undergraduate research. The students are like sponges – they like to learn new things, and they’re not quite sure where they want to go yet. Research gives them options for the future. Plus, they’re just fun. I enjoy conducting research with undergraduate students because it keeps me on my toes, and they’re really great to work with.”

KRISTY KOUNOVSKY-SHAFER

Title: Associate Professor
College: Arts and Sciences
Department: Chemistry
Education: Bachelor of Science, Chemistry and Math with minor in Biology, Wayne State College, 2005; Ph.D., Analytical Chemistry, University of Wisconsin – Madison, 2013.
Years at UNK: 6
Areas of research/specialization: Use of 3D printing to create devices to concentrate large DNA. These molecules can be used in sequencing and physical mapping platforms to find variations within genomes, such as cancer.
CAUSE AND EFFECT
Philip Lai studies brain’s connection to communication, behavior

By TYLER ELLYSON

As a young boy, Philip Lai didn’t know much about his older sister’s brain injury.

It’s not something the family discussed.

Sally attended a different elementary school for a couple years and took medication for severe headaches, but Lai wasn’t sure why.

“I really didn’t understand what was going on until around high school,” said Lai, an assistant professor in the University of Nebraska at Kearney’s Department of Communication Disorders.

Sally, who is 16 months older than Lai, suffered a perinatal stroke as a baby, causing damage to the left side of her brain. This impacted her language skills and made the right side of her body weaker than the left.

Now 37, Sally was able to overcome those setbacks and earn a degree from San Diego State University. She currently runs a business with her cousin in Los Angeles.

“When you see her now, you can’t really tell there are any deficits,” Lai said, “and that’s true for most children with perinatal stroke. It just shows you the power of the brain and how it can recover after that initial injury.”

His sister’s experience sparked an interest in Lai, who wanted to study the brain and its connection to communication, language and behavior. That led him to the University of California, San Diego, where he earned a bachelor’s degree in cognitive science with a specialization in neuroscience.

Lai stayed in his hometown to pursue a master’s degree in psychology at San Diego State, then enrolled in a joint doctoral program through SDSU and UCSD. The two universities, along with the Salk Institute for Biological Studies, received a multimillion-dollar grant from the National Institutes of Health to study children with neurodevelopmental disorders.

“We wanted to stay there because I knew there were lots of different supports across the three institutions,” Lai said.

During his doctoral program, Lai was part of a research team that collected data on four groups of children ages 7-14 – typically developing children, children with high-functioning autism, children with Williams syndrome and children with left and right hemisphere brain injuries, including perinatal stroke.

The extensive project included one-on-one, recorded interviews with each child, as well as tests that measured their heart rate and skin response when they viewed images meant to evoke different emotions.

As part of his dissertation, Lai wrote about the brain’s recovery following a perinatal stroke, which occurs from the third trimester through the first month after birth, and its effect on language development.

“We want to provide parents with these tips and clues on how to get your child to interact socially with you.”
The researchers also noted another finding. Only two of the 26 typically developing children asked the experimenter questions during the one-on-one interviews. In contrast, a majority of the children with Williams syndrome, who tend to have lower IQs and higher levels of sociability, asked questions. The same was true of children with high-functioning autism, who have normal IQs but generally are less social.

“What we concluded is these two groups haven’t acquired the skills at this age range to learn the social display rules of their culture,” Lai said.

AUTISM’S IMPACT

After earning his Ph.D. in language and communicative disorders in 2015, Lai found an opportunity to take a more in-depth look at autism spectrum disorders and their impact on children’s communication skills as a postdoctoral fellow at the University of Wisconsin-Madison.

Prior to his arrival, researchers at the university conducted a longitudinal study focusing on autistic children over a four-year period. The children’s language abilities encompassed the entire spectrum—half were verbal, and half were nonverbal at 2 1/2 years old.
Researchers recorded the children for 15 minutes during a play session with their mothers. The same sessions were repeated when the children were 3 ½, 4 ½ and 5 ½ years old. Lai, who spent two years at Wisconsin, used this information to compare the ways verbal and nonverbal autistic children communicate with their parents.

His hypothesis: “I thought nonverbal children would gesture more and communicate in other ways.” However, the observations didn’t support this theory.

“Not only were the preverbal children not speaking, they weren’t gesturing at all, which meant that at this age range they were severely delayed in communication, whether it was through verbal or nonverbal means,” Lai said.

The good news, he noted, is a majority of those preverbal children were speaking by age 5 1/2.

Lai also looked at how the parents interacted with their children and noticed the mothers of preverbal toddlers made a lot more physical contact.

The connection, he believes, is preverbal autistic children communicate by whining or crying, and the mothers were trying to soothe them.

“If your child is not talking yet, they’re going to communicate in other ways,” Lai said.

“The earlier we can intervene, the better off they’ll be in the future,” he said. “We want to provide parents with these tips and clues on how to get your child to interact socially with you so they can learn all these things and succeed at every stage of life.”

UNK CAREER

When Lai was hired by UNK in 2017, he brought the data from his doctoral and postdoctoral programs with him.

He’s currently working with a dozen undergraduate and graduate students, most of whom are using this information for research projects.

“It’s been very fulfilling as a professor to see them go...
through this process,” said Lai, who serves as a faculty mentor through UNK’s Undergraduate Research Fellows program.

In April 2019, six of his students presented their projects during UNK’s Student Research Day. Lai also took two graduate students to the Association for Psychological Science conference in Washington, D.C., this past May, and three undergraduate students joined him in October at the Society for Neuroscience conference in Chicago.

The 36-year-old is currently writing a grant proposal to study children with autism in the Kearney area, and he serves as director of research at UNK’s LaVonne Kopecky Plambeck Early Childhood Education Center, which opened in November.

Located in UNK’s University Village development, the 19,900-square-foot facility provides early education for up to 180 children from infant to age 6, including those with special needs.

The Plambeck Center is also a lab school where undergraduate and graduate students can work directly with children while preparing for their future careers. This opens the door for numerous professional development and experiential learning opportunities, including observations, practicums, internships, student teaching, diagnostic testing and research.

Lai called the Plambeck Center a “great resource” for UNK researchers from a variety of fields, including education, communication disorders, family studies, psychology and kinesiology and sport sciences.

“We’re very excited to start collecting data at the new center,” he said.

In addition to Lai, the Plambeck Center research team includes Natalie Danner, the LaVonne Kopecky Plambeck Chair of Montessori Education; Susan Catapano, the Cille and Ron Williams Community Chair for Early Childhood Education; and associate professor of exercise science Matthew Bice, who serves as UNK’s associate dean of graduate studies, director of undergraduate research and creative activities and director of research compliance.

Working in conjunction with Plambeck Center Director Deb Zuelow, the team is already gathering information from staff and parents using questionnaires that address topics such as stress, anxiety and physical and mental well-being. Parents are also asked about their children’s social-emotional
development, which includes sociability, personality and behavior.

Eventually, Lai said, they want to create research databases that can be shared directly with UNK faculty.

“It’s an exciting time,” he said. “There are great possibilities.”

**NASA GRANTS**

Lai’s research isn’t limited to children.

For the past three years, he’s received grant funding through NASA’s Established Program to Stimulate Competitive Research (EPSCoR) in Nebraska to study teamwork and communication in adults.

The research is aimed at improving collaboration and reducing anxiety among astronauts aboard the International Space Station.

In Year 1, Lai focused on how individuals communicate after completing tasks with varying levels of difficulty.

He purchased different sports balls and marbles, then designed the tasks, such as stacking the balls or placing the marbles in a certain pattern. Some were easy, and others were more difficult.

Once a test subject was done with an activity, they were taken into a room for a one-on-one interview Lai recorded.

“We wanted to see, depending on the task, would they communicate differently,” Lai explained.

The experiment went a step further in Year 2, when Lai formed teams of three individuals who had to work together on these tasks while the camera was rolling. They were then isolated for one-on-one interviews.

“The experiment is intentionally conducted in a small room, simulating the isolation and close quarters astronauts experience in outer space.

“We want to determine whether a smaller space has an effect on cognition and communication,” said Lai, who is assisted by UNK graduate students.

The next step, which started in January, looks at whether certain personality traits positively or negatively impact teamwork.

Using questionnaires, Lai ranked each participant by their personality type, then matched them with other subjects who share the same traits.

“We want to see if personality traits affect teamwork performance over time,” Lai said.

Will the outgoing, ambitious group clash with each other? Can people who are shy and relaxed come together to accomplish a task? Or does it even matter?

Each team will meet a total of three times before Lai and his graduate students review the footage.

Like his other research projects, verbal and nonverbal cues will tell the story.

“We want to see if personality traits affect teamwork performance over time.”
New Frontiers Through The Years

2008

PRADEEP BARUA
Professor, History
SUSANNE BLOOMFIELD
Professor, English
TIM BURKINK
Dean, Business and Technology
VALERIE CIGLER
Professor, Music and Performing Arts
SCOTT DARVEAU
Professor, Chemistry
CHRIS EXSTROM
Professor, Chemistry
KATE HEELAN
Professor, Kinesiology and Sport Sciences
SRI SESHAHDI
Professor, Marketing and Management
KENYA S. TAYLOR
Dean, Graduate Studies and Research
KATHRYN N. BENZEL
Professor, English
KURT BORCHARD
Professor, Sociology
GREGORY BROWN
Assistant Professor, HPERL
KIM CARLSON
Assistant Professor, Biology
VICTORIA GÓRÓ-RAPOPOW
Associate Professor, Art
SUSAN JENSEN
Associate Professor, Marketing
JEANNE STOLZER
Assistant Professor, Family Studies
WILLIAM AVILÉS
Associate Professor, Political Science
JOSEPH CARLSON
Professor, Criminal Justice and Social Work
LINDA CROWE
Chair/Professor, Communications Disorders
DARLEEN COWLES MICHEND
Professor, Music and Performing Arts
KATHRYN ZUCKWEILER
Assistant Professor, Management

2009

MARK ELLIS
Chair/Professor, History
CHAD FONAROFF
Associate Professor, Art and Art History
KEITH GELUSO
Associate Professor, Biology
MAX McFARLAND
Professor, Counseling and School Psychology
TING-LAN CHEN
Associate Professor, Music and Performing Arts
BRENDA ESCHENBRENNER
Assistant Professor, Accounting/Finance
SATOSHI MACHIDA
Associate Professor, Art and Art History
JANE STRAWHECKER
Professor, Teacher Education
NAHOM BUCKNER
Professor, Music and Performing Arts
DAVID HOF
Professor, Counseling and School Psychology
NATHAN BUCKNER
Professor, Management
SUSAN HONEYMAN
Professor, English
PETER LONGO
Professor, Political Science

2010

TEARA ARCH WAMETEY
Education Research Consultant
SYLVIA ASAY
Chair/Professor, Family Studies and Interior Design
HERBERT CRAIG
Chair/Associate Professor, Modern Languages
NATHAN BUCKNER
Professor, Management
DAWN MOLLERKOPP
Associate Professor, Teacher Education
MARGUERITE TASSI
Professor, Economics

2011

PRADEEP BARUA
Professor, History
SUSANNE BLOOMFIELD
Professor, English
TIM BURKINK
Dean, Business and Technology
VALERIE CIGLER
Professor, Music and Performing Arts
SCOTT DARVEAU
Professor, Chemistry
CHRIS EXSTROM
Professor, Chemistry
KATE HEELAN
Professor, Kinesiology and Sport Sciences
SRI SESHAHDI
Professor, Marketing and Management
KENYA S. TAYLOR
Dean, Graduate Studies and Research
KATHRYN N. BENZEL
Professor, English
KURT BORCHARD
Professor, Sociology
GREGORY BROWN
Assistant Professor, HPERL
KIM CARLSON
Assistant Professor, Biology
VICTORIA GÓRÓ-RAPOPOW
Associate Professor, Art
SUSAN JENSEN
Associate Professor, Marketing
JEANNE STOLZER
Assistant Professor, Family Studies
WILLIAM AVILÉS
Associate Professor, Political Science
JOSEPH CARLSON
Professor, Criminal Justice and Social Work
LINDA CROWE
Chair/Professor, Communications Disorders
DARLEEN COWLES MICHEND
Professor, Music and Performing Arts
KATHRYN ZUCKWEILER
Assistant Professor, Management

2012

MARK ELLIS
Chair/Professor, History
CHAD FONAROFF
Associate Professor, Art and Art History
KEITH GELUSO
Associate Professor, Biology
MAX McFARLAND
Professor, Counseling and School Psychology
TING-LAN CHEN
Associate Professor, Music and Performing Arts
BRENDA ESCHENBRENNER
Assistant Professor, Accounting/Finance
SATOSHI MACHIDA
Associate Professor, Art and Art History
JANE STRAWHECKER
Professor, Teacher Education
NAHOM BUCKNER
Professor, Music and Performing Arts
DAVID HOF
Professor, Counseling and School Psychology
NATHAN BUCKNER
Professor, Management
SUSAN HONEYMAN
Professor, English
PETER LONGO
Professor, Political Science

2013

TEARA ARCH WAMETEY
Education Research Consultant
SYLVIA ASAY
Chair/Professor, Family Studies and Interior Design
HERBERT CRAIG
Chair/Associate Professor, Modern Languages
NATHAN BUCKNER
Professor, Management
DAWN MOLLERKOPP
Associate Professor, Teacher Education
MARGUERITE TASSI
Professor, Economics

UNIVERSITY OF NEBRASKA AT KEARNEY
42
UNK students get firsthand experience participating in research projects. This is a place where people dedicate their lives to improving others. From the classroom...to the labs...to the fields...to the stage and beyond...let us show you what you’re made of.