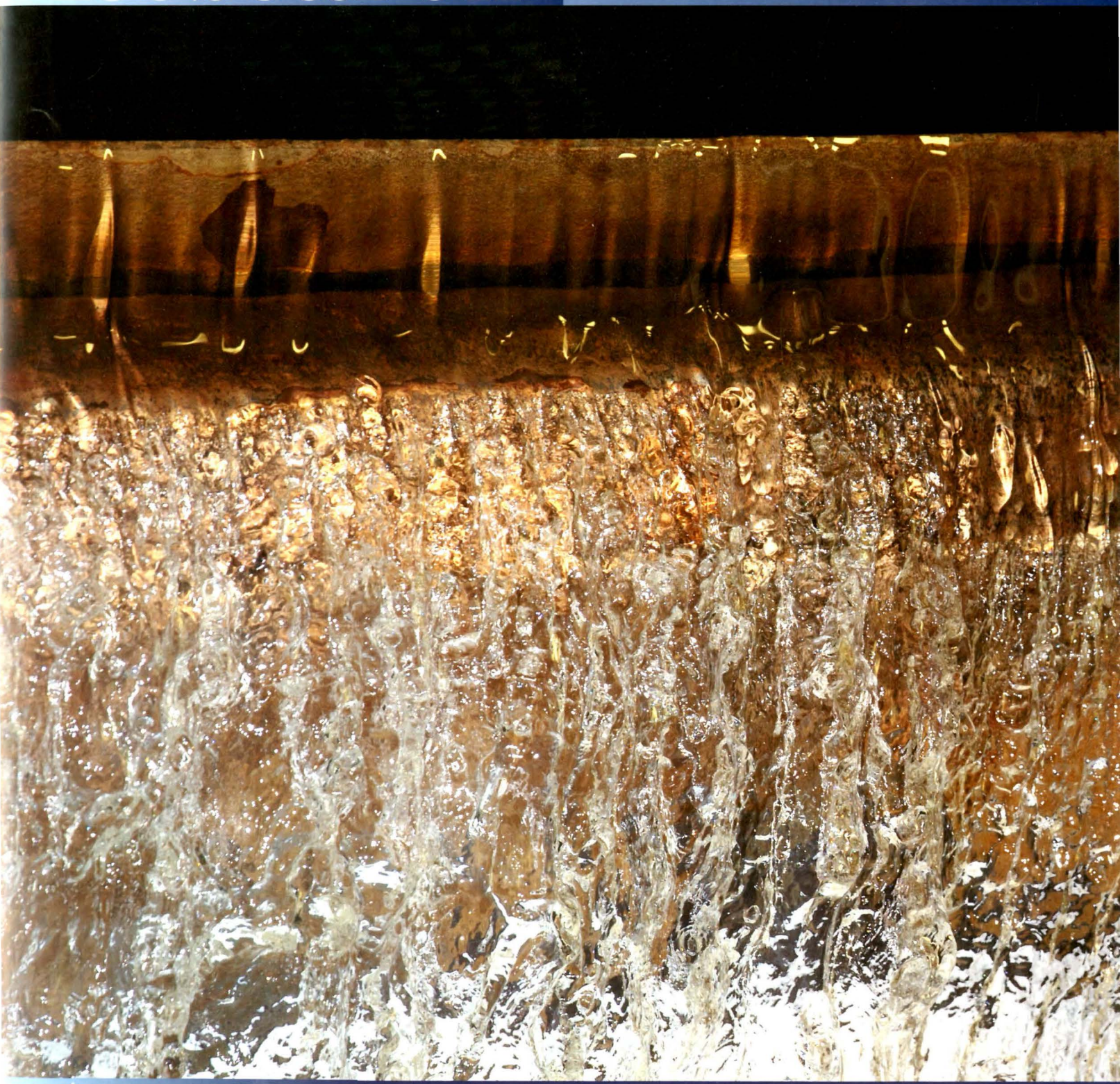
Research

SOUTH DAKOTA STATE UNIVERSITY



South Dakota State University
Fall 2015

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SDSU
FALL 2015

PINE RIDGE ELDERS

to educate peers about wills, advanced care planning

Mary Isaacson

It's about the challenges of remoteness. It's about patients and their family members. It's about death.

When assistant professor Mary Isaacson approached Pine Ridge Reservation elders about end-of-life care last summer, she wasn't sure how they would react. In July, trained Lakota elders used the brochure they developed to discuss wills and advanced-care directives with their peers.

For her work with Native Americans, Isaacson was named the outstanding researcher for the College of Nursing at the February Faculty Celebration of Excellence. The exploratory work was done through a $2,500 Delores Dawley Faculty Seed Grant, while the subsequent outreach project is supported by a one-year grant for nearly $10,000 from the South Dakota Comprehensive Cancer Control Program.

Empowering through education

"Mary has such compassion for our people to get us going on elder care," said Lakota elder Patricia Catches The Enemy, a breast cancer survivor who knows how knowledge can empower a person facing death.

"The doctor just told me I had cancer and walked out. I was shocked," she recalled. Her daughter helped her get support and treatment. That was eight years ago.

Catches The Enemy, who worked with the Oglala Sioux Tribal burial program in the 1990s, said she wants people to know the options they have and encourages them to plan ahead.

For Isaacson, the project was an opportunity to combine her experience as a hospice nurse with her passion for Native American health care. "Geography is one of the major challenges," said Isaacson. Pine Ridge is the second-largest reservation in the country, stretching over more than 2 million acres.

From May to September 2014, Isaacson met with elders in focus groups. "What came from that research was the overwhelming need for advanced-care planning or advanced directives."

This insight led them to secure the larger grant to develop a Lakota-specific advanced directive brochure and to train Lakota elders to be advanced directive coaches.

Adapting approach to Lakota culture

Beginning in January, Isaacson worked with Lakota elders to adapt a South Dakota Comprehensive Cancer Control Program brochure to their needs and to incorporate other national hospital and palliative care organization guidelines. The group simplified the terminology, translated key points into the Lakota language and contracted with a Lakota artist for illustrations.

For many elders, Lakota is their first language, Isaacson explained. "I never thought of it—they are bilingual."

Bad news, in particular, is best delivered in their native language, Isaacson explained, noting that "their ability to internalize and understand is better in Lakota than in English."

However, even at Indian Health Service, having those conversations in Lakota is not an option, she pointed out. That's why the brochure contains key messages in Lakota.

When choosing the artwork, group members also wanted the moccasins on the brochure to be symbolic. The elderly are on the last part of their life journey, so "the moccasins needed to be old and worn because they are," recalled Isaacson.

In their Care for Our Elders or Wakanki Ewastepikte brochure, the elders emphasized the message, "If we do not make these choices, the government will make them for us." Isaacson explained that the issue about property and sovereign nation status is unique to Native Americans because materialism or wealth is not part of their cultural belief system.

Encouraging action

The grant will cover travel costs for the three trained coaches—Catches the Enemy, Valaria Red Cloud and Garfield Apple—as they attend events, such as pow-wows and flea markets, and visit community centers where elder meals are served to distribute brochures and hopefully start those conversations.

Isaacson also wants to recruit and train another male elder.

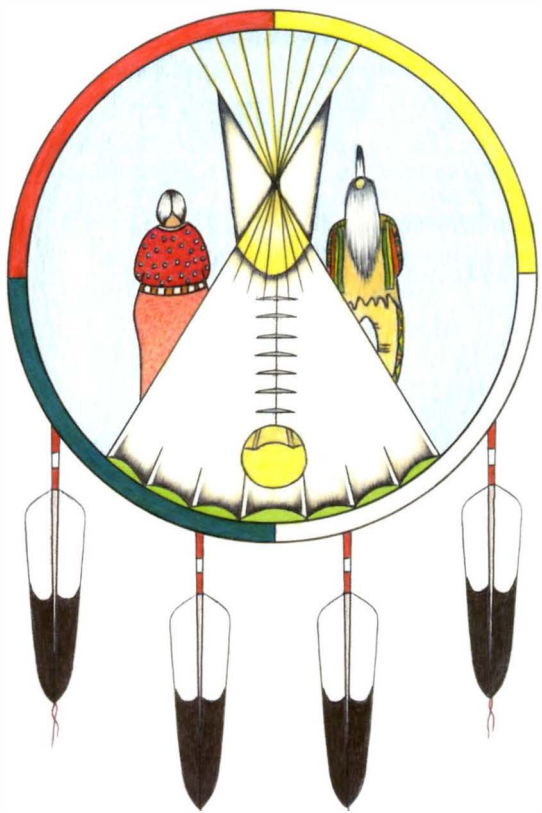
Dakota Plains Legal Services of Pine Ridge will provide free services to those 62 or older wanting to write wills and advanced directives. If groups of four to five individuals in an outlying community need their services, Dakota Legal will come to them.

"It's about raising awareness," Isaacson explained. "It's about having the conversation with family members and providers."

As part of the grant, the Pine Ridge elders will share the brochure with other tribes and visit other reservations to train fellow elders. Indian Health Service has asked to reprint the brochure and the trained elders will accompany them to their distribution sites.

Catches The Enemy said, "I hope what we do can be carried on. It is much needed." As she has learned, education is empowering.

Remoteness is one of the barriers that the Pine Ridge elders must overcome in talking to their peers about wills and advanced-care directives. The Manderson area, pictured above, is 25 miles from the city of Pine Ridge.



Valaria Red Cloud and Patricia Catches the Enemy, along with Garfield Apple (not pictured) developed a Lakota-specific advanced-directive brochure with assistance from nurse-researcher Mary Isaacson.

The hoop represents the four stages of life in Lakota culture—birth, adolescence, adulthood and elderly years.

Researchers address regional, national, global changes

"Once you begin, it will be your life's work."

These words of wisdom capture the level of commitment of faculty researchers and scholars at South Dakota State University. This report celebrates these dedicated professionals whose research projects address regional, national and global challenges.

This year, scientists at the Animal Disease Research and Diagnostic Lab at South Dakota State had to meet challenges on a regional and national scale that had global implications, as they responded to two disease outbreaks—Porcine Epidemic Diarrhea virus and avian influenza.

The ADRDL scientists, led by veterinary and biomedical sciences professor Eric Nelson, developed diagnostic tests for PEDv, a disease that hit the U.S. swine industry in April 2013. And then in spring 2015, ADRDL staff worked around the clock to give Midwestern poultry producers the answers they needed to prevent the spread of avian influenza.

The lab conducted more than 90,000 tests due to PEDv and avian influenza to help protect the safety of the nation's food supply.

Addressing state and national concerns, faculty are working to strengthen families and improve people's health. Assistant professor Jennifer Anderson leads the charge to make Brookings the first breast-feeding friendly city in South Dakota. Professor Kendra Kattelmann collaborates with SDSU Extension and 4-H educators to teach youngsters and their families about healthy foods and family mealtimes through iCook, a U.S. Department of Agriculture program being tested nationwide.

Grappling with Native American health concerns, assistant professor Mary Isaacson helped Lakota elders on the Pine Ridge Reservation begin an initiative to discuss wills and advanced-care directives with their peers. Their collaboration may form the basis for similar projects on reservations across the state and perhaps the nation.

On a global level, scientists, such as wildfire expert Mark Cochrane of the Geospatial Sciences Center of Excellence, track climate change and its effect on the forest fire season and help developing countries, such as Indonesia, document reductions in carbon emissions caused by deforestation. Others, like microbiologist Heike Bucking, investigate ways to make agriculture more sustainable by reducing the need for fertilizers.

All have the same goal—to make this world a better place for our descendants. That encompasses the land-grant mission that drives research at this university.

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Diversity

Teaching diverse learners requires responsiveness to students' needs

Social justice, inclusion and equity—these threads run through the work that earned assistant professor Christine Nganga of the Department of Teaching, Learning and Leadership recognition as the outstanding scholar for the College of Education and Human Sciences.

"I look at educational leadership through the lens of equity and social justice," explained Nganga, who has been at SDSU since 2012. She earned her master's in school administration and then her doctorate in educational leadership from the University of North Carolina-Greensboro.

"Diversity and inclusion are not just about ethnicity," said the Kenya native, citing gender, abilities and disabilities, social and economic class and religion in

addition to race. "It's the interplay of all these markers and how to cater to students' diverse needs in the classroom."

Nganga has authored or co-authored five book chapters and three journal articles in the last three years. She also mentors minority undergraduate students through a grant from Women and Giving, which supports research through the SDSU Foundation.

Leading program growth

Nganga has helped increase enrollment in the English as a Second Language endorsement program from four to 16 students. She teaches three of four required courses for the ESL endorsement.

Before coming to the United States to do graduate work, Nganga taught English for eight years in Kenya. In one of the schools, she said, "I had 7 textbooks to teach 45 students." Despite this, she added, "Those ninth-graders were so eager to learn."

Nganga introduces education students to ESL through a linguistic diversity unit in an undergraduate human relations class. Once they learn that ESL endorsement improves their chances of getting a teaching job, they are interested, Nganga explained.

Then a colleague takes them on a field trip to Huron, and Nganga said, "That seals the deal." Of the 760 students in the Huron public schools, 30 percent are in the ESL program, according to ESL director Kari Hinker. Half of those are Asian and the rest are Hispanic.

Teaching students to adapt to change

As she prepares future teachers, Nganga said "one of the challenges is that our world is changing so dramatically." What freshmen encounter in the classroom when they graduate will be very different compared to what it is now, she pointed out.

"You have to teach students to be responsive to the students they will later instruct in their classrooms wherever they come from," Nganga said. However, she added, "Our students are not usually trained to think that way."

When it comes to learning about their relationship to a diverse world, "oftentimes, students think that learning about diverse students and developing inclusive communities is learning about 'those' people," Nganga wrote in her education philosophy statement.

She recalled her students were surprised that 80 percent of all ESL learners in American schools were born in the United States. "Some didn't believe it," she added, emphasizing the need for students to distinguish knowledge from opinion and examine their own biases and assumptions about people who are different from themselves.

Based on their K-12 experiences, students want a script they can follow, such as 10 strategies to teach diverse learners, Nganga explained. "In college, we ask them to think differently."

Two students from similar backgrounds can have very different responses to her classes. "Some students from rural communities sit at the front of the class and want more," she said. "Others feel 'this will never touch me.'"

She approaches this challenge by helping students "understand how interconnected we are," she said. "Learning is a shift in identity. We cannot shut the door and say it doesn't affect us; we need to understand how we can work together to help one another.

"For me, learning is about becoming," she said. "I challenge my students to not just know and do, but to become."

Top photo: International students gather near the Campanile as part of opening activities for fall semester.

From left:
As part of an English as a Second Language summer program outing, Ketsia Lubiba of the Democratic Republic of Congo and Hyunjeong Choi, Yeonji Eom, Hyesoo Cho and Loojin An of South Korea, learn to build a camp fire from instructor Cory Mettler.

ESL students Haemin Park of South Korea, far left, Loojin An and Joo Kyoung Kang of South Korea, center, and Divine Kavunga of the Democratic Republic of Congo, far right, pose with two Vietnamese women in traditional costumes during the 19th Annual Festival of Cultures in Sioux Falls.

Joo Kyoung Kang of South Korea, right, meets a member of the Siouxland Renaissance group at the Sioux Falls Festival of Cultures in June.

Mahmood Alnasser of Saudi Arabia, Dogyeong Han of South Korea and Mahmood Alturki of Saudi Arabia prepare to climb the rock wall at the Wellness Center on campus.

An excursion to the Dakota Nature Park in Brookings gives ESL students In-Hun Chung of South Korea and Asuka Ohno of Japan a chance to try kayaking.

Opposite bottom: Hyesoo Cho, Hyunjeong Choi and Joo Kyoung Kang, all of South Korea, enjoy SDSU ice cream on the steps of the Coughlin Campanile as part of welcome back activities for international students.

"You have to teach students to be responsive to the students they will later instruct in their classrooms wherever they come from. Our students are not usually trained to think that way."

Christine Nganga

iCook 4-H program

teaches youngsters, caregivers to prepare healthy meals

Renaissance

writers address social values still relevant today

Bruce Brandt

Looking at concepts such as heroism and ambition through the lens of Renaissance literature gives students a different perspective, according to English professor Bruce Brandt. "It lets you see the world through the eyes of people living with different assumptions about life."

Though the works were written more than 400 years ago, Brandt said, "Modern students can find lots of things that can lead them to be better people."

Brandt specializes in the English Renaissance, teaching courses on Shakespeare and Renaissance drama, prose and poetry. The Nebraska native came to SDSU in fall 1979 after completing his doctorate at Harvard.

"I've always felt like I was pursuing a life that focused on issues of value and what's important to people in the sense of what we do in the humanities," said Brandt, who was named the outstanding scholar for the College of Arts and Sciences at the 2015 Faculty Celebration of Excellence. "Doing scholarly research flows right into teaching," he added.

Brandt has authored two books, co-edited two books of proceedings, written 36 scholarly articles and delivered 35 conference papers during his 36-year career while teaching a full class load of three or four classes per semester. In 1992, he received the F. O. Butler Award for Excellence in Scholarship.

Exploring ambition, heroism

Most of his scholarly work has been about the writings of Christopher Marlowe, a contemporary of Shakespeare, Brandt explained. He was editor of the Marlowe Society of America newsletter for 16 years and served terms as vice president and president of the Marlowe Society. Though the stories involve kings, queens and wars, the issues they face are relevant today.

For example, Marlowe was one of the earlier writers to address the question: "What would you sell your soul for?" Brandt explained. "All of the writers who tackled the question had to come up with something that would seem sensible to a person of their time."

In the late 16th century, Marlowe's "Doctor Faustus" wanted knowledge, but in the 21st century, he said, "we would just Google it." That then opens discussions about "What is the big temptation for our age? What is it that we really dream of and value?"

In the 1587 play, "Tamburlaine the Great," Marlowe's hero began life as a shepherd in an era when social class determined a person's fate, but he claimed the noble title lord based on his conquests. "He would like to live in a world with certain values and since he doesn't see it in the world, he's going to create it," said Brandt.

Tamburlaine's cruelty and inflexibility fuel a debate concerning "whether he just doesn't care or is trapped by his own self-description," Brandt explained. The work addresses issues about creating warriors and what it means to be a conqueror.

In addition, Brandt noted, "Marlow was probably the first English playwright to create a very clear-cut homosexual character." However, he pointed out, "at the time, the word homosexual did not exist yet and the understanding of gender differed greatly from our own."

Analyzing longstanding issues

Students also connect with the characters in Shakespearean literature, according to Brandt. In looking at "Hamlet," he pointed out, "Who doesn't

Roasted vegetables, fruit salads and spinach smoothies can form the basis for a healthy meal and provide a chance to connect as a family. These are insights that 9- and 10-year-olds and their caregivers gained through the iCook 4-H program.

"I learned how to make a bunch of healthy foods and how to stay healthy," said Sarah Dunn of Brandon, adding that she steamed vegetables and made spinach smoothies that "actually tasted good."

Though they completed the curriculum more than a year ago, Sarah's parents, Jeff and Julie Dunn, said they still use what they learned. Mealtime conversations now start by saying "tell me two good or not-so-good things about your day," rather than asking "how was school?" explained Julie.

"It's about trying to get some face time," Jeff added.

The iCook program seeks to increase culinary skills, family mealtime and physical activity as a means of preventing childhood obesity, according to professor Kendra Kattelmann, who received the F. O. Butler Award for Excellence in Research at the 2015 Faculty Celebration of Excellence.

She is the state's lead on the U. S. Department of Agriculture project, which involves four other land-grant institutions—University of Maine, West Virginia University, University of Tennessee and University of Nebraska-Lincoln. The five-year National Institute of Food and Agriculture project began in August 2012.

Learning by Doing

SDSU Extension and 4-H educators at two sites—Sioux Falls and Sisseton—recruited participants and taught the six two-hour iCook lessons over a three-month period in fall 2013. Eight child-caregiver pairs in Sisseton and 18 in Sioux Falls received instruction as part of the intervention group.

Each lesson has a nutritional component tied with the cooking lesson and a physical activity, such as playing a game, according to Kattelmann. "The lessons talk about better choices, healthier choices."

Mikaela Hoff, who goes to Rosa Park Elementary School in Sioux Falls, said, "I'm a very good cook. I've learned to how to chop and sauté vegetables." Her favorite dish was Jamaican jerked chicken.

Cindy Borg, who accompanied her granddaughter, Brianne Noethlich, said, "I underestimated how well she could do in the kitchen."

To measure physical activity, 25 percent of the intervention group wore accelerometers for a week prior to and four months into the program. When it comes to helping children become more active, graduate student Chase Merfeld said, "Parents are agents of change."

However, Merfeld found that decreasing children's sedentary behavior and increasing moderate to vigorous physical activity will require a more intense intervention than iCook.

Based on the raw data, iCook got positive marks from the participants and parents reported increased self-confidence to do the cooking, according to Kattelmann. The families gave educators feedback after each class. Researchers took physical measurements of the children and parents filled out quality-of-life questionnaires at zero, four, 12 and 24 months.

Educators also encouraged families to set attainable goals and then followed up at the next lesson, according to Kattelmann. Mikaela's mom, Sheila Hoff, said she found that planning meals ahead of time helps with budgeting and time management.

Creating lifetime habits

Researchers used an interactive website to keep participants connected after the lessons were completed, Kattelmann explained. Each family received a mini-video recorder and instructions on how to upload videos and photographs to the website to share how they met weekly or monthly challenges, such as eating a seasonal vegetable or doing a yoga pose.

Those who completed the challenges were entered in a drawing for a gift card. "One boy bought an iPad with the money he won," Kattelmann added. However, she admitted, online participation was limited.

The curriculum has been expanded to eight lessons, in part to increase participants' proficiency with the website, and will eventually be available to all 4-H and Extension educators.

Helping children and their caregivers gain confidence in their ability to make healthy food choices and to prepare meals will help prevent obesity, Kattelmann explained. "It's about reinforcing parenting through cooking."

Kendra Kattelmann

Opposite page:
Sarah Dunn, of Brandon, makes her family's favorite dish, enchiladas. She and her parents completed the iCook training more than a year ago and are still using the lessons they learned to prepare healthy meals and enjoy them at family mealtime.

left:
Gathered around leader Tracey Lehrke for an iCook lesson are Emma Dahl, Cheryl and Grace Krump, Kurk and Aspen Snaza, Emma Ellis and Shawn Parker, Ruth Ellis, Mitch Moen and Parker Hanson. They participated in the program at Sisseton.

Center:
Eleven-year-old Brianne Noethlich burns some energy during an iCook event at Sky Zone, an indoor trampoline park in Sioux Falls.

Right:
The iCook curriculum encourages playing games to promote physical activity. Sisseton participants Emma Ellis, Amy Dahl, Shawn Parker, Emma Dahl, Parker Hanson (middle), leader Tracey Lehrke, Kurk Snaza, Cheryl Krump, Michelle Moen and Grace Krump play a Frisbee game.

have some issues concerning a father who has given them an impossible task and a mother whom they have disappointed? These are very real questions.

"When young people get into the older literature, it helps them safely explore some of these questions," Brandt said. "Putting it in this other place allows them to look at it more analytically."

Pointing to the issues of jealousy and racism raised in "Othello," he said, "Though that exact scenario would never exist again, those issues have not gone away."

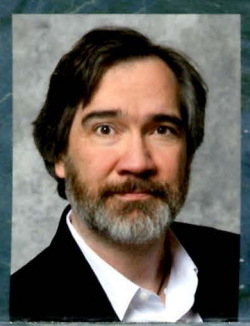
"I've always felt like I was pursuing a life that focused on issues of value and what's important to people in the sense of what we do in the humanities."

Bruce Brandt, English professor

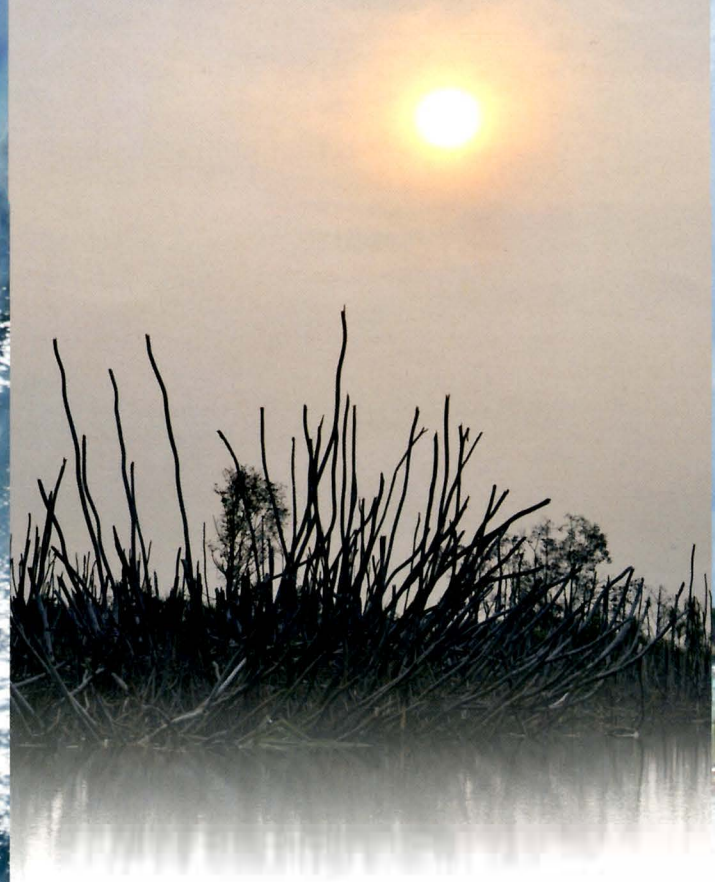
The music department takes guests back to the Renaissance through its biennial Christmasse Madrigal Feast, complete with a four-course meal, Madrigal singers and even court jesters. Attendees get a glimpse of the era that professor Bruce Brandt shares with students in his English Renaissance literature classes.

f·Forest fire

expert helps Indonesians assess carbon emissions



Mark Cochrane



The smoky haze from forest fires that closes businesses, airports and schools in Southeast Asia during the dry season is more than an inconvenience—it's a health hazard.

"We treat it as a natural disaster, but it happens every year," said Malaysia native Melvin Lee. "It affects the whole continent."

"You can't even breathe," added his sister Rachel. The siblings earned their civil engineering degrees from South Dakota State in December 2013.

Deforestation from an ill-fated plan to convert nearly 2.5 million acres of Kalimantan peat swamp forest into rice paddies has contributed to Indonesia becoming the third-largest emitter of carbon, according to professor Mark Cochrane, a senior scientist at the Geospatial Sciences Center of Excellence.

Since 2013, he has been using satellite imaging, field studies and computational modeling to help the Indonesian Forest Research and Development Agency assess the progress being made to reduce carbon emissions through a three-year $2.2 million NASA grant. For his work, Cochrane received the award for faculty engagement in global research at the university's 2015 Celebration of Faculty Excellence.

He collaborates with carbon emissions expert Robert Yokelson, a chemistry professor from the University of Montana, and professor Bambang Hero Saharjo, a forensic fire expert at Bogor Agricultural University in Indonesia. This year, SDSU postdoctoral scientist Erianto Indra Putra, a forest and land fire specialist from the Bogor Agricultural University, joined the team.

Creating disastrous situation

The Mega Rice Project, which began in 1996, sought to raise enough rice to feed the Indonesian population. Former Indonesian President Suharto authorized construction of nearly 2,900 miles of channels to drain the peat swamps and then loggers came in to clear the trees.

The peat forest soils consist of large accumulations of dead organic matter, some it tens of thousands of years old, more than 20 feet deep, Cochrane explained. Under normal circumstances, these water-logged, oxygen-starved peat domes don't decay or burn.

"Draining the peat swamp forest is akin to melting permafrost in the Arctic," Cochrane explained, but the process occurs much faster and for a longer period of time.

Smoldering peat fires slowly burn thin layers of the organic matter but can only be extinguished when the land floods, Cochrane explained. Peat fires eat into the ground surface and release huge amounts of carbon, much more than typical forest fires do.

These peat fires can last for weeks or months, creating the thick smoke and suspended particulates that are carried to neighboring countries. He estimated that the peat contains 20 times as much carbon as the trees themselves did.

In September 2014, the Jakarta Post reported that 55 percent of the nation's yearly carbon emissions—470 megatons—came from forest and peat fires. According to the National Disaster Mitigation Agency, more than 90 percent of the fires were intentionally set.

Dealing with the aftermath

Before the forest was cleared, people made a living hunting and fishing, according to Putra. Now, they collect timber left over from logging and burn it to make charcoal. Some are employed in the saw mills, but many struggle with subsistence-level farming.

Putra's doctoral research helped establish a national regulation that only areas where the ground water level is less than 40 centimeters, or 15.7 inches, below the surface can become agricultural land. However, this conservation standard is difficult to enforce due to the rapid growth of palm oil plantations, many of which were built on peat in the range of 16 to nearly 23 feet deep, according to Putra.

An international program called reduced emission through deforestation and degradation, or REDD, offers financial incentives to countries that reduce their carbon emissions, according to Cochrane. Another program, REDD Plus, provides funds specifically to support people's livelihoods, such as developing a sustainable logging system.

However, progress in reducing carbon emissions must be documented by a third party—that's the challenge. The researchers are developing a monitoring tool that will reliably predict how much carbon the deforested areas are losing based on the conditions and subsequently how Indonesian conservation measures have reduced those losses.

Building a statistical model

To do this, Cochrane and his colleagues analyzed satellite images of land cover as far back as 1993 to document when the forest was cleared and the land drained. To assess vegetation and hydrology, they rely on light detecting and ranging, commonly called LIDAR, a mapping technique that takes 3-D images of the Earth's surface using a laser scanner and GPS receiver via airplanes. Datasets were collected in 2007, 2011 and 2014.

Using forest fire data and comparing the sets of LIDAR data, Cochrane can surmise that depressions had peat soil losses due to subsurface fires. Using this information, Cochrane and Putra are developing a model to predict how much peat will be burned based on the conditions.

"We can explore what and how these parameters link to each other," Putra said. Using the third set of LIDAR data acquired in 2014 will allow the researchers to figure out "how close we are to actuality," Cochrane explained. "This is a way of testing our model."

This fall, Yokelson will use portable lab equipment to measure the quantities and types of gases coming off the peat swamp fires in Indonesia. Until this, no method existed to accurately determine the composition of active peat fire emissions, explained Cochrane, adding that up to 200 different gases may be escaping through these fires. This groundbreaking field work gives the researchers, what Cochrane called, "the best data for peat fire emissions."

Once they know what parameters are necessary, Cochrane expects that their model will be portable to other locations in Indonesia, such as Sumatra, Borneo and Papua, facing similar challenges. "The basic principles will be the same."

This will provide a way to document reduction in carbon emissions and get the financial help necessary to protect the peat swamp forests.

Above:
During the dry season, smoke from fires in the Kalimantan forest on the island of Borneo creates a haze that threatens to blot out the sun.

Villagers used to make a living hunting and fishing, but must now figure out how to survive in the altered landscape that deforestation has created.

Right:
SDSU postdoctoral scientist Erianto Indra Putra, a forest and land fire specialist from Bogor Agricultural University in Jawa Barat, Indonesia, wades through a deforested section of the Kalimantan forest.

Smoke in the background provides evidence that thin layers of the organic matter beneath senior scientist Mark Cochrane's feet are on fire.

Cochrane uses a probe to determine the temperature of fires beneath the surface—he has recorded readings in excess of 500 degrees Celsius.

D-21 marks ownership of this land parcel that a Kalimantan villager has likely sold to a development company. However, some developers take more land than they have purchased, according to Putra.

Villagers collect timber left over from logging and burn it to make charcoal to sell.

Below:
These palms will be planted on the cleared areas of the peat swamp forest. In September 2015, the U.S. Department of Agriculture estimated that Indonesia will produce 35 million metric tons of palm oil, more than any other country.

Diagnostic tests key to controlling swine virus

When Porcine Epidemic Diarrhea virus hit swine herds in May 2013, Animal Disease Research and Diagnostic Lab researchers moved quickly to give veterinarians tools to identify the disease.

"We didn't have much for diagnostic tools," said Eric Nelson, an ADRDL researcher and veterinary and biomedical sciences professor. "Though PEDv had been in England since the 1970s, this was the first time we dealt with it."

The series of tests, antibodies and reagents developed to identify infected herds and evaluate candidate vaccines has produced nine invention disclosures that have resulted in eight licenses in the last three years, according to Will Aylor, assistant vice president for technology transfer and commercialization.

For his work at ADRDL, Nelson received the Pat and Jo Cannon Intellectual Property Commercialization Award at the 2015 Faculty Celebration of Excellence. Since 2007, Nelson has been inventor or co-inventor on 17 intellectual property disclosures.

"It's a team effort," Nelson said, pointing to the work of research associates Steve Lawson, Travis Clement and Aaron Singrey as well as senior microbiologists and graduate students.

Diagnosing infected herds

PEDv, a corona virus, produces diarrhea and vomiting and is particularly devastating to baby pigs. The symptoms are also similar to transmissible gastroenteritis virus.

One week after the diagnostic lab at Iowa State confirmed PEDv had spread to the United States, the ADRDL research team released a first-generation, gel-based polymerase chain reaction (PCR) test to differentiate PEDv genetic material from that of other viruses. ADRDL scientists then developed a faster, more sensitive second generation PCR test that made same-day results possible, according to Nelson.

ADRDL's quick turnaround time for diagnostic testing provided a real value to producers in South Dakota and the region, explained Glenn Muller, executive director of the South Dakota Pork Producers.

The PCR-based test can also be used on environmental samples to detect whether items brought onto the farm are contaminated, explained Jane Christopher-Hennings, who leads the ADRDL and the Department of Veterinary and Biomedical Sciences.

Tetracore, which licensed the PCR test, now offers one test that will differentiate among three viruses—PEDv, porcine deltacorona virus and transmissible gastroenteritis virus—using saliva and fecal samples.

Detecting antibodies

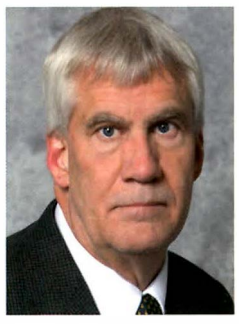
ADRDL scientists also developed a variety of tests to evaluate an animal's immune response by identifying PEDv antibodies.

By early 2014, the researchers had developed monoclonal antibody reagents to detect PEDv in tissues from infected animals and viable virus in cell cultures. That technology was licensed to Medgene Labs, a Brookings animal health company, which distributes them worldwide to research and diagnostic laboratories.

A variety of serological tests that detect PEDv antibodies resulted in additional license agreements. These tests are important, not only to identify animals previously exposed to PEDv but also to evaluate candidate vaccines.

Supporting research, vaccine development

"ADRDL researchers have a great understanding of the swine industry and importance of very proactive research and diagnostics to deal with field-based problems," said Scott Dee, director of research at Pipestone Veterinary Services. The company has three veterinary clinics—one in Minnesota and two in Iowa—and 30 veterinarians.



Eric Nelson

"Eric Nelson was the first to cultivate PEDv in the lab," noted Dee, who was a professor at the University of Minnesota and has been a veterinarian for 28 years. He collaborated with Nelson and Hennings and SDSU veterinarian Michele Mucciante on developing biosecurity for PEDv, specifically transportation, sanitation and risk of infection through feed.

"We were the first to prove that PEDv could be transmitted through feed," said Dee. He worked with the SDSU researchers to design experiments to determine how long and under what conditions the virus can live in feed ingredients.

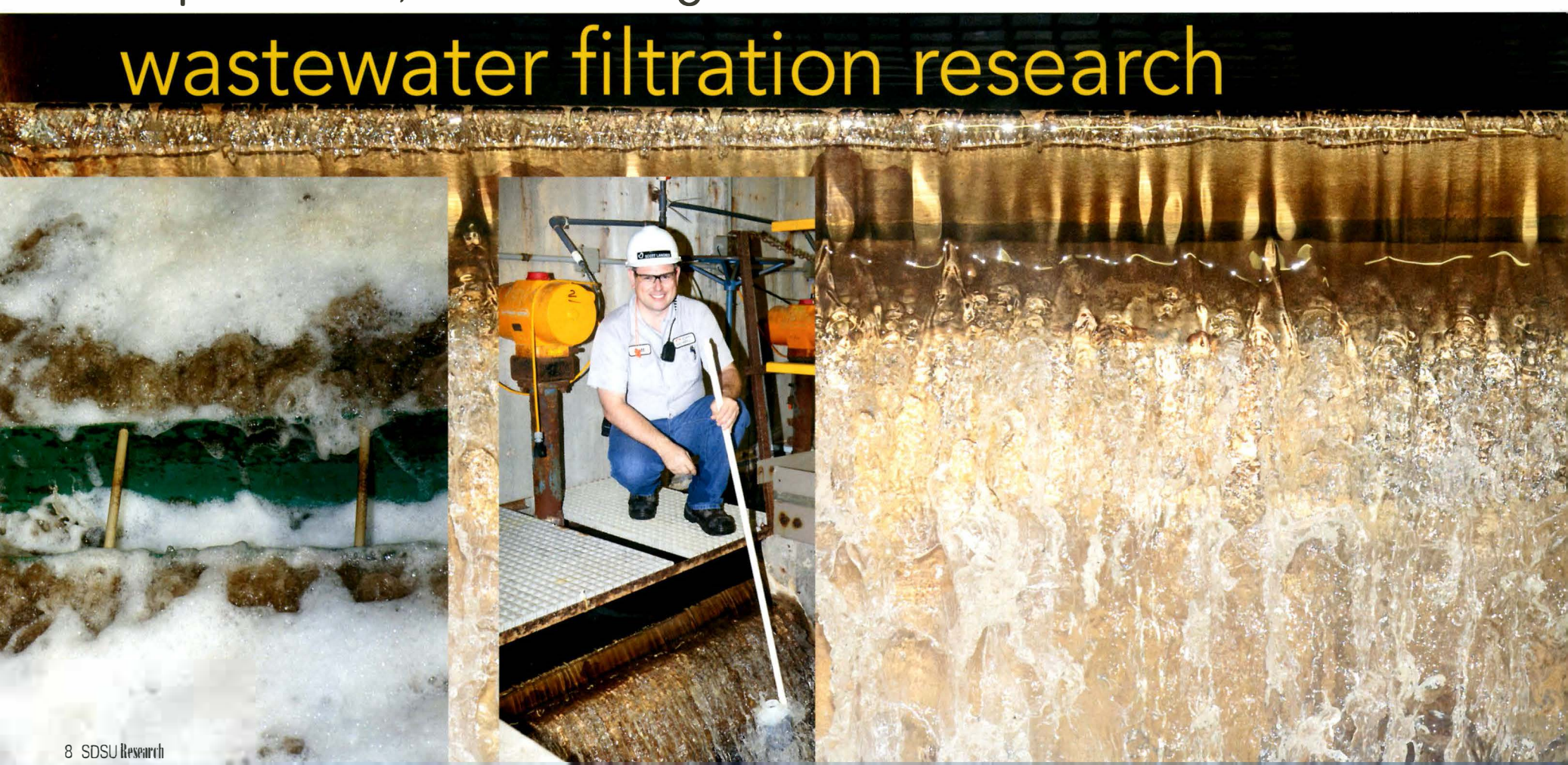
Hank Harris, president and CEO of Harrisvaccines, said, "Nelson was instrumental in helping us be the first company in the United States to develop a PEDv vaccine." The company, which the former Iowa State veterinary science professor began in 2005, received a conditional license for its PEDv vaccine in summer 2014.

An estimated 2 million doses of the vaccine were prescribed that year, according to feedstuffs.com. The vaccine is designed to boost the sows' immunity so that sufficient antibodies can be transmitted through their milk to protect newborns.

To evaluate the effectiveness of experimental vaccines, the company sent Nelson serum samples to test for virus-neutralizing antibodies.

"He's got the best test," said Harris. Overall, he pointed out, ADRDL is "one of the top diagnostic labs."

Experience, networking fuel wastewater filtration research



Breast-feeding friendly climate benefits businesses, communities

She's not an astronaut, but Jennifer Anderson is on a mission—to make Brookings the first breast-feeding friendly city in South Dakota.

The assistant professor in the communication studies and theater department wants moms who wish to breast-feed their babies to have the support they need, not only after the birth but also when they return to the workforce. To accomplish this, she and assistant professor Rebecca Kuehl assembled a team of nurses, lactation experts and business people.

"Breast-feeding benefits communities by helping build strong families and a strong workforce," said Anderson, whose expertise is health communication.

For her research, Anderson received the Sherwood and Elizabeth Berg Young Scientist Award at the 2015 Faculty Celebration of Excellence. The Brookings Supports Breast-feeding Project is funded through a $73,721 Community Innovation Grant from the Bush Foundation.

Sharing personal experience

Anderson learned firsthand how crucial support is for first-time moms who wish to breast-feed. On Feb. 17, 2014, she underwent an emergency cesarean section due to preeclampsia to deliver her first child—eight weeks before his due date.

Her son Winter was transferred from Brookings Health System to a neonatal intensive care unit in Sioux Falls before Anderson awoke from the anesthesia. She did not see him until four days later.

"My nurse and my doula knew that I wanted to breast-feed, so they helped me use a breast pump before I was even strong enough to do it myself," she said. "I could not have done it without their support."

Winter was in the intensive care unit for 31 days, Anderson recalled during a Nov. 11, 2014, lecture delivered onstage while breast-feeding her son. Her presentation on YouTube has gotten more than 15,000 views.

Expanding support beyond hospitals

In South Dakota, 77.7 percent of moms are breast-feeding their newborns when they leave the hospital, but by the time the babies are 6 months old, those numbers have fallen to 45.6 percent, according to the 2014 Breastfeeding Report Card from the National Center for Chronic Disease Prevention and Health Promotion.

In addition, South Dakota has the highest percentage of working mothers in the nation at nearly 80 percent, according to the 2010 U.S. Census.

To help make Brookings a breast-feeding friendly community, Anderson and the research team investigated how businesses can accommodate breast-feeding mothers when they return to work.

Other team members are SDSU nursing professor Lois Tschetter, Brookings Health System director of obstetrics Mary Schwaegerl and director of marketing and public relations Julia Yoder, breast-feeding advocates Marilyn Hildreth and Charlotte Bachman and business representative Heidi Gullickson, who is the former executive director of the Brookings Area Chamber of Commerce.

Engaging business leaders

The team hosted a communitywide public event Nov. 1, 2014. Prior to this, they had organized three focus groups to look at breast-feeding policies, challenges in the workplace and possible solutions.

Feedback from the 22 participating business representatives showed that slightly more than half of the businesses had formal breast-feeding policies, while three had informal policies. The focus group emphasized the value of interpersonal interactions in providing support for breast-feeding employees.

Overall, the researchers concluded that businesses need to create policies that protect and support employees who must pump during work hours and must clearly communicate those policies to all employees, according to Anderson. In addition, nursing mothers need a lactation room with supplies, such as a refrigerator and sink.

However, she cautioned, these are only general guidelines because the sample was small and the data gathered was qualitative.

In May, the South Dakota Department of Health's Office of Chronic Disease Prevention and Health Promotion and Women, Infants and Children (WIC) Programs selected Brookings as the pilot community for its breast-feeding initiative. The pilot project brings together efforts of the S.D. Department of Health, Brookings Supports Breastfeeding, Brookings Health System, SDSU Extension, Brookings Chamber of Commerce and the South Dakota Breastfeeding Coalition.

The goal is to increase the length of time that mothers breast-feed their babies by building public, business and peer support in the Brookings community, according to healthy foods coordinator Megan Hlavacek of the S.D. Department of Health.

"We want to support breast-feeding moms any way we can and to change the culture to make breast-feeding the norm, not the exception," she said. The initiative will also fulfill goals set by the Governor's Task Force on Infant Mortality.

"Brookings is just the perfect community because it already has the Brookings Supports Breastfeeding team in place," she pointed out. Planning has just gotten underway.

Assistant professor Jennifer Anderson nurses son Winter while giving a talk on why communities and businesses should support breast-feeding moms.

Experience in wastewater filtration and networking with wastewater managers have made the Water and Environmental Engineering Research Center a valuable resource for businesses and municipalities, according to center director Chris Schmit.

For his role in the center's continued success, Schmit was recognized as the outstanding researcher for the Jerome J. Lohr College of Engineering. The civil and environmental engineering professor has been the center director for three years and has been doing research for more than 16 years.

Responding to industry

In March 2014, wastewater plant manager Scott Langner asked Schmit to do a pilot study to select filter media at Smithfield in Sioux Falls. University researchers have worked on projects for Smithfield, also known as John Morrell, and the City of Sioux Falls for the last 10 years.

"Because of that ongoing relationship, we turned this around very quickly," Schmit said. The sponsored service agreement was in place by the end of April and graduate student Casey Leaf did the majority of the research work in summer 2014.

Smithfield provided some equipment and the manpower to do the pilot testing. The $9,000 grant primarily covered labor costs for the graduate student because Schmit was able to use the pilot filters from a previous project. Langner provided the filter media.

"Their plant operators ran the filter system, took samples and recorded data, so coordination was key to the success of the project," said Schmit, noting that the shared costs made the project affordable.

Selecting filtration media

"Choosing the right media to use in wastewater filtration can make all the difference," Schmit said. The filtration selection project was similar to one Schmit had done at the Sioux Falls Water Reclamation Plant for which the City of Sioux Falls, H.R. Green Engineering and SDSU received awards from the American Council of Engineering Companies of South Dakota and the South Dakota Engineering Society.

Solids removal, filter run time and backwash time to remove debris from the filter were major factors in selecting the proper wastewater filtration material, according to Langner. This filter is part of the Smithfield wastewater treatment system. After the wastewater runs through this system, it is discharged into the Big Sioux River, which was also the case in the Sioux Falls Reclamation Plant filtration project.

For the pilot unit filter, the SDSU researchers evaluated anthracite coal media in three particle size ranges—0.8 to 1.2 millimeter, 1.2 to 1.6 millimeter and 1.65 to 2 millimeters in diameter.

Smaller media will remove more suspended solids but require more frequent backwashing, while larger media result in longer filter run time. "The pilot plant tells you what will and won't work," Schmit added.

Based on the levels of suspended solids in the incoming wastewater, Schmit noted, "These filters are an integral part of the wastewater treatment process and are necessary to meet surface water discharge permit requirements."

The researchers found that the nature of the suspended solids, rather than the amount of water flowing through the filters, dictated the length of time the filter could be used before backwashing.

"We ran the filter through the paces, measured the solids in the filter and came up with a 1.2 to 1.6 millimeter design recommendation," Schmit explained. In addition, backwashing the filter for 15 minutes removes 95 percent of the solids.


Chris Schmit

The pilot study data verified that the company was using the correct size media, according to Langner. "Because our process hadn't changed, we didn't require a different size media," he said. H.R. Green Engineering then designed the filter, which has been installed at the plant.

Langner said, "This filtration project confirms that the proper processes are in place to maintain compliance and ensures that we are good environmental stewards."

A pilot study confirmed that the medium-sized media currently used is the best choice for this new wastewater filter at Smithfield. Wastewater plant manager Scott Langner takes samples, center, to monitor the quality of the water being released into the Big Sioux River.

Dairy scientist harnesses power of milk protein

Whether they're building muscle or managing weight, health-conscious consumers have fueled an increasing demand for high-protein foods and drinks. In 2012, nearly 20 percent of new products catered to this demand, according to Mintel, a market research firm.

However, consumers want those high-protein products to taste like their regular counterparts, according to dairy science assistant professor Hasmukh Patel. He develops ingredients from milk that make high-protein foods and drinks more palatable and reduce the need for artificial additives.

Patel's research focuses on the functional and nutritional properties of dairy ingredients, such as whey protein concentrates and isolates, milk protein concentrates and micellar casein.

He has secured more than $800,000 in funding from the Midwest Dairy Food Resource Center, National Dairy Council, the Australian Research Council and the U.S. Department of Agriculture National Institute of Food and Agriculture Hatch project through the SDSU Agricultural Experiment Station. Three undergraduate researchers, six graduate students and one postdoctoral researcher work on these projects.

For his work, Patel received the Sherwood and Elizabeth Berg Young Scientist Award at the 2015 Faculty Celebration of Excellence. In the last two years, he filed four patent applications.

Improving texture of high-protein yogurt

Patel has developed two processing techniques to improve the texture of high-protein yogurts, dips, spreads and puddings. The first uses carbon dioxide to treat the milk proteins and the second creates bubbles and then collapses the bubbles within the product during processing.

Normally, Greek yogurt contains 7.5 to 8 percent protein, according to Patel. "We can go to 10 to 11 percent protein without any impact on taste and texture."

In addition, these patent-pending processing methods can solve a longstanding problem—how to dispose of the liquid acid whey. "This is a huge environmental problem for the Greek yogurt, cottage cheese and cream cheese industries," Patel said. "The process we came up with does not generate acid whey at all."

The university is working with industry partners to commercialize these technologies. "This will be something really big in the next two to three years," he predicted.

Expanding uses of milk-proteins

Yogurt, ice cream, soups and sauces contain stabilizers, such as gum, gelatin, pectin and starch, which improve their body and texture, according to Patel. Consumer demand for clean label products with fewer additives and more natural ingredients provides dairy scientists another opportunity to expand the use of milk proteins.

Changing processing parameters, such as temperature and pH, can alter the interactions of milk proteins, according to Patel. This can help create a range of functional properties including foaming, gel formation, viscosity and emulsification. New processing techniques developed at SDSU will help milk protein ingredients replace artificial food additives to create the desired body, consistency or viscosity in these products.

Optmizing spray drying

To develop new ingredients, industries must optimize the processing conditions, Patel explained. But that takes time that industry doesn't have.

South Dakota State dairy scientists use a bench-scale single-droplet dryer to determine the exact parameters that create a consistent quality ingredient with the desired functional properties. Data on the core-to-shell drying process and drying behaviors of different materials will be used in collaboration with chemical engineering associate professor Cordelia Selomulya of Monash University in Melbourne, Australia, to develop a computational fluid dynamics model that will predict the drying parameters needed to produce an ingredient/powder with the desired characteristics.

Hasmukh Patel

A semi-commercial-scale dryer at the Davis Dairy Plant will then be used to validate the methodology and scale up the models developed.

"Such practical research can then be easily applied to benefit dairy and foods industries," added Patel, who will continue to collaborate on this and other research projects in his new role as senior principal scientist at Land O'Lakes in Minneapolis.

For a project on high solids drying, master's student Harsh Dahiya concentrates milk using a lab scale rotary evaporator.

Pharmacists' study helps prevent antibiotic-induced kidney failure

When associate professor of pharmacy practice Tadd Hellwig and three pharmacy colleagues at the Sanford USD Medical Center noticed that some hospital patients given two common antibiotics developed kidney failure, they decided to take a closer look.

What they discovered led to closer monitoring of patients receiving vancomycin and piperacillin-tazobactam due to an increased risk of kidney damage.

Vancomycin is used to treat patients with staph bacteria that are resistant to antibiotics, Hellwig explained. Piperacillin-tazobactam is a broad-spectrum antibiotic combination.

"Both are very common within the hospital setting," he said, noting that they are given intravenously.

For his contributions to research, teaching and service, Hellwig was named the outstanding scholar for the College of Pharmacy at the 2015 Faculty Celebration of Excellence. Last year, the South Dakota Society of Health-System Pharmacists recognized him as Pharmacist of the Year. In addition, he received the Sanford Health Residency Preceptor of the Year Award in 2013.

Looking at numbers

"People associate vancomycin with nephrotoxicity," said Sanford collaborator pharmacist Rhonda Hammerquist. She recalled that the question about whether the combination of vancomycin and piperacillin-tazobactam increased that risk came up during a weekly residency program meeting. Others involved in the study were Sanford pharmacists Beth Loecker and Jamie Shields.

The antibiotics can be used for several types of infections, including skin and soft tissue infections, as well as pneumonia, Hammerquist explained. "Based on our population, we see this combination quite frequently."

The researchers identified 735 Sanford USD Medical Center adult patients who received vancomycin, piperacillin-tazobactam or both during two three-month periods, one in 2009 and another in 2010. From 2009 to 2010, the procedure for administering piperacillin-tazobactam changed from a 30-minute to a 4-hour infusion time.

More than 20 percent of the 109 patients who received both antibiotics in the shorter infusion time developed acute kidney failure, according Hellwig. Among the 101 who received the drug combination infusion over the longer period, the incidence of kidney failure was 16.8 percent.

This is significantly higher than the overall 10.5 percent rate of acute kidney failure for all the patients in the study, he noted. When only piperacillin-tazobactam was administered, the kidney failure rates decreased to 13.5 percent for the shorter infusion time and 8.4 percent for patients who received the antibiotic over the 4-hour period.

"Piperacillin-tazobactam results in more acute renal failure than vancomycin," Hellwig pointed out. With vancomycin alone, the kidney failure rate dropped to 4.9 percent.

Sharing results, monitoring patients

"We were among the first groups to look at and present the data," Hammerquist said. That then led to educating the Sanford staff about what they had learned.

Tadd Hellwig

"This is one of the first big research projects that I've done," Hellwig said. "It showed me that even without grant funding, I can still look at problems, do research and get results that can improve patient care."

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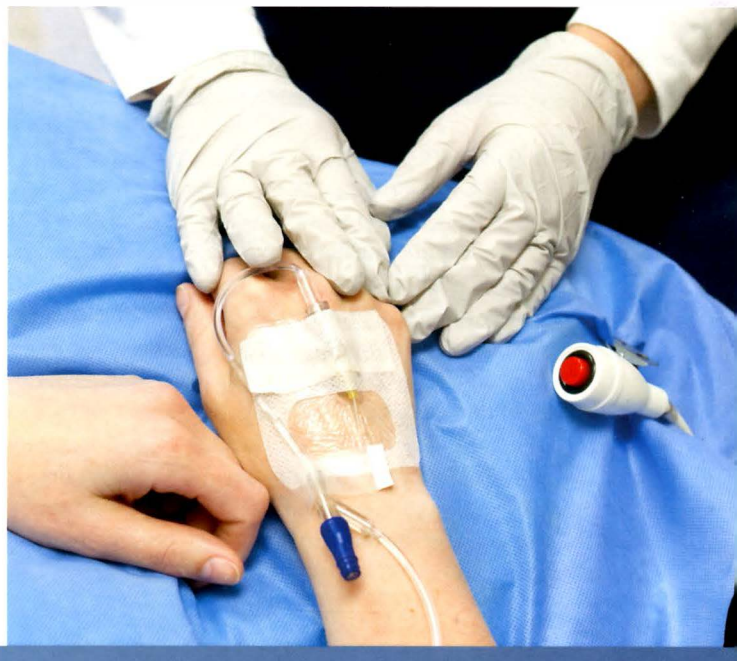


A pharmacy study showed that patients receiving the intravenous antibiotics vancomycin and pipperacillin-taxobactam are at increased risk for kidney damage and should be closely monitored. *Photo courtesy of Sanford Health*

Plants

exchange carbohydrates for nitrogen, phosphorus from mycorrhizal fungi

Heike Bücking

An ancient, mutually beneficial relationship between plants and fungi could make agriculture more sustainable by reducing the need for chemical fertilizers, according to professor Heike Bücking of the biology and microbiology department. To identify which fungi are most beneficial for specific crops, scientists must understand how nutrient uptake and transport pathways are triggered in these complex interactions.

For more than 600 million years, the majority of land plants, including trees, have shared their carbohydrates with fungi that colonize their roots, she explained. In exchange, these fungi provide plants with nitrogen and phosphorous as well as trace elements of copper and zinc.

Approximately 65 percent of land plant species form relationships with arbuscular mycorrhizal fungi, according to Bücking, who studies these interactions in food and bioenergy crops including wheat, corn, soybeans, alfalfa, clover and perennial grasses, such as prairie cordgrass. Her research has been supported by the National Science Foundation, South Dakota Wheat Commission, Sun Grant Initiative, Soybean Research and Promotion Council and the U.S. Department of Energy Joint Genome Institute.

For her work, Bücking was recognized as the outstanding researcher for the College of Agriculture and Biological Sciences at the 2015 Faculty Celebration of Excellence.

Establishing balanced relationship

Fungi need the host plant to reproduce, Bücking explained. Spores in the soil germinate and the hair-like fungal threads called hyphae then penetrate into the plant roots and form an intimate interface, referred to as arbuscules, within the host root. The fungus then generates an extensive network of hyphae in the soil that takes up soil nutrients far beyond the plant's root system.

Supply and demand determine the amount of nutrients that plant and fungi exchange in this mutualistic relationship, according to Bücking. To unravel these complex interactions, she collaborates with researchers at the Vrije Universiteit in Amsterdam and the University of British Columbia as well as Agricultural Experiment Station researchers. Five doctoral students, two master's students and three undergraduates work on this research.

"Though a host plant is colonized by multiple fungi species simultaneously, the plant knows exactly where certain benefits are coming from. The host plant can distinguish between good and bad fungal behavior and allocates resources accordingly," she said.

The host plant transfers anywhere from 4 to 20 percent of its photosynthetically fixed carbon to mycorrhizal fungi, Bücking explained. However, she noted, "to maximize the nutritional benefits for the host, we need to better understand how nutrient transport is regulated and controlled."

These fungi also form common mycorrhizal networks that give them access to multiple hosts. When host plants were shaded and thus decreased their carbohydrate allocation, fungi responded by reducing their nutrient share, Bücking explained. "Despite depending on their hosts for reproduction, fungal partners can thereby retain their bargaining power."

Optimizing fungi for certain crops

"We think these fungi can increase the biomass production of bioenergy crops and the yield of food crops and do so in a more sustainable and environmentally friendly way," she said. The challenge is to figure out which fungi will most benefit the crops under certain environmental conditions.

Some fungi are more cooperative than others, Bücking pointed out. She and her collaborators evaluated the relationship between alfalfa and 31 different isolates of 10 arbuscular mycorrhizal fungal species. They then classified the fungal isolates as high-, medium- or low-performance isolates.

The researchers found that high-performance isolates increased the biomass and nutrient uptake of alfalfa by more than 170 percent, while the low-performance isolates did not have any effect on growth.

However, those that benefit one crop may not provide the same nutrients or benefits to another crop species, she cautioned. "Even different isolates of one fungal species can behave differently."

Adapting to stressors

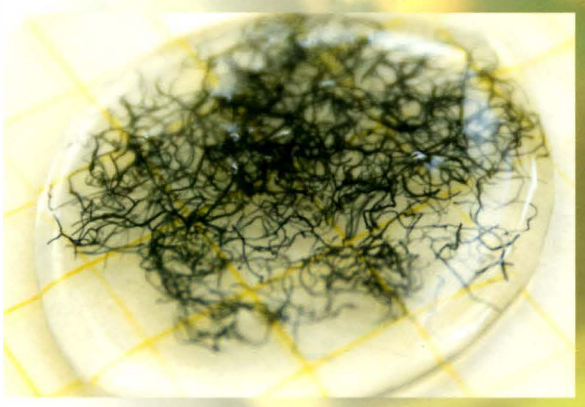
In addition to providing nutrients, these fungi can protect food and bioenergy crops from diseases and environmental stresses, such as drought, salinity and heavy metals, Bücking explained. "All the stresses that a plant can potentially be exposed to are generally improved by mycorrhizal interactions."

Increasing tolerance through conventional breeding generally targets only one specific stress factor, but crops are often subjected to multiple stresses simultaneously, she pointed out. "These fungi, if used efficiently, can provide the plant with an improved resistance against stresses that are often difficult for us to predict.

"Plants in the soil are not living in a sterile compartment," Bücking said. "What we see later in terms of yield is a combination of plant traits and the microbial communities associated with the plants, along with their ability to take advantage of these microbial communities."

Though Bücking acknowledged the need to increase food production using inorganic fertilizers, she noted that "excessive fertilizer applications can cause a lot of environmental problems."

Increasing the efficiency with which crops interact with their microbial communities and take up nutrients will reduce costs and increase production without negatively impacting the environment.



Top:
Plant roots are stained and examined for mycorrhizal colonization under the microscope.

Middle:
This microscope image shows thin hyphae that emerge from a root colonized with arbuscular micorrhizal spores.

Bottom:
Prairie cordgrass, a perennial native to the tall grass prairies, can serve as a bioenergy plant due to its high biomass production and ability to grow on marginal lands.

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CONTINUED FROM PAGE 10

Kidney failure

Practicing pharmacists noticed that patients given two common intravenous antibiotics tended to develop kidney failure—what they and subsequent researchers found has led to changes in the way these drugs are administered and closer monitoring of renal function.
Photo courtesy of Sanford Health

Tyler Turek, pharmacy clinical manager at Sanford USD Medical Center, said, "Overall, this study heightened our awareness of the need to consider alternative therapies whenever clinically appropriate."

Hellwig and his colleagues presented their results at the February 2012 Society of Critical Care Medicine annual meeting. Their work was one of two studies subsequently highlighted in the June 2012 Pharmacy Practice News.

"It opened the doors for lots of others to look at it further," he said. Researchers from the University of Florida-Jacksonville, Duke University and Campbell University in North Carolina and the University of Maryland published similar studies in a 2014 issue of Pharmacotherapy.

"This work continues to highlight the role that our pharmacists have as experts who can identify opportunities for improvement in medication-related care," Turek said.

Hellwig agreed. "Within a hospital setting, we are able to identify these types of problems, then do the research to clarify what the results actually are and how to use those results in daily monitoring of patients in the hospital."

For a description of SDSU technologies available for licensing, go to http://www.sdstate.edu/research/tto/technologies/index.cfm

More technical information is available through Will Aylor, assistant vice president for technology transfer and commercialization—will.aylor@sdstate.edu or (605) 688-4752.

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