LSU RESEARCH

Office of Research & Economic Development ····· The Constant Pursuit of Discovery | 2019–20

CONVERGENCE

a study in multidisciplinary collaborations

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FROM THE VICE PRESIDENT

Convergence in research is about weaving many ideas and perspectives into a single fabric. Each day, we see this grow and change across the LSU campus—a new and beautiful synergy. We are building upon our existing strengths and developing new initiatives, such as the Center for Collaborative Knowledge, where faculty from the seemingly disparate fields of biology, anthropology, religion, mass communication, and more came together to create a truly multidisciplinary center dedicated to the very idea of convergence.

The National Science Foundation has identified "deep integration across disciplines" as one of its 10 Big Ideas, stating:

"As experts from different disciplines pursue common research challenges, their knowledge, theories, methods, data, research communities, and languages become increasingly intermingled or integrated. New frameworks, paradigms, or even disciplines can form sustained interactions across multiple communities."

In the following pages, we share some of the fruits of our labor and insight from some of our leading researchers and convergence experts.

I hope you enjoy seeing how we have put these principles into action. Visit **lsu.edu/research** for more stories throughout the year.

Samuel J. Bentley

Vice President, Research & Economic Development
Billy and Ann Harrison Chair in Sedimentary Geology

ABOUT THIS ISSUE

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About the Cover

Leonardo da Vinci was a forefather in convergence research. In his work, you see both the artist's eye for detail benefiting the study of science and scientific study of the human figure elevated to art. When thinking about collaboration in the midst of convergence research, this aspect of da Vinci's sketches should not be overlooked. From our perspective, hands are the most symbolic part of the body when it comes to collaboration. This magazine cover seeks to communicate the beauty of collaborative efforts in convergence research while paying homage to the aesthetic of da Vinci as well as his studies. This cover illustration was created by staff graphic designer Marcus Soniat.

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NEWS

By Beth Carter and Alison Lee Satake

Risk Remains Low Despite Rise in Global Shark Attacks

A study led by LSU Department of Oceanography & Coastal Sciences Assistant Professor Stephen Midway shows that although the number of shark attacks has increased over time, the rate of attack is low, and the risk of being attacked by a shark is highly variable across the globe. Midway and his collaborators conducted the first statistical analysis of shark attacks worldwide using data collected over a 55-year period.

A spate of shark attacks in North Carolina in 2015 made Midway, whose expertise is in fish ecology, curious about whether these events were unprecedented or normal, numerically speaking.

Midway and colleagues applied time series models to shark attacks that occurred in 14 countries and further investigated specific regions within three countries that had the highest number of shark attacks: the U.S., Australia, and South Africa. They found that shark attack rates, although extremely low, have doubled over the past 20 years in highly populated regions, including the East Coast of the U.S. and southern Australia.

"With more people in the water, the chance for a shark attack naturally increases. But even in the places where we saw an increase, the chances were still one in several million," Midway said.

Other studies have shown that year-over-year variation in the number of shark attacks is often the result of a combination of factors. For instance, the increased number of attacks in North Carolina in 2015 is now thought to be the result of a very warm summer, changes in prey distribution, and an increased number of beachgoers.

Other factors include the overall number of people in the water and the type of water activity conducted at specific locations. Therefore, shark monitoring measures and management activities can be implemented at the local level to further lower the risk of shark attacks.

New Bird Species Discovered

LSU Museum of Natural Science researchers discovered a new species of bird on the island of Borneo. Their discovery of the Cream-eyed Bulbul, or *Pycnonotus pseudosimplex*, was published in the *Bulletin of the British Ornithologists' Club* scientific journal.

This bird is found from southern Thailand to Sumatra, Java, and Borneo. In most of its range, another bird, the Cream-vented Bulbul, has white eyes. On Borneo, however, most bulbuls have red eyes, although there are also a few with white eyes. Naturalists previously thought the eye color differentiation on Borneo was inconsequential since the birds look identical otherwise. However, LSU researchers discovered the white-eyed birds on Borneo actually represent a completely new species, which they dubbed the Cream-eyed Bulbul.

Credit: Subir Shakya, LSU.

LSU PhD student Subir Shakya and his advisor, LSU Museum of Natural Science Curator of Genetic Resources Fred Sheldon, discovered a new species of bird on Borneo, which they've named the Cream-eyed Bulbul illustrated here by Shakya.

"One of the reasons we knew we had a new species as opposed to just a variant of another species was because the two populations—the red-eyed and white-eyed populations—actually occur together on Borneo," said Subir Shakya, lead author and LSU Department of Biological Sciences PhD student. "One of the theories of speciation is if two birds co-occur in the same area, and they are not interbreeding, then that's a definitive sign that they are different species."

Shakya made the discovery after he had returned to LSU from an expedition to Sumatra. He was sequencing the DNA of several bird specimens from Sumatra and Borneo to compare them when he discovered that the white-eyed bulbuls from Borneo were genetically distinct.

"This discovery was made due to Subir's dogged detective work and a little serendipity," said co-author Fred Sheldon, the LSU Museum of Natural Science curator of genetic resources and Shakya's PhD advisor.

The LSU Museum of Natural Science houses the world's largest collection of genetic samples of birds from Borneo and Sumatra.

Credit: LSU

LSU researchers (left to right) Ryan Burner, Lindsey Burner, Fred Sheldon, and Subir Shakya at their fieldwork site in southeast Borneo.

Salt: Mover and Shaker in Ancient Maya Society

Salt is essential for life and a biological necessity. However, as ancient civilizations evolved from hunters and gatherers to agrarian societies, it has not been clear how people acquired this mineral. Recently, an anthropologist at LSU discovered remnants of an ancient salt works in Belize that provide clues on how the ancient Maya at the peak of their civilization more than 1,000 years ago produced, stored, and traded this valuable mineral. New analyses of stone tools found at this site, called the Paynes Creek Salt Works, reveal that not only were the Maya making salt in large quantities, but they were salting fish and meat to meet dietary needs and producing a commodity that could be stored and traded.

"Since we found virtually no fish or other animal bones during our sea-floor survey or excavations, I was surprised that the microscopic markings on the stone tools, which we call 'use-wear,' showed that most of the tools were used to cut or scrape fish or meat," said Heather McKillop, the study's lead author and the Thomas & Lillian Landrum Alumni Professor in the LSU Department of Geography & Anthropology.

McKillop also discovered a tool made out of high-quality translucent jadeite with an intact rosewood handle at her study site in Belize. During the Classic Period of A.D. 300–900, high-quality translucent jadeite was typically reserved for unique and elaborate jadeite plaques, figurines, and earrings for royalty and other elites.

The discovery of these high-quality materials—jadeite and rosewood—used as utilitarian tools, demonstrates that salt workers played an important role in the Classic Maya marketplace economy more than 1,000 years ago.

"The salt workers were successful entrepreneurs who were able to obtain high-quality tools for their craft," she said.

Credit: LSU

An LSU study of ancient Maya chert, or flint, tools reveals that not only were the ancient Maya making salt in large quantities, but they were salting fish and meat to meet basic dietary needs and producing a commodity that could be stored and traded.

Study Shows Scientists Who Selfie Garner More Public Trust

Many scientists today embrace social media as a tool to communicate their research and to engage broader audiences in scientific discovery and its outcomes. But the rise of the "social media scientist" has also led communicators and scholars to ask an important and often overlooked question: Do people trust the scientists who show up in their social media feeds? The answer may depend on how these scientists portray themselves, according to a study conducted by researchers at LSU.

Credit: Paige Jarreau and Becky Carmichael, LSU

"Social media channels, like Instagram, provide an exciting opportunity for scientists to improve their public image," said co-author Becky Carmichael, LSU Communication across the Curriculum science coordinator. "We wondered whether seeing the faces of friendly, honest scientists sharing glimpses of their everyday work in the science lab or field could help change the problematic stereotypes that scientists are competent but not warm."

The results of the study showed that scientists who post "selfies" or self-portraits in their Instagram feeds can foster trust.

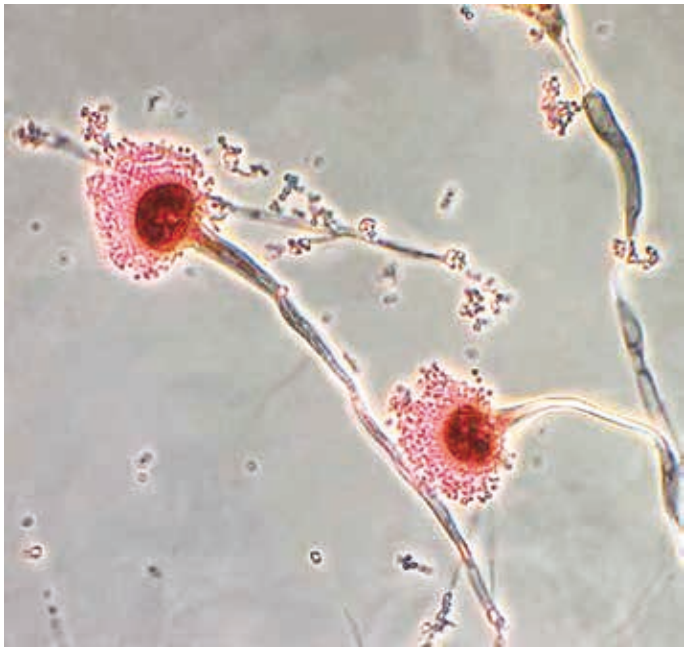
The study participants who saw images including a scientist's smiling face, or "scientist selfies," evaluated the scientists in the images and scientists in general as significantly warmer than participants who saw control images or images of scientific environments or equipment that did not include a person.

"We think this is because people who viewed science images with a scientist's face in the picture began to see these scientist communicators on Instagram not as belonging to some unfamiliar group of stereotypically socially inept geniuses but as individuals and even as 'everyday' people with 'normal' interests—people who, like us, enjoy taking selfies," said lead author and LSU alumna Paige Jarreau, who is a former LSU science communication specialist and current director of social media and science communication at LifeOmic.

The team further found that seeing a series of female scientist selfies on Instagram significantly shifted gender-related science stereotypes, namely those that associate STEM fields with being male.

Chemists Characterize the Fatal Fungus Among Us

Life-threatening fungal infections affect more than two million people worldwide. While effective antifungal medications are limited, one of the major challenges is that the fungal cell wall has been poorly understood, which has impeded the development of effective antifungal medications that target the cell wall. For the first time, however, an LSU chemist has identified the cell wall structure of one of the most prevalent and deadly fungi, which could usher in a new era of antifungal drug development to help save millions of lives.



Credit: LSU.

LSU chemists have identified the cell wall structure of one of the most common and deadly airborne fungi, *Aspergillus fumigatus*.

LSU Department of Chemistry Assistant Professor Tuo Wang and colleagues have identified the high-resolution architecture of the cell wall of one of the most common fungi, *Aspergillus fumigatus,* which is airborne and can be found both indoors and outdoors. In people with compromised immune systems, the fungus multiplies at an extraordinary rate. It affects more than 200,000 people annually, including a quarter of all leukemia patients, and kills more than half of these patients.

"This is the first time anyone has looked at the whole cell of these fungi in its native state at such high resolution. Our work provides the molecular basis to engineer more effective antifungal drugs," Wang said.

Next, Wang and colleagues will test the efficacy of various antifungal drugs against *Aspergillus fumigatus* in his lab at LSU. ■

Credit: Elsa Hahne, LSU

Isiah Warner with his current and former mentees at the Nature Award for Mentoring in Science ceremony.

On Mentoring

Q&A with LSU Boyd Professor Isiah Warner

By Elsa Hahne

Upon accepting his lifetime achievement Nature Award for Mentoring in Science, LSU Boyd Professor Isiah Warner elaborated on the method that made the LSU Department of Chemistry the top producer of doctoral degrees in chemistry for both women and African Americans in the U.S.

How do you feel about receiving this lifetime achievement award?

I feel very honored.

Why is mentorship important to you?

I mentor because there were always people there for me. I didn't have any role models in terms of science when I grew up in Bunkie, Louisiana, with segregated schools, but there were people along the way who helped me figure out the path I wanted to go down.

Credit: Elsa Hahne, LSU

Warner and his wife, Della Blount Warner, whom he credits as his greatest mentor.

Who has been your own greatest mentor?

I always point toward my wife. She took a country boy and made him into the man I am—a country boy who knows how to do other things.

Also, my English teacher in high school. She asked me around graduation time what I wanted to do, and she's the one who suggested chemistry and worked to get me into a summer workshop with Dr. Vandon E. White, who was the Chair of Chemistry at Southern University across town. He told me, 'Mr. Warner, you'll have your PhD before you're 30.'

And I looked around to see if anyone else knew what a PhD was. I said, 'Dr. White, what's a PhD?' I thought we were calling him Dr. White because he had some kind of medical degree or something—I didn't know. I was going to college and didn't know what a PhD was.

That summer workshop was $120—for the whole summer, including boarding and eating and everything, it was a bargain—but I had to come up with $60 on my own, and that was hard for me. So, I went to my father who said, 'I'll try to get it,' and he ended up borrowing the money from my grandfather. That whole experience changed my life.

How do you feel about your own mentorship style?

I never thought of what I do as mentoring. It's just a natural instinct of mine. Then I started winning these mentoring awards and realized, maybe I am doing something different. I never thought of myself as doing something special.

I hear you have a method, however. Can you describe your method?

Not everyone requires the same input to get them to function. You have to vary what you're doing from person to person. So, how can you call that a method, really? There are students who think I'm too strict, that I have these rules, but it's a matter of finding rules they can accept.

So, what are the rules?

There are no rules! [laughs] I just try to find out what each student needs.

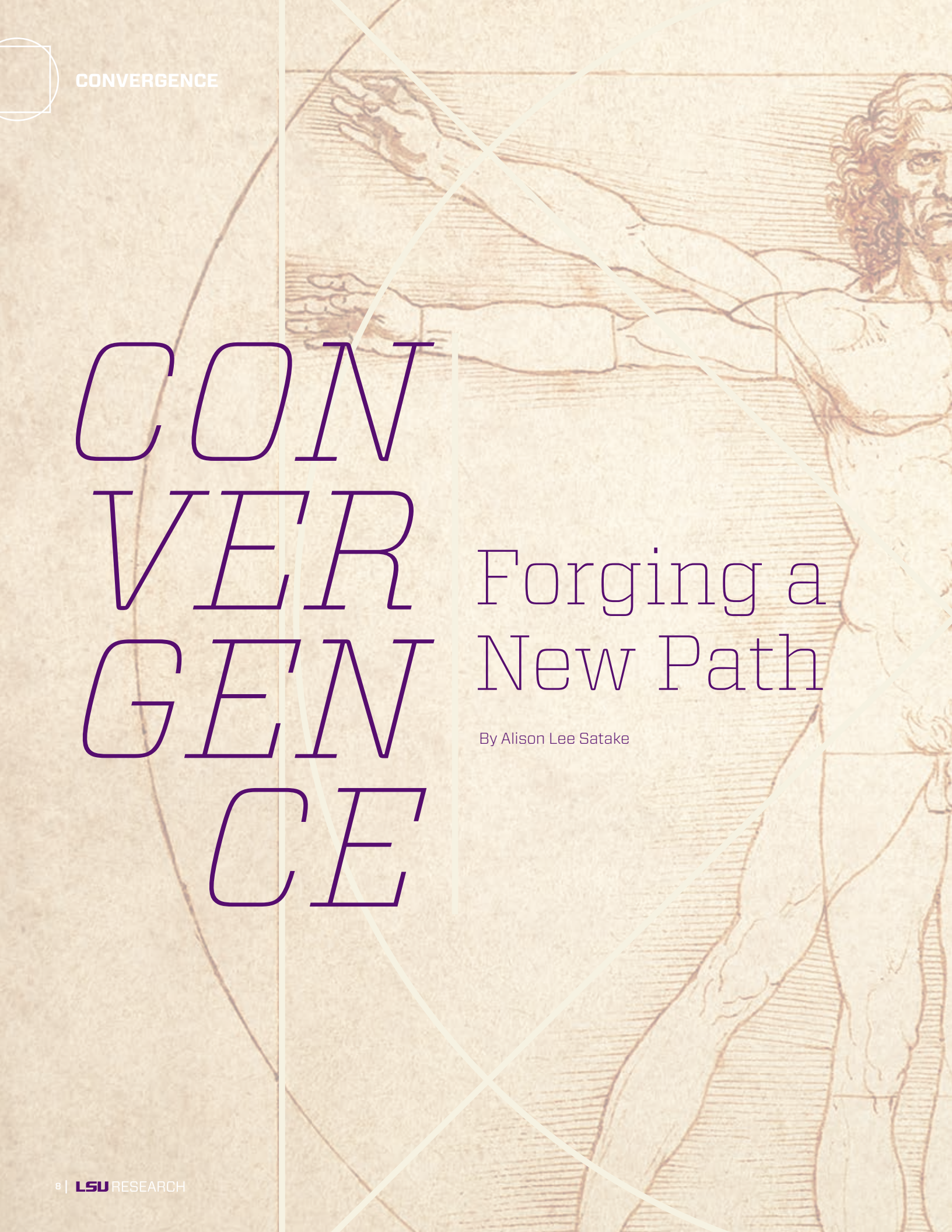
There are people who join my group thinking, because they're black and I'm black, that I'm going to give them a free pass. But I don't give anybody a free pass. Also, there are people who say I'm harder on African American students than I am on white students. I don't see that, and I certainly don't feel that way, but I do recognize that there's not an equal playing field in this country yet. There are people who will treat you differently—not all, but some—and you have to be prepared.

If I was simply a research advisor, everyone in my group would be treated the same. I would say, 'Here are the rules. Follow these rules. Get me results.' But I adjust to the needs of each particular student.

Lately, a lot of female students have joined my group. Out of 15 students, 13 are female.

Do you feel at this point in your career that you fully understand the dynamics of mentorship?

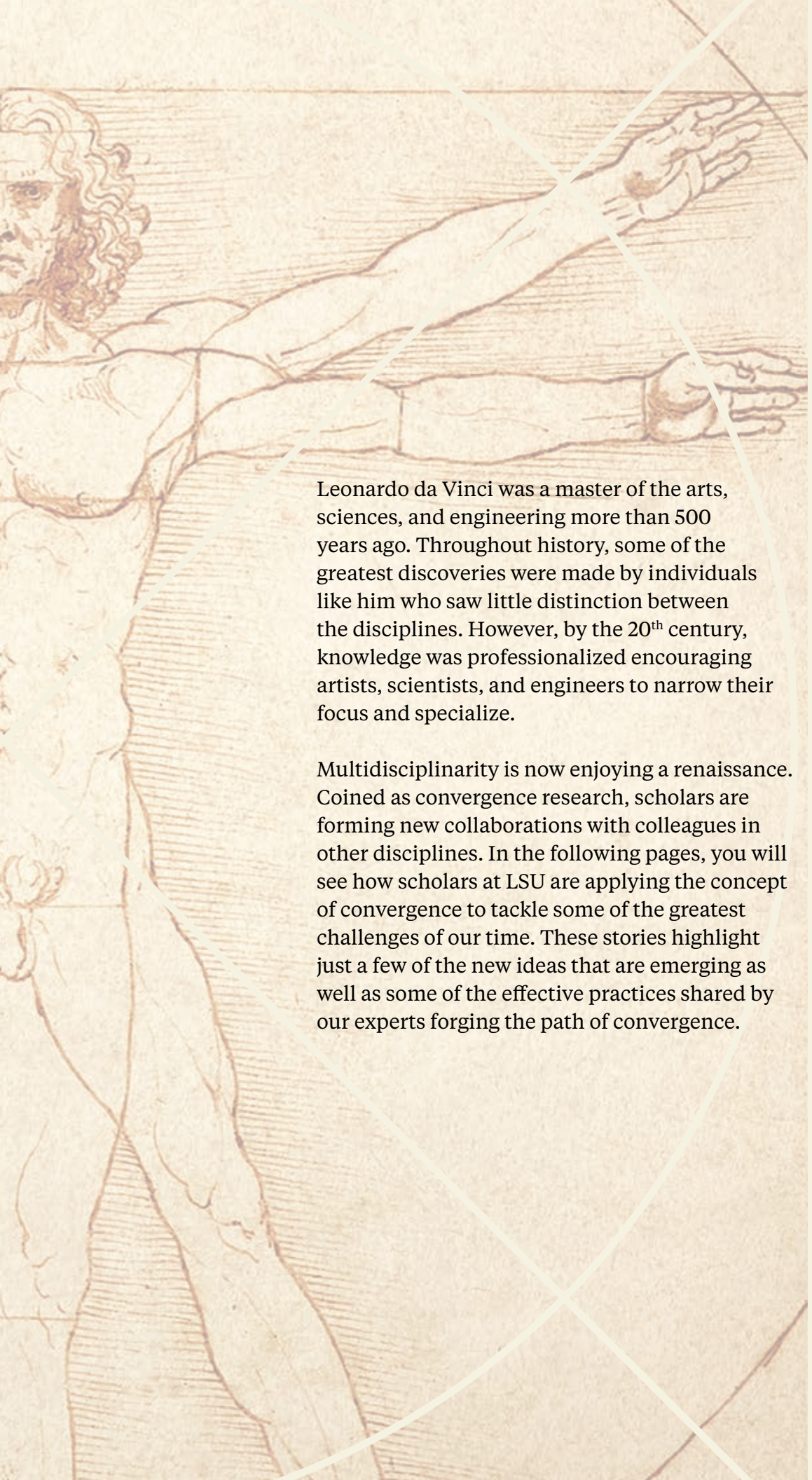
Ha! Let's just say I understand it better than I used to. Like I said, I never thought of what I do as mentoring. I'm just trying to help other people. And that's my wife's natural instinct also. ■



CONVERGENCE

Forging a New Path

By Alison Lee Satake



Leonardo da Vinci was a master of the arts, sciences, and engineering more than 500 years ago. Throughout history, some of the greatest discoveries were made by individuals like him who saw little distinction between the disciplines. However, by the 20th century, knowledge was professionalized encouraging artists, scientists, and engineers to narrow their focus and specialize.

Multidisciplinarity is now enjoying a renaissance. Coined as convergence research, scholars are forming new collaborations with colleagues in other disciplines. In the following pages, you will see how scholars at LSU are applying the concept of convergence to tackle some of the greatest challenges of our time. These stories highlight just a few of the new ideas that are emerging as well as some of the effective practices shared by our experts forging the path of convergence.

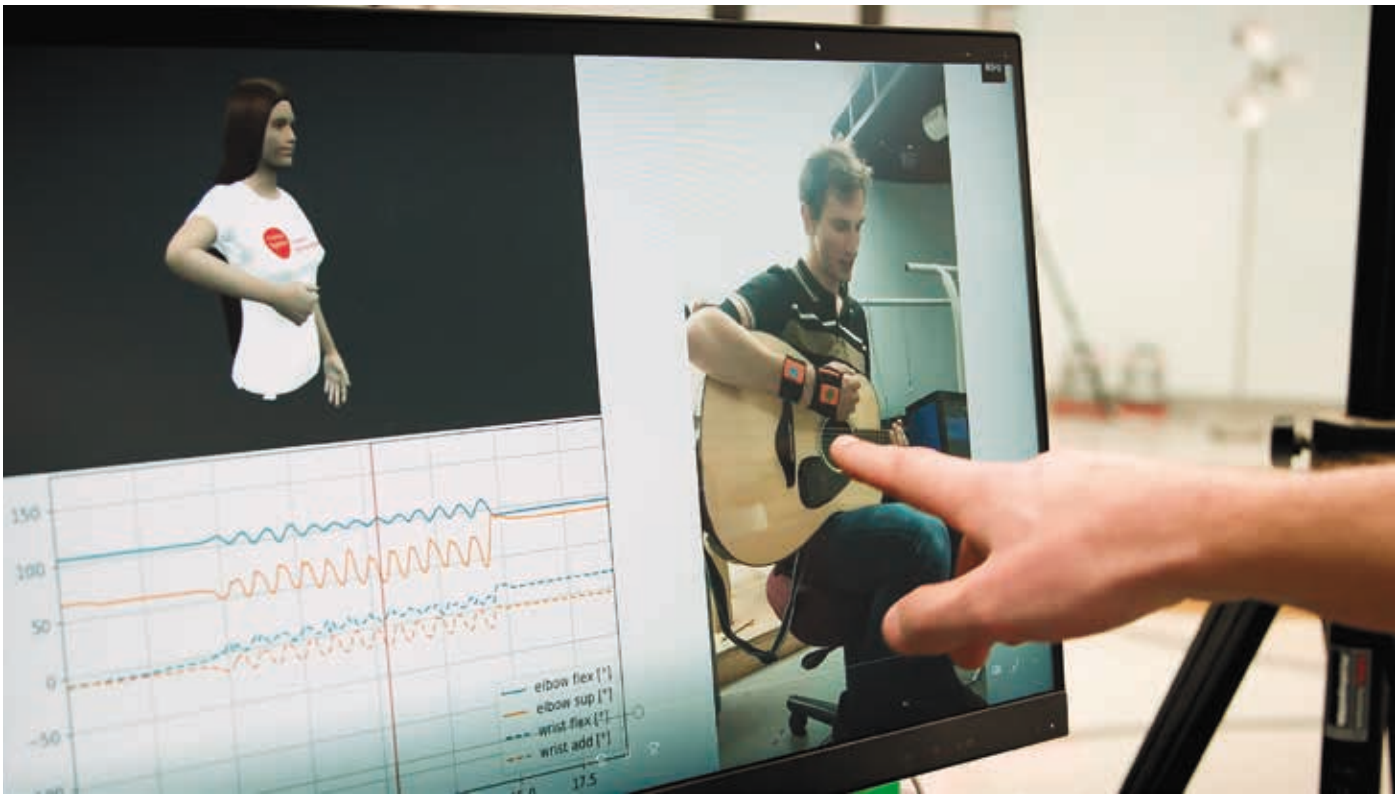
Adaptive Guitar

For Stroke Rehabilitation

By Rachel Holland

A group of kinesiologists and engineers are creating and researching a music-based technique to help stroke patients rehabilitate their arm and hand movements. Their work is personal.

"The initial idea came about from personal experience. I knew someone who was a guitar player before, and they had a stroke, and they had a thought of returning to the activity they really enjoyed doing before this," said Nikita Kuznetsov, an assistant professor in the LSU School of Kinesiology. "There were some devices on the market that were targeted to that audience, but no one actually did any research on how people may use an adapted guitar instrument to improve movement after a stroke."



Credit: LSU

LSU kinesiologists and engineers have collaborated to create an adaptive guitar for stroke patients.

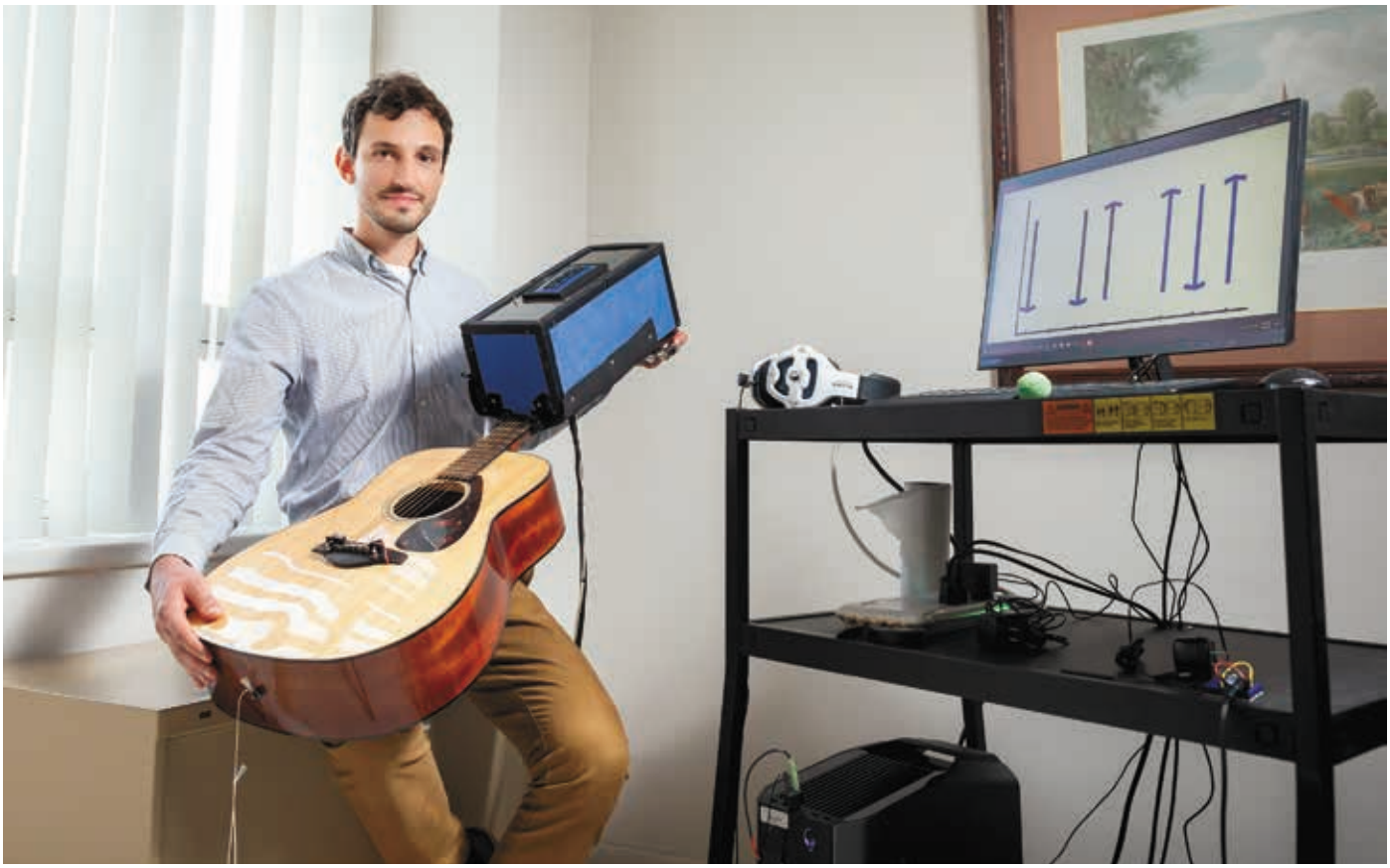
> "We are amazed at what he has developed and excited to assist in his research. Guitar can be an especially challenging instrument, as two hands work in coordination doing different things to make music. Dr. Kuznetsov's adaptive guitar will allow patients to learn and play guitar using one foot and one hand, strengthening their motor skills while developing new brain connections, improving emotional outlook, and having fun."
>
> Mary Malloy
> Baton Rouge General Hospital music therapist

Research has shown music can help improve motor function and alter brain function in healthy people. Guitar is particularly interesting because it requires the coordination of two arms to produce a rhythm and play chords.

"I thought this would be a really nice area to go into: What happens to your brain and muscle coordination when you learn how to perform this very complex motor skill? Can we use music-based approaches to enhance clinical movement rehabilitation outcomes in stroke survivors? I actually wanted to purchase some of the adapted guitar devices that were on the market, but they were not being sold anymore for some reason. So, we had to make our own," Kuznetsov said.

Kuznetsov shared that idea with Hunter Gilbert, an assistant professor in the LSU Department of Mechanical & Industrial Engineering.

"We decided we needed to build our own prototype in order to facilitate this study. So, I worked with a team of undergraduates who are all at the senior level, pretty much in their last year of school in mechanical engineering and electrical engineering. And this team, under my advisement, produced the initial prototype," Gilbert said.



Credit: LSU

LSU School of Kinesiology Assistant Professor Nikita Kuznetsov demonstrates the adaptive guitar.

The team created a device that is attached to the neck of the guitar as part of their senior design project.

"It has servomotors on the inside, which can apply pressure to the strings of the guitar to fret the strings in any chord shape you want. This device is capable of producing literally every chord that's capable of being produced on a guitar," Gilbert said.

James Kirsch, an LSU electrical engineering and robotics student, was part of the team that built the prototype.

"Basically, we have programmed it so the user can step on a pedal and that sends a signal to the computer that runs the device. And depending on how you have it programmed to work, it will send a signal to the servo, and they will, depending on which chord you wanted, press down onto the strings and fret the chords," Kirsch said.

Kuznetsov, along with undergraduate and graduate kinesiology students, are conducting the first phase of their study.

"We are testing the guitar with healthy, young adults here at LSU, to characterize motor learning skills and how people will actually interact with the device. We are testing specific hypotheses about changes in their motor behavior and coordination. We also want to make sure we fix all the bugs before trying it out with stroke survivors. We need to make sure we can get accurate measurements of the timing of the strumming pattern and the movements of the arm. The end goal is to apply it to individuals with chronic stroke disease in a pilot study, then enlarge the pilot study depending on the results. We are currently working on a grant submission to the National Institutes of Health as part of their 'Sound Health' initiative to study how music could be harnessed for health and wellness applications in daily life," Kuznetsov said.

After this first phase, the guitar will be used and studied with patients at Baton Rouge General Hospital.

Sarah Cherry, an undergraduate honors kinesiology major from Reno, Nevada, says she loves being involved with this project.

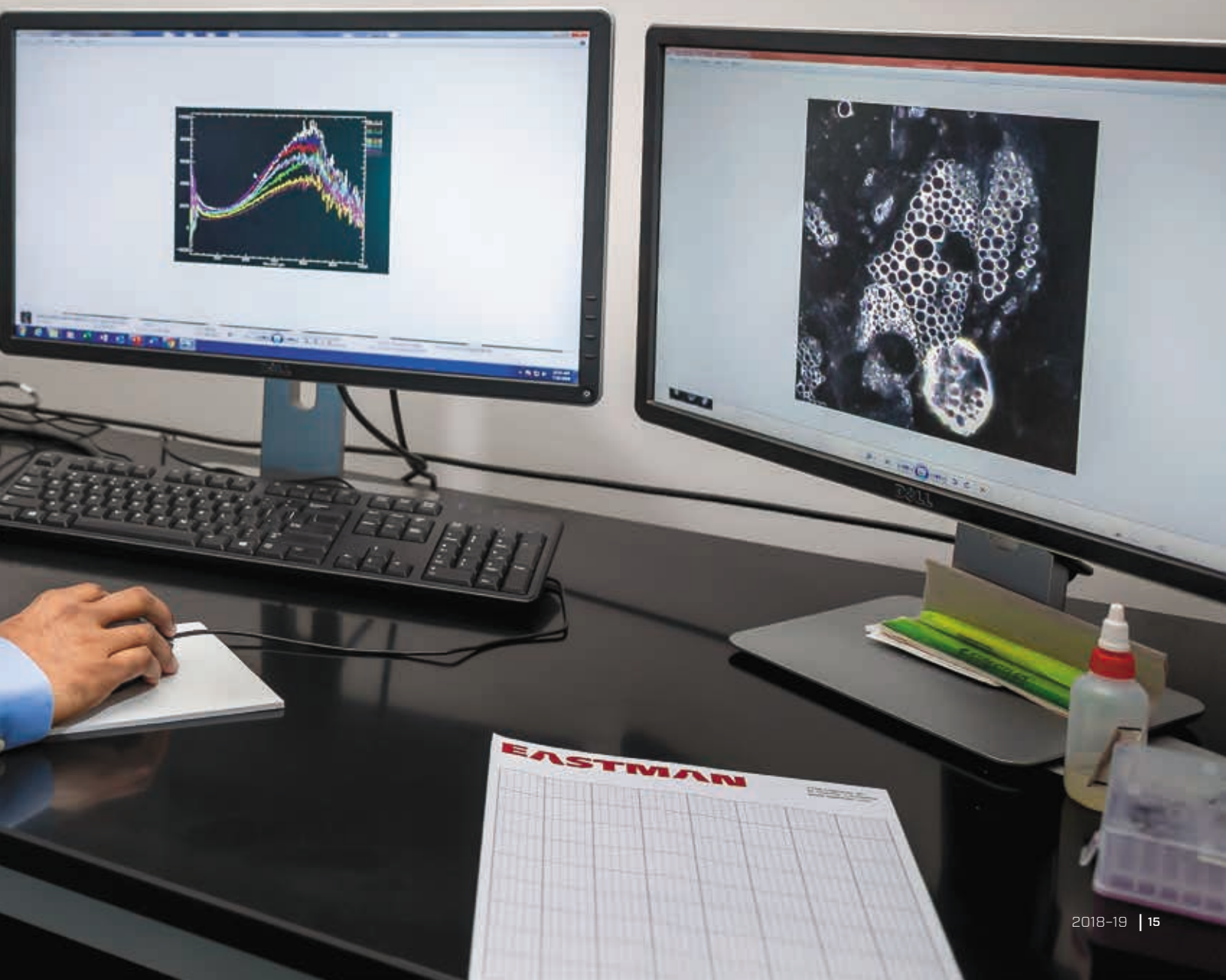
"I have family members who have gone through stroke rehabilitation. And it's really cool to see that we're trying to produce a kind of rehab that would be more enjoyable, I think, for patients. I help Dr. Kuznetsov run the project, bring in participants, set things up, and everything like that. It's really cool getting exposure to research as a freshman, because I know a lot of friends at other universities who haven't been able to do that yet," she said. ■


CytoViva
OLYMPUS

CONVERGING TO ADVANCE CANCER DETECTION AND TREATMENT

By Libby Haydel

It's projected that 1.7 million Americans will receive a cancer diagnosis in 2019. Half of those Americans are women, with breast cancer cases alone accounting for 30 percent. While scientists work to find a cure for cancer, which is the second leading cause of death in the U.S., researchers are diligently working on innovative ways to make early detection and personalized cancer treatment more accessible.



Cancer Detection at Your Fingertips

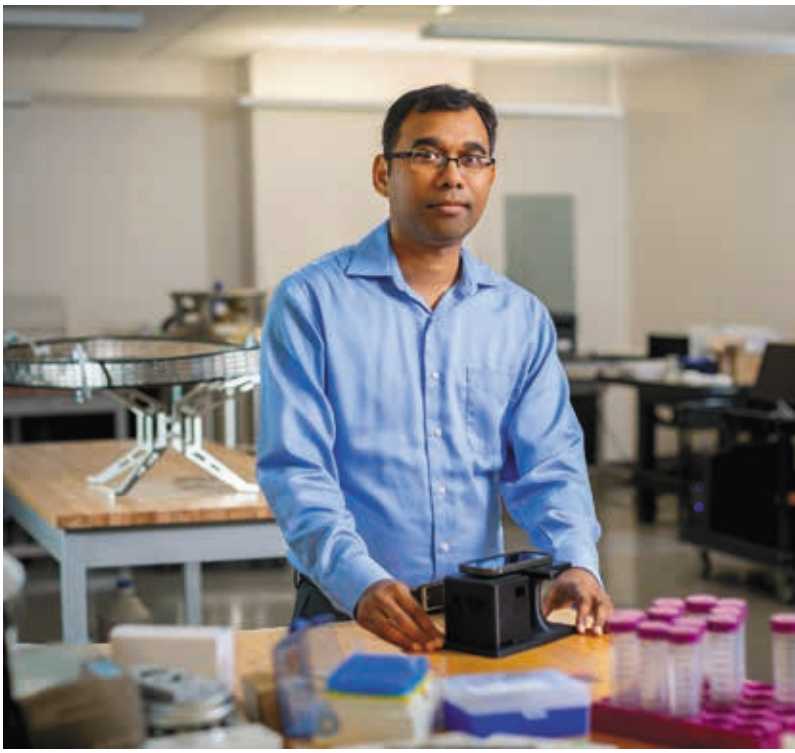
"Breast cancer is the second most common cancer in women in the United States," said LSU Mechanical Engineering Assistant Professor Manas Gartia. "In 2015, 41,523 women died of breast cancer in the U.S., with 3,523 of those in Louisiana. We believe that early detection saves lives."

In order to improve cancer detection, Gartia has designed a point-of-care device to test for the breast cancer gene, also known as BRCA1, a gene mutation that greatly increases the risk of developing breast or ovarian cancer in women. The FluoroZen device would allow patients to do a DNA test for this gene in their doctor's office with results in just 20 minutes as opposed to waiting weeks using an expensive home kit.

> "That's why genetic testing is so popular. People want to detect cancer before it's found in a mammogram. We chose to test for the BRCA1 gene due to its high prevalence in half of the global population and, secondly, because a lot of researched data about the alterations and mutations are available at the gene level from various databases."
>
> Manas Gartia
> LSU Mechanical Engineering assistant professor

The FluoroZen is a portable fluorescence microarray-based imaging system that analyzes blood or saliva on nitrocellulose, or NC, paper that is then set on a glass slide holder. The FluoroZen detects the fluorescent oligonucleotide spots on the NC paper using two light spectrum filters—one to excite the fluorescent dye and the second to capture the emission spectrum. The spots with higher intensity will be brighter, indicating the presence of the mutated BRCA1 gene. A smartphone, which is attached to the FluoroZen, then shows the results as a simple "YES" or "NO" on the screen after taking a picture of the spots.

"There will be a smartphone app to download so you can see the results," Gartia said. "The rapid development of smartphone technology with increasing computing power, high-resolution cameras, GPS capabilities, and internet connectivity has enabled a smartphone-based point-of-care testing platform suitable for field deployment."



Credit: Katherine Seghers LSU

LSU Mechanical Engineering Assistant Professor Manas Gartia has designed a point-of-care device to test for the breast cancer gene.

Gartia believes that early detection is the best way to beat cancer, which is why he and his team want to make the FluoroZen accessible to everyone through primary care physicians' offices. Currently, 14.8 million women in low-access U.S. counties, or LACs, must travel more than 50 miles to find a gynecologic oncologist.

"In Louisiana, there are only eight gynecologic oncologists available to 669,705 women in LACs, which makes up 44 percent of the state," Gartia said.

Not only would the FluoroZen be more accessible to patients, but it would also be more affordable. Gartia says it would only cost $50 or less to run a test, though that's no guarantee doctors and hospitals wouldn't increase the cost.

"Doctors can charge more, but generally, all the costs are covered by insurance," he said. "Most of the cost during our research is due to reagents and purification and extraction of DNA from blood or saliva. The cost of the microfluidic device is less than $5 and less than $1 if mass produced."

Until the FluoroZen is available, Gartia emphasizes the importance of early detection and stresses that patients should talk with their doctor before getting tested.

Personalizing Medicine

When it comes to cancer treatment, one size does not necessarily fit all. To develop more personalized cancer treatment, LSU Biological & Agricultural Engineering alumna Meagan Moore created the first life-size human body model for radiation therapy research. Her project, also known as The Phantom Project, will help test radiation exposure on a real-size human to figure out the best angle for dose distribution.

"Phantoms have been used in medical and health physics for decades as surrogates for human tissue," said Moore, who is a skilled artist and scientist from Baton Rouge. "The issue is that most dosimetric models are currently made from a standard when people of all body types get cancer. No personalized full-body phantoms currently exist."

While current phantoms cost $40,000, have no limbs, and don't represent every body type, Moore's phantom, named Marie, represents an entire human body that is more realistic and costs only $500 to create. Using 3D scans of five real women that were procured from the Pennington Biomedical Research Center, Moore developed a lifelike 5-foot-1-inch, 15-pound female phantom made of bioplastic that can be filled with water to establish varying density similar to a patient.

> "I specifically wanted to work with a woman because, in science, women typically aren't studied because they're considered complex due to a variety of reasons. I want a person with the most complex geometry."
>
> Meagan Moore
> LSU Biological & Agricultural Engineering alumna

It took Moore 136 hours to 3D print Marie in four sections on LSU's BigRep printer. To connect the sections, Moore used a combination of soldering, friction stir welding, and sandblasting. She even used a hammer and chisel at times to take off chunks of plastic without damaging Marie.

"This project started from the art perspective, then became science," said Moore, who was able to combine her art and science skills in engineering.

The main trouble was figuring out where to put the pipe for dose measurements, which ended up going down the midline from her head to her pelvic floor.

In order to test the phantom on multi-million-dollar equipment, multiple water tests first had to be conducted on Marie. During each test, 36 gallons of water were poured into her to see if she could hold that weight for four and a half hours. Moore then improvised by using a PVC pipe to catch the "dribbles" that were coming out of some areas.

"This process always makes me nervous, but I know it won't burst because it has roofing sealant covering it," Moore said. "The way Marie is shaped also helps."

Credit: LSU

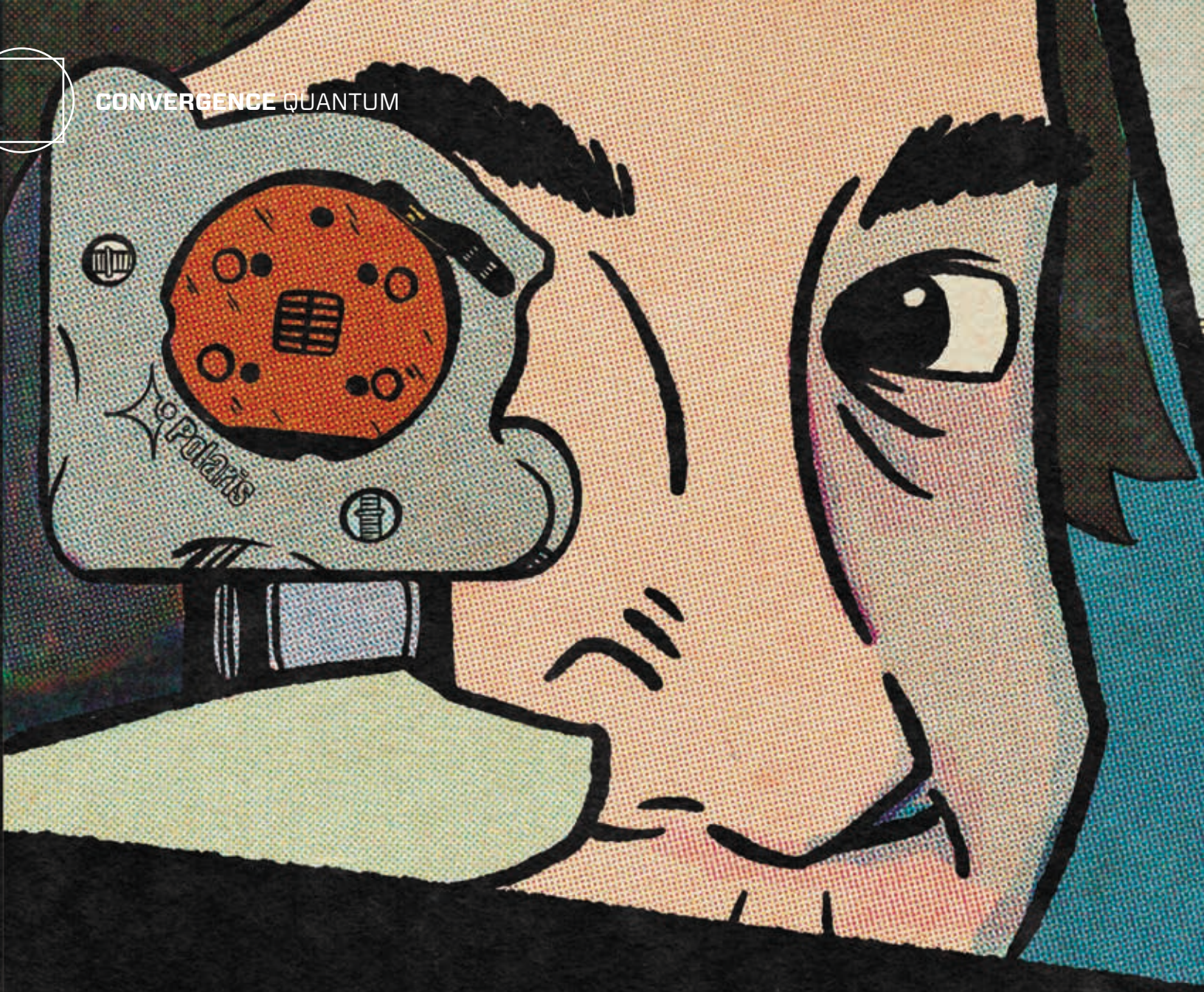
LSU Biological & Agricultural Engineering alumna Meagan Moore created the first life-size human body model for radiation therapy research.

Thanks to LSU Medical Physics Program Director and Professor Wayne Newhauser, Moore brought Marie to the University of Washington Medical Cyclotron Facility in Seattle where researchers were interested in testing fast neutron therapy on her. This type of therapy—a specialized and powerful form of external beam radiation therapy—is often used to treat certain tumors that are radio-resistant, meaning they are extremely hard to kill using x-ray radiation therapy.

"One reason I like working with Dr. Newhauser is he is good at finding the yeses," Moore said. "That's what pushes each project into existence: not just having an idea but the action behind the idea. That's the kind of environment I like working in, where we can make something happen."

Moore hopes personalized replicas of Marie will one day be created and used in the medical field to more precisely treat cancer patients.

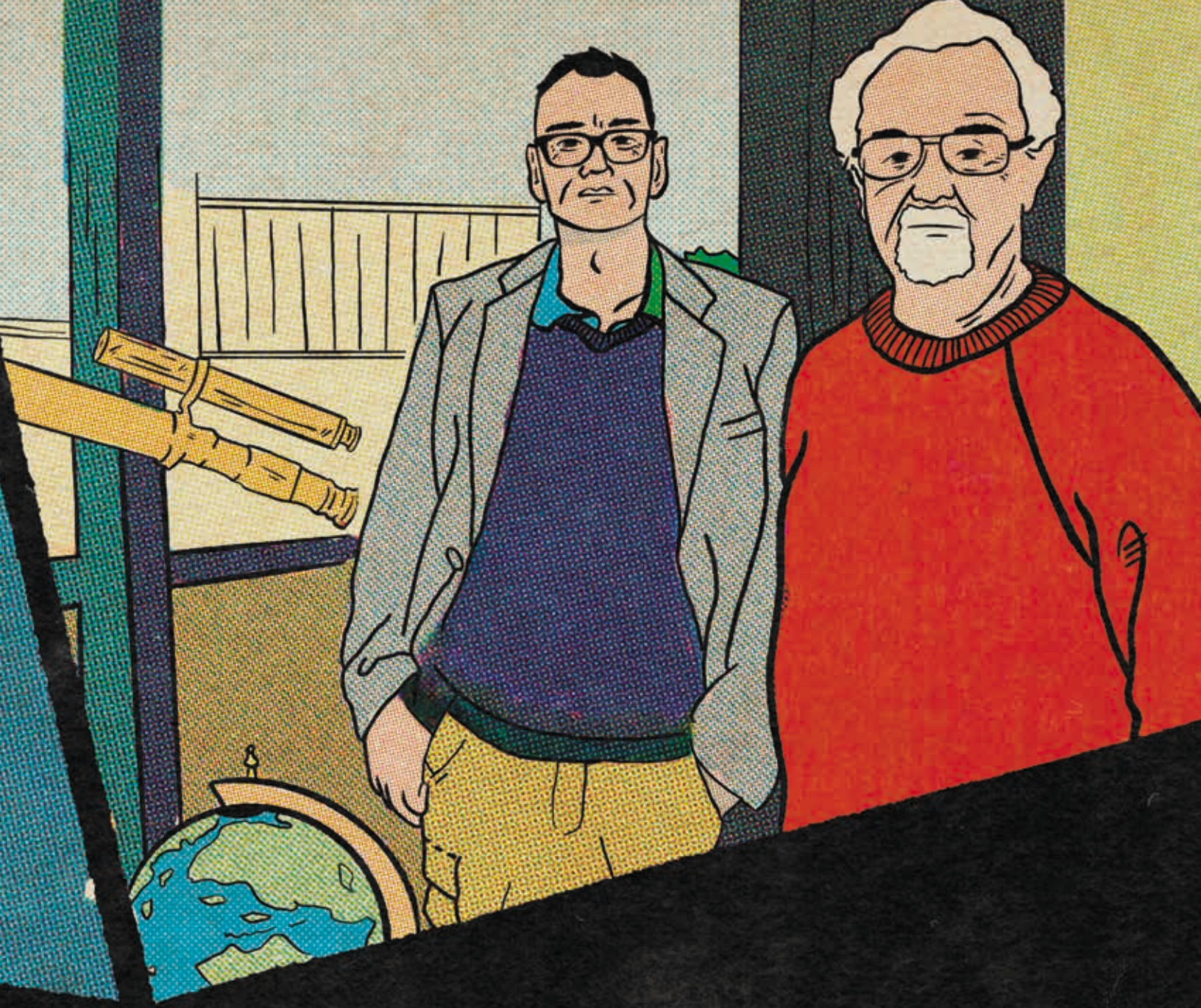
"What I'd like to see for this project is the research to be used as foundational work to personalize cancer treatments for people with more complex diagnoses or body types," Moore said. "Children and breast cancer patients have really differing morphology that is usually very difficult to treat. I find that the more we learn about any body, the more complex it's going to be. We're still getting medicine wrong on a lot of levels. We have a lot to learn." ■



QUANTUM REALM

HOW THE SUPER SMALL IS REVOLUTIONIZING THE WORLD

BY KRISTOPHER MECHOLSKY



If you've seen any of the recent movies in the Marvel Cinematic Universe, you've probably spent at least a brief moment pondering the word "quantum." Like a lot of scientific words used in movies, quantum sounds important, difficult, and powerful. And it gets thrown around a lot to explain difficult plot necessities. As Scott Lang says in *Ant-Man and The Wasp*: "Do you guys just put the word quantum in front of everything?"

Quantum physics has been around for more than a century. Whether you realize it or not, quantum physics underlies most things in the modern world from fridge magnets and computer memory to cell phones, MRI machines, and drug design. In fact, you can't really separate quantum science from science in general anymore. You may not notice it, and you may not need to use its difficult math to describe the everyday world, but the quantum revolution in science established that the quantum mechanical explanation of the world is the one that is most correct at the most levels so far.

In short, Isaac Newton's equations don't always work at the very smallest physical scale.

Quantum mechanics, which physicists developed at the beginning of the 20th century, describes how light and matter behave at the miniscule atomic scale. You probably recognize at least some of the founders' names: Max Planck, Albert Einstein, Niels Bohr, Werner Heisenberg, Erwin Schrödinger, Louis de Broglie, Paul Dirac, Max Born, and many others. They developed quantum mechanics to explain several observations that classical physics could not, such as the nature of light.

Wave or Particle?

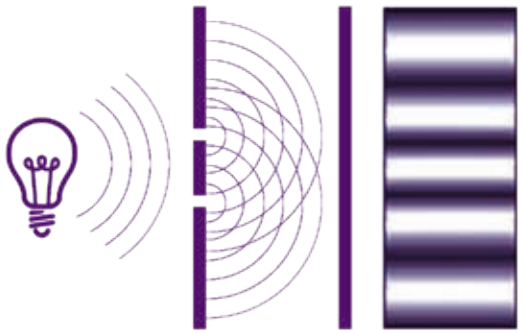
Newton suggested light was a stream of particles, but experiments by scientists in the 19th century revealed that light acted like a wave of water. In his famous "double-slit" experiment in 1805, Thomas Young showed that when light passes through two slits in a barrier, it moves through like water. The waves of light pass through the openings and interfere with each other. These waves of light form a pattern with peak intensities.

About a century later, Einstein found that light was only absorbed and radiated in defined chunks, called quanta of energy. Was light a wave or a bunch of particles?

This apparent contradiction came to a head when scientists recreated Young's experiment by shooting single particles, like electrons, through the slits. Something very puzzling happened. The clumps of electrons would land at distinct points. However, after several rounds had been fired at the detection screen, the clumps of electrons resembled the wave interference pattern that occurs when light passes through the slits, but only if the electrons were detected on the screen and not before. It was like the individual particles were interfering with themselves. Resolving this discrepancy, called "wave-particle duality," has plagued physicists ever since.

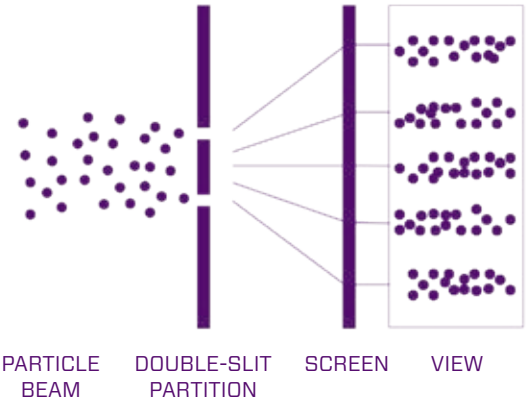
After Einstein realized that light waves also move as individual photons, Louis de Broglie suggested that electrons, and all matter, actually, must also move like waves somehow. A few years later, Schrödinger developed a wave equation

LIGHT WAVE INTERFERENCE PATTERN



Light passing through double slits as a broken wave, interfering with itself to reveal a pattern of light and dark sections.

OBSERVED PARTICLE DISTRIBUTION



Individual particles passing through double slits, measured only at the screen. Instead of two distinct sections, as classically predicted, an interference pattern still appears.

Credit: Elsa Hahne, LSU

that described the "quantum state" of a particle or group of particles. This equation was known immediately to be correct mathematically. But puzzlingly, it also described strange realities. For example, it states a particle could be in two places at the same time. When you measure it, though, it would only be found in one place. No one could explain what this meant in the everyday world.

In fact, to this day, no one completely agrees. Other physicists, like Hugh Wheeler, have suggested that the multiple possibilities dictated by Schrödinger's equation actually predict multiple actualities—that is, many worlds, or the "multiverse" if you're in the Marvel Cinematic Universe. The particle really is in both places, just in different universes, and they interfere with each other, but you can only directly measure one of them in your own reality.

Certain or Uncertain?

The way the single particles acted when fired at the two slits has flummoxed scientists. They could point the "electron gun" right at one slit, and some electrons would apparently go through the other slit. Although scientists could accurately predict a football's trajectory, they could never tell you exactly where an electron would go. Further, it turned out that Schrödinger's wave function predicted accurately that if you changed one particle in a system, it would almost magically change a separate, entangled particle, even if that particle was across the universe! But even measuring basic properties of these particles was more challenging than scientists expected. The Uncertainty Principle states that there's a limit to our ability to measure certain pairs of physical properties at any one time. For instance, you can measure an electron's position, but you are then limited in how well you can measure its momentum. And it's true for a particle's energy and time. The more you know one, the less you know the other.

One unexpected, mind-bending feature of this principle is the observed and verified fact that pairs of particles can suddenly appear and disappear literally out of nowhere, as long as it happens in a very short amount of time. These quantum fluctuations in spacetime mean the fabric of the universe, like the ocean, will never be completely still. In fact, the whole universe is entangled in groups and pairs that affect each other.

Given the incredible consequences of quantum mechanics, head-scratchers in the Marvel Cinematic Universe don't seem quite as far-fetched.

Quantum Future

So, what do these strange consequences mean for us now? As Jonathan Dowling, LSU Department of Physics & Astronomy professor and Hearne Chair of Theoretical Physics, sees it, quite a lot.

"We are currently in the midst of a second quantum revolution," he said. "The first quantum revolution gave us new rules that govern physical reality. The second quantum revolution will take these rules and use them to develop new technologies."

All of the quantum technology research conducted at LSU fall into three general categories: quantum sensing and imaging, quantum cryptography and communications, and quantum computing. These broad areas are each based on fundamental quantum properties.

Of all quantum technologies, it's quantum computing that is getting the most attention, and for good reason. In normal computing, information is transmitted through bytes, which are brief messages written in a Morse-like code of eight bits, each of which are either 0 or 1. But in the quantum realm, a particle can be in a superposition of both here and there, or both 0 and 1. Thus, you can use quantum bits, or qubits, to compute on more possibilities at once. And when entangled particles are used for those qubits, algorithms could compute tasks that are practically impossible now at speeds far outstripping current capabilities. What would take a modern computer years and years to compute, a quantum computer could handle in seconds.

Credit: Elsa Hahne, LSU

A custom-built device used to measure quantum radiation pressure noise created by LSU physicist Thomas Corbitt and Crystalline Mirror Solutions.

LSU Department of Physics & Astronomy Professor Illya Vekhter, one of the many scientists conducting quantum research at LSU, provides the following perspective:

"Everything fundamental science needed to know about silicon we knew by the late 1960s, and only after that, scientists have still developed devices that continue to improve over half a century later. Everything fundamental about cell phones we knew by the 1980s. So, when I do my research, I have some ideas of what it may be used for, but the job of a condensed matter physicist or quantum technologies person is to study what can be turned into a device 10, 20, or 50 years later. That is the only way we can bring about new developments."

In all the uncertainty of quantum physics, one thing is certain. Quantum technology is going to be world altering. Earlier this year, the White House organized a meeting with leading research universities, including LSU, as part of the National Quantum Initiative, a $1.2 billion federal investment to establish a coordinated effort to advance quantum information science and technology.

"This dialogue was the beginning of a national effort potentially on the scale of the Manhattan Project or the Space Race, leading to new technologies we cannot even imagine now," said Samuel J. Bentley, LSU vice president of research and economic development.

Administrators directing five federal agencies attended the meeting and facilitated discussions on key topics such as basic research, educational strategies, workforce development, and technology commercialization. At this meeting with fellow flagship universities and the Ivy League, Bentley represented LSU and the quantum faculty, who are at the forefront in developing theory and materials important to quantum information science. No word on whether Dr. Pym or Mr. Lang were present. ■

COLLABORATIVE CHAMPIONS

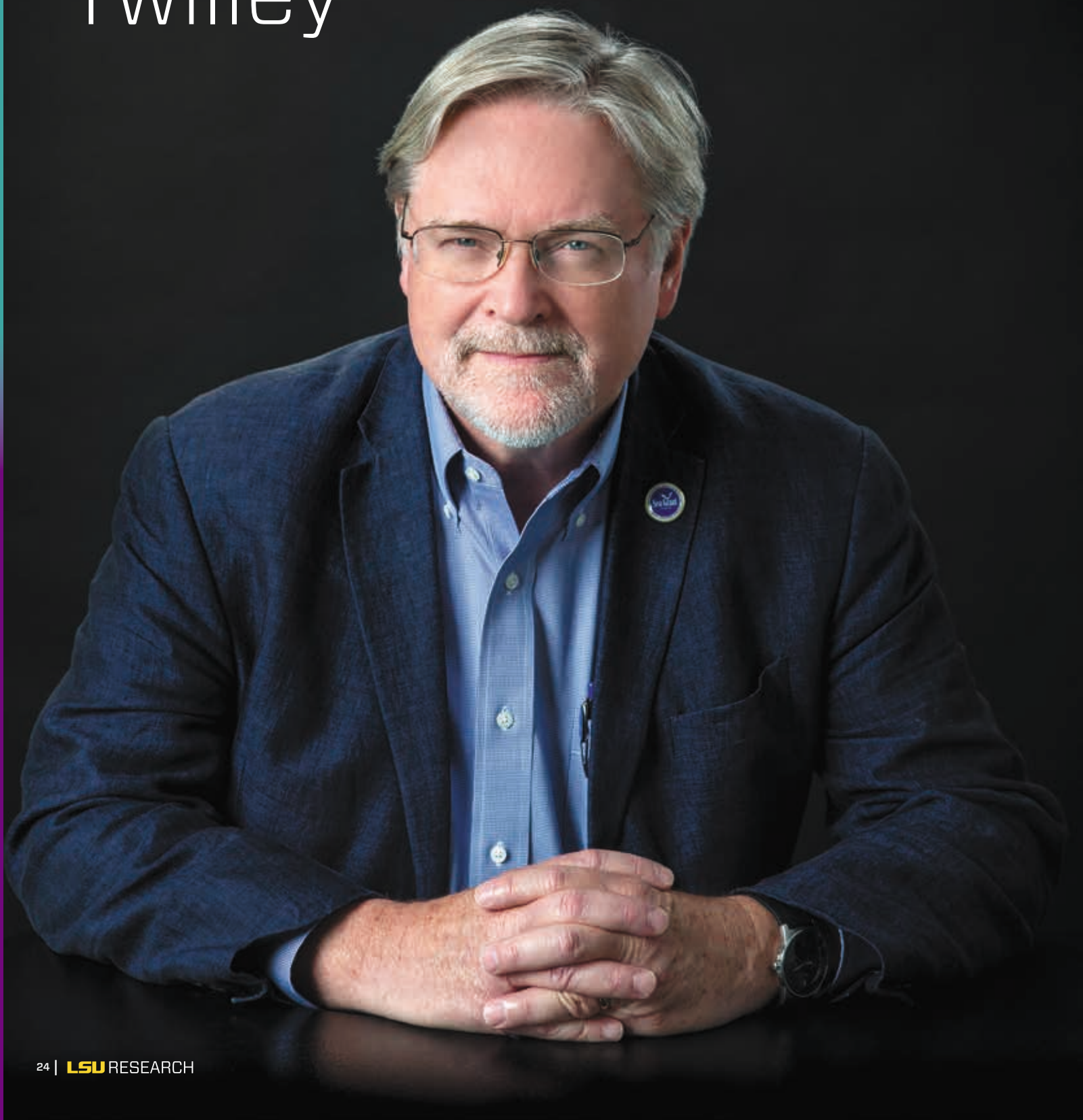
By Elsa Hahne and Alison Lee Satake

Convergence research is the latest term to describe transcendent work borne from the combined strengths, skillsets, and methodologies of researchers and scholars from a range of disciplines. This approach to research, for various reasons, is not easy. But the outcome can be great. For example, the National Science Foundation is looking to convergence research to solve large and complex problems, focusing on societal needs. But how do you achieve this?

We've turned to the experts to hear their answers. These faculty members describe working across disciplines as intuitive, but there's more to it, of course. On the following pages, you will meet a handful of LSU researchers who embody the spirit and philosophy of collaboration. They are our collaborative champions.

COLLABORATIVE CHAMPION

Robert Twilley



Robert Twilley is the executive director of Louisiana Sea Grant and a professor of oceanography and coastal sciences at LSU, where he heads up the Coastal Systems Ecology Lab. He has published extensively on wetland ecology and global climate change and has been involved in developing ecosystem models coupled with engineering designs to restore the coast and wetlands. In an effort to get researchers from different disciplines to work collaboratively to solve problems, he founded the LSU Coastal Sustainability Studio in 2009.

How did you first come to see the value of collaboration?

During my PhD, I studied ecosystems under a famous systems ecologist, H.T. Odum, at the University of Florida. Odum would do these diagrams of ecosystems, and everything was in it: plants, animals, microbes, nutrients, and soil. All of it connected with sunlight, precipitation, and water flow. And people were also part of ecosystems with governance, economics, and religion depicted in the same diagrams. Our job was to put all of these pieces together—and understand how one part of the system impacted another—including interactions between nature and culture. So, if you really want to do systems ecology, you have to collaborate. It's the nature of systems ecology. You can't do it any other way.

How has this played out in your own research?

When Hurricane Katrina hit, I started to think about how can we use the wetlands for storm surge reduction; how can we clean nitrates out of the water before it causes hypoxia offshore; and how can we connect all of these pieces together?

Credit: LSU

Robert Twilley presents his research to the public at LSU Science Café.

Tell me about your favorite collaboration of all time?

The Baton Rouge Area Foundation hired a fellow by the name of Peter Calthorpe from Berkeley, California, a world-famous regional planner and one of the founders of 'new urbanism' and sustainable communities. I mean, this guy is world-class. One thing about regional planners is that they're systems thinkers. Our kindred spirits of using a systems approach to solve complex problems was a hit. It was the most fun I've ever had in my entire career, and we put together a report called *Louisiana Speaks*. We designed this whole landscape where we were going to have wetlands and people.

When we finished the report, Peter said, 'You know, your challenge now is to build institutional support around the ideas that we have in this vision for the coast. Institutions have to keep these ideas going.'

Later, I was attending a dinner in Washington, D.C., to talk about Louisiana's needs post-Katrina, representing LSU. There were several executives from oil and gas, including the Gulf of Mexico Vice President for Chevron, Warner Williams. On a napkin, I started explaining a studio design concept to him, and he said, 'I love it. We'll fund it. These are the students I want to hire because they know the team concept and know that solving a problem requires collaborative teams.'

With the help of LSU leadership and several deans on campus, along with America's Wetland Foundation and additional funding from Shell, we built the LSU Coastal Sustainability Studio. We're about to celebrate our 10th anniversary, and we're well over a million dollars in total sponsorship. People love the idea that if you do a project in the studio, you get all of the expertise that LSU has to offer around a problem. Collaboration, in my experience, is about taking a problem that's real and putting the pieces together to solve it. ■

COLLABORATIVE CHAMPION

Melissa Beck

Melissa Beck, professor of psychology, heads up the Beck Visual Cognition Research Lab, conducting cutting-edge research on visual attention and memory, and serves on the executive committee for the LSU MIND group, or the Multidisciplinary Initiative for Neuroscience Discovery. She's been described as "the glue" for various cross-campus collaborations, but in her mind, it's all about starting new conversations.

What got you started with collaboration across disciplines?

When I first came to LSU, I was doing basic science research with my graduate students while also doing applied collaborative research at the Human Factors Group at the Naval Research Laboratory at the Stennis Space Center in Mississippi. We were looking at how pilots allocate attention to digital maps while they're flying and how their expertise develops. I learned how to take basic research and apply it to different areas while working with people who aren't cognitive psychologists.

Are there any disadvantages to working collaboratively on applied research?

Applied research is slower. In basic research, if I have a research idea, I can go down to the lab and program something on the eye tracker and collect data within a few weeks. With the applied stuff, there's a lot more conversation that needs to happen, translating across disciplines. Also, I might have to move away from some of the methodology I'm most comfortable with.

Tell us more about the MIND group.

Since September 2018, we've focused on trying to strengthen research opportunities related to neuroscience at LSU. We're still trying to increase awareness and bring people together so they can start having conversations about how to collaborate and work together in ways we aren't able to do alone.

At all universities, silos get created. Someone in engineering might think psychology is therapy—and it is!—but there's also this huge other area of psychology called cognitive science. It doesn't occur to them that we have all of these people with skills and the ability to study interesting problems that are related to business or marketing or engineering. We could collaborate, but people don't understand what our skills are, and vice versa. Not unless we have conversations.

Elaborate on these conversations.

Lately, I've been working with faculty members in construction management and architecture on a grant submission to look at how architects and engineers communicate with each other around design. People from different disciplines have different conceptualizations of what they do. For example, they might cognitively perceive a building differently. So, how do we get them to communicate well with each other? It's kind of meta, because the very thing we want to study—cross-discipline communication—is necessary during our collaboration.

In our meetings, I find myself saying stuff like, 'I understand this term to mean... while you seem to understand it to mean...'

It can be challenging. But the end product is much more interesting, more applicable, and well-rounded.

What is one of the MIND projects?

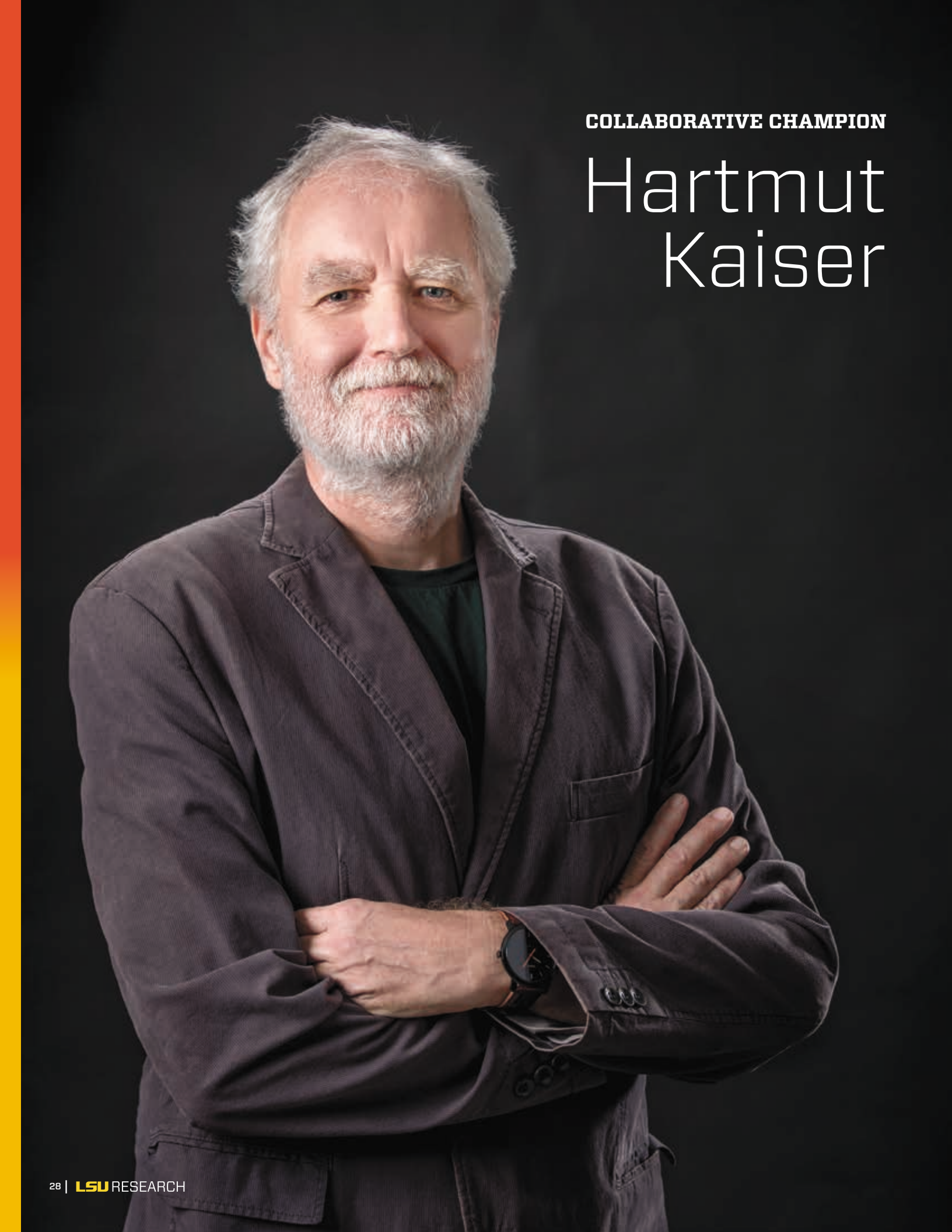
I'm leading a collaborative project on visual spatial reasoning. We've developed a training protocol to help improve spatial reasoning skills. These skills are predictors of success in science, technology, engineering, and math—or STEM—disciplines. We're interested in questions like: Is spatial visualization and reasoning trainable? What cognitive processes are involved?

We are measuring brain activity using functional magnetic resonance imaging, or fMRI, and visual attention using eye tracking to better understand how cognitive processing changes with improvements in performance. This is a really exciting and interdisciplinary project since we have people from psychology, chemistry, and the Center for Computation & Technology all involved. So far, our data suggests that the skills are trainable.

The goal of MIND is to do more projects like this and encourage more collaboration.

Were you a born collaborator?

I don't think so. But what I do is try to explore every opportunity that comes my way. I don't say, 'I'm too busy; I can't,' when someone reaches out. I want to at least talk and see where it can go. That helps—just being open. ■



COLLABORATIVE CHAMPION

Hartmut Kaiser

Hartmut Kaiser, IT consultant at the LSU Center for Computation & Technology and adjunct professor in the Department of Computer Science, grew up in East Germany on the other side of the Berlin Wall, where he learned that guarding what you have can lead to losing everything. Once the Wall came down, Kaiser spent more than 15 years developing software for international companies learning new methods of working and collaborating. Now, as the leader of the LSU STE||AR Group, or Systems Technology, Emergent Parallelism, and Algorithm Research, which advances high-performance computing to better suit today's hardware architecture, Kaiser sees the group's ideas popping up around the globe, and its work is becoming more successful than ever. How? By sharing, and seemingly giving everything away.

What's the overall method for open-sourcing your work and sharing it as a research strategy?

We've never thought about how to formally describe it. It's more intuitive. But the general underlying idea of what we do is to share the results of our work as open-source projects, with the hope that other people pick that up and change things based on their own ideas and requirements and then contribute back. It makes the whole project more interesting for more people.

What, in your mind, is the main reason young people want to come to LSU to work with your group?

The centerpiece, at the end, is developing ideas of how we can improve computing. The coding work is really just experimenting and supporting how we solve problems. That's interesting and important because this allows the students to identify themselves with the ideas and not with the code. Even if they go somewhere else, they probably won't be able to use the code or the libraries of code they've been working on, but they carry the ideas with them, and that's the important part.

How do you teach open-sourcing and collaboration?

Young people tend to like when they create something and other people start using it. Some people are very money-focused and only do things when you pay them, but some people are quite altruistic and try to contribute even though they don't immediately get a reward.

Can you tell me more about the work you're doing, and what's contributed to its success?

We're on the cutting edge of using parallelization using C++, yet the stuff we're doing is well-known to everybody because we're using C++ and anyone can read it, but it's the way we're using things that's different. The alignment of the standardization work we're doing with our open-source and research projects was actually the key to community acknowledgment, and that was completely emergent.

Are you sure you're not in communications?

Ha! Openness just allows people to look at what we're doing, that it's not just words. They can look at the quality of the work, which is portable across many platforms, and we put a lot of effort into the quality of implementation. Openness has never hurt us in any way—never. The opposite is true. If you write a proposal and you write about your library and it's open-source and everyone can look at it, the program officers or reviewers are much more inclined to fund you because it's real, and there's already a community around it.

Are you never afraid that someone will come along and make a lot of money off of the work you're giving away for free?

Many people try to do what we've done. We see our ideas popping up everywhere, which is great. In the end, someone will come up with something really cool, and we'll then reintegrate that into our work. We don't have to be afraid. ■

COLLABORATIVE CHAMPION

Marwa Hassan

Marwa Hassan is the Construction Education Trust Fund Distinguished Professor, the Jacobs Professor of Excellence, and director of the Transportation Consortium of South-Central States, or Trans-SET, a collaboration between nine universities and two community colleges in five states. From her undergraduate studies at the American University in Cairo to receiving her PhD at Virginia Tech, she has grown a research program based on multidisciplinary collaboration.

What led you to pursue a career in engineering?

As a kid, I was always inspired by constructing things and seeing ideas come into being, which is why I went into engineering. The reason why I chose civil and construction was the fact that you build structures and buildings and actually see something change the urban environment around you. That fascinated me. When I started learning more, I was fascinated by materials. How can we solve problems by using unique materials? How can we change the properties of the materials so they can be more useful?

When you work in materials, you cannot live in a silo because you require expertise from so many different people. You need the material science, you need the characterization, you need the chemistry. So, you're bridging out to work with other people, and that got ingrained in me when I got my PhD.

Can multidisciplinary collaboration be taught?

Yes. It's hard in the beginning, but the more you see how useful it is, the more you want to put in the effort.

During our research meetings, I tell my PhD students that you will not learn unless you read. I have them read what other people have done, so they can think about how to take it to the next level. I tell them that every week, you need to read five to 10 journal papers. I know proficiencies are different. I tell them, just read the paper even if you don't understand 100 percent of it, because you won't in the beginning. Read it. Put it aside. Spend 10 minutes writing one paragraph on what you understood.

Then, we discuss what they wrote. I have them re-read it one more time and see if their understanding has improved. We keep doing this until they can capture everything in the paper and read and criticize what they are reading. You're slowly building critical thinking. If you push them a little bit, within a year and a half, they start coming up with their own ideas, and it becomes a two-way conversation.

How unique is this approach in your field?

It's very unique. I've had people from the University of Illinois and Berkeley ask me how I get the students and the faculty to talk the same language.

So, it's difficult for even top national universities.

I said, it is two things. It's trying to spend the time to understand each other. And it's getting the students to bridge this gap, because when they take different classes from different professors, they start to learn how to speak these languages. So, if we can build a new generation of students who are capable of bridging the gap and speaking different languages, it's going to get easier in the future.

Funding agencies, especially at the national level, are now pushing towards this because they understand that the complex problems of today will not be solved if everyone stays in their silos.

What advice can you share with other faculty who would like to pursue convergent research?

Two pieces of advice: do what scares you the most. If you get out of your comfort zone, there is no failure there. You will learn so much, so it's a success either way, and you will eventually succeed and create a big network.

The second one is: don't be shy about speaking to people. Don't worry about not talking the same language. Once the conversation starts flowing, the ideas that are put on the table will be amazing, and you'll be able to solve much larger problems. ■

COLLABORATIVE CHAMPION

Michael Pasquier

Michael Pasquier is the director of the Center for Collaborative Knowledge at LSU, which aims to inspire and create solutions to complex problems through convergent collaboration. Pasquier is also an associate professor of religious studies and history and the Jaak Seynaeve Professor of Christian Studies at LSU.

How did you develop this philosophy of working with multiple disciplines in academia?

As someone in the humanities, when I think of scientists, engineers, and policymakers and all of these types of professionals that do what I don't do, one thing they are all really good at is being humanists. It is one thing we all have in common. We're all interested in people. Scientists don't dig around in the mud and wetlands just because they like playing around in the mud. They do it because they think it's important to people. I think sometimes scientists and those in other fields don't say that out loud enough. But I think underlying it, people are trying to do good. That's what drives convergence and collaboration. It's about identifying a big problem and recognizing there's no silver bullet or one discipline that can 'fix' it. You've got to come together.

You mentioned that the BP oil spill was a catalyst for you. How did this event change you?

I'm a Louisiana boy. I grew up about 30 miles from the coast as the crow flies. But I lived in a farming town. I didn't live on the coast or the bayou. There are three kinds of Cajuns in Louisiana—bayou Cajuns, prairie Cajuns, and river Cajuns, and the three are very different. People who live down in Lafourche Parish are different from people who live in Acadia Parish. As a child, my only encounters with the coast were when we went to Holly Beach or Grand Isle and did a little bit of fishing. I didn't know why the bottoms of my feet were black whenever I went back home from those beaches. It was because there were tar balls all over the place. That was back in the 1980s.

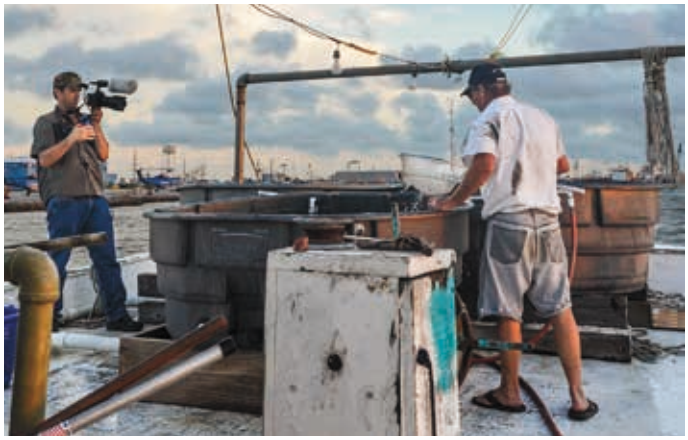
I think my experience with the coast as a Louisiana native is very similar to people who live in Louisiana today. Most Louisianans don't grow up having an intimate knowledge of the coast. We're severed from it, yet our connectivity to it and dependence on it is so important because of the way we have engineered the river and all of the other waterways in Louisiana. We live in a water world, but we do a great job of covering it up and leveeing it up so it doesn't touch us, until it does.

The BP spill drew my attention to Louisiana's coast in ways that were very different from my childhood experiences. Eleven men died. The environmental impact was substantial. As I started to study the history of oil and gas in Louisiana, I also started to consider the cultural impact of land loss, land subsidence, sea level rise, the canalization of the landscape, and all of these other factors at play on Louisiana's coast. It got me thinking broadly about the complexity of life in coastal Louisiana and the need to work with people from many scholarly perspectives to understand that complexity.

How did you apply your research tools to better understand, preserve, and appreciate the true complexity of Louisiana coastal living?

It led to a documentary called *Water Like Stone*, which I made with a filmmaker faculty member in the English department, Zack Godshall, with help from Louisiana Sea Grant. Then, through the LSU Coastal Sustainability Studio, I received a National Endowment for the Arts grant with architecture and landscape architecture faculty to create a mobile museum exhibit called *On Land | With Water: Tracking Change in a Coastal Community*.

Had it not been for these collaborations, I would have never done these activities. I didn't go into my PhD program in religious studies thinking that I would produce documentary films and art exhibits. I was lucky to meet some really smart people at LSU who pushed me to work outside of my academic field. ■



Credit: LSU

Filmmaker and LSU Department of English Assistant Professor Zack Godshall films *Water Like Stone*.

Between the Ground & Sky

LSU College of Art & Design Assistant Professor of Photography Johanna Warwick's photographic essay, Between the Ground & Sky, was selected as one of five winners in *The Washington Post* and *Visura's* In Sight 2018 open call for submissions for photo essays. The series, selected from more than 300 entries, was featured in *The Washington Post* and numerous photography blogs.

Writing and Photography by Johanna Warwick

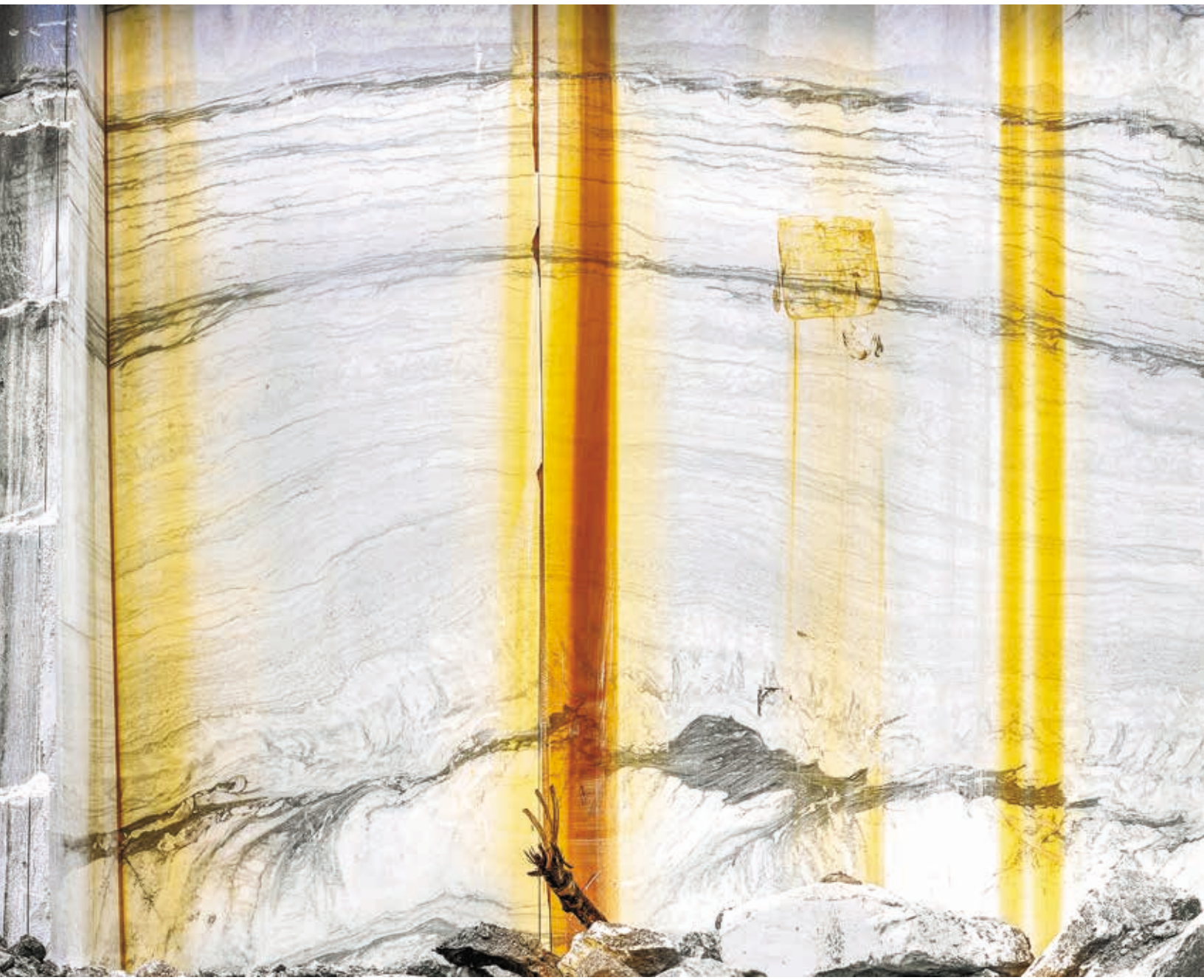
These photographs document the changing landscape of the Danby Marble Quarry in Dorset Mountain, Vermont. The Danby Quarry has been in use since the 18th century. It is over a mile long, has a footprint of 25 acres, and is 1.5 miles deep. It is the largest underground marble quarry in the world.

I began photographing the marble curious about its use but eventually became charmed by the physical history carved into the space. The heavy, unyielding material takes a geometric form in a huge, organic landscape. I am fascinated by the constant metamorphosis of the space. Etched, carved, and broken apart, Danby Mountain is a record of time. The physical markings inside the mountain created by both the original method and the current method of quarrying is at the center of my interest due to its impact on the nature of the mountain. From the beginning of quarrying there to today, the technology has vastly changed and is visible inside the walls of the quarry. In the shallowest depths, the quarry reveals the chaos of past axe quarrying in the ceiling, showing every stroke each man took, while the more recently excavated spaces reveal the control of diamond rope cutting into precise geometric cubes. Each method has left an indelible impression on the mountain by destroying its natural state and creating a geometric and ordered new landscape. These are the qualities I find both interesting and intriguing. I am fascinated by its now formal beauty.

My photographs of Dorset Mountain capture scenes between buried underground, immersed in darkness, to being elevated into the sky and mountains, overcome by light. The sense of where you are is confused by ever-changing planes of focus. The ground and ceiling, up and down, become indistinguishable. I photograph little to indicate scale, rather, creating a world where a mountain can be a pebble, a crevice can be a valley, and a stone can be a grave. Through photographic examination, I hope to reveal the captivating landscape of this place while evoking a sense of its history and questioning how it will continue to change in the future. ■

"I began photographing the marble curious about its use but eventually became charmed by the physical history carved into the space."

Johanna Warwick
LSU College of Art & Design assistant professor of photography



"My photographs of Dorset Mountain capture scenes between buried underground, immersed in darkness, to being elevated into the sky and mountains, overcome by light."

Johanna Warwick
LSU College of Art & Design assistant professor of photography

Hydrothermal vent.

Credit: ©MARUM-Center for Marine Environmental Sciences, University of Bremen

Microscopic Titans:

How Viruses Thrive at Extreme Depths

By Christine Wendling

Viruses are microscopically tiny, only about 50 nanometers in size, but when they infect a host, the results can be explosive.

These small, infectious agents are made up of a DNA or RNA core that replicates within the cells of living hosts, often until the cell membrane ruptures and explodes. Then, after the carnage, they move on to another cell or host. While we already know a lot about viruses that infect humans in this way, aquatic viruses have only begun to be studied relatively recently. It was not until 1989 that scientists discovered viruses were present in high abundance in the ocean—an order of magnitude more than bacteria, and these viruses are as mysterious as they are extreme. Jennifer R. Brum, assistant professor in the LSU Department of Oceanography & Coastal Sciences, is studying the ecological and biogeochemical impacts of aquatic viruses that infect bacteria in one of the most extraordinary environments on Earth—hydrothermal vents.

Hydrothermal vents are intensely hot cracks in the sea floor that spew geothermally heated water capable of exceeding 750 degrees Fahrenheit; however, the mineral-rich water does not boil due to the crushing pressure of the deep ocean. Brum collects virus samples from five different hydrothermal vent fields on the Mid-Atlantic Ridge, a divergent tectonic plate on the Atlantic Ocean seafloor that makes up part of the longest mountain range in the world. These vents are made up of a series of human-height "chimneys" that spew what appears to be black smoke. This chimney smoke is actually made up of intensely heated particulates that create the darkened appearance. Often, shrimp swarm along the side of the chimneys to feed while mussels surround the base, where the temperature is lower.

"I chose hydrothermal vents as my study site because they're fascinating features where the earth's crust is pulling apart. Seawater is circulated through really hot rock and interesting chemical reactions happen, resulting in a very different ecosystem from one you might find only a few hundred feet away. And currently, we know very little about the viruses there," Brum said.

In order to collect her samples, Brum uses a remotely operated vehicle, or ROV, that can withstand the extreme temperature and pressure of the vents. The ROV has been outfitted with a metal rack housing six open-ended bottles that hold five liters each. It carries the rack over to the desired location and snaps the bottles closed, entrapping the water and viruses within. Once the rack is brought back to the surface, Brum stains the

Credit: ©MARUM-Center for Marine Environmental Sciences, University of Bremen

A metal rack housing six open-ended bottles that hold five liters each. LSU oceanographer Jennifer R. Brum uses this equipment to collect virus samples from hydrothermal vents.

viruses' nucleic acid, which causes them to glow. Then, using epifluorescence microscopy, she can observe them under a microscope and count them. Or she can see even more detailed images of the viruses using a transmission electron microscope.

According to Brum, so little is known about aquatic viruses that many of them do not yet have names or standardized scientific classifications. As a result, she must use a makeshift system of classification based on the viruses' DNA, often assigning them numerical identifications.

After collecting the samples at sea and analyzing them in her lab at LSU's College of the Coast & Environment, Brum discovered that some of these unnamed viruses are exhibiting unusual behaviors. Her preliminary data suggests that some of them are capable of making calculated decisions about when to kill their host bacteria. They are able to lay in wait until conditions are favorable to kill the cell through replication, a behavior known as lysogeny. This behavior is not unlike that of viruses she studied in Antarctica previously.

"Basically, [some viruses in Antarctica] would hold over winter in their host. Then, when spring came and their host became productive—boom, they would kill the host. And it might have been mutually beneficial. The virus helps the host survive the winter and the host helps the virus survive the winter. Think of it like an armistice in war. Then, when spring arrives, they go back to killing each other again," Brum said.

Driving Evolution

Not only can viruses kill their hosts and approximately 20 percent of the oceanic microbial biomass daily, but they are also capable of transferring a host's DNA when they invade their next victim. This DNA exchange can augment the metabolism, immunity, and distribution of their new hosts and have potentially huge impacts on the evolution of both the host organism and the virus, according to a study published in *Nature*. In fact, according to Brum, this could be a driving factor in influencing the structure and diversity of aquatic microbial communities as well as the evolution of many organisms within the marine ecosystem.

> "There is considerable evidence, although we will never know for sure. That's part of the exploratory, fun part of doing research."
>
> Jennifer R. Brum
> LSU Department of Oceanography & Coastal Sciences
> assistant professor

Brum's work may not only have an impact on the ability to predict how viruses will behave in the future as they adapt and mutate, but it may also help explain the origins of life on Earth. In fact, many scientists believe that deep-sea hydrothermal vents are where life originated on our planet.

"The reason why hydrothermal vents are thought to be where life originated is because they have this special chemical and electron gradient. People have actually generated RNA in artificial glass globes by making a little artificial hydrothermal vent," Brum said.

And the presence of viruses there indicate they may have played a role in the initial stages of evolution. ■

YOU ARE MY SUNSHINE

By Ferris Wayne McDaniel

Lauren Slay, a music education senior and clarinetist in LSU's marching band—the Golden Band from Tigerland—approached her professor Ann Marie Stanley and explained how her brother, who has autism spectrum disorder, or ASD, shared her passion for music and the performing arts but didn't have the same opportunities she had. Slay wanted to do something impactful for children like her brother. And she told Stanley that several of her classmates were also eager for more hands-on experiences working with students who learn differently.

> "Our students are so community minded, and they are seeking meaningful outreach. The students have these really impressive ideas about social justice and improving the community."
>
> Ann Marie Stanley
> LSU associate professor of music education

Stanley, whose background includes teaching music in public schools and teacher professional development, and Slay launched the Sunshine Project this year.

The seven-week music program is designed to teach and engage children ages 6 through 16 with social, emotional, and learning exceptionalities. The project brought together 17 children, or "Cast Members," who are developing neuro-atypically and paired them with 19 "LSU Buddies," mostly volunteer undergraduate and graduate students from a range of disciplines. They met on seven Sunday afternoons in the LSU School of Music. The session culminated in a performance last April.

For Slay and her classmates studying music education, the opportunity to gain hands-on experience with ASD children was invaluable for their careers as future educators. Stanley

Credit: Lauren Slay, LSU

Lauren Slay and her dad on gameday.

marveled at the LSU Buddies' confidence to run a rehearsal, professionally interact with parents, and maintain children's safety and comfort. The opportunity to participate as a Sunshine Project Buddy sets LSU apart, she said, in terms of what the university's graduates know and will do in the schools as teachers.

Research shows that increasingly more students on the autism spectrum or with social behavioral disorders are successfully completing high school and attending universities. According to the U.S. Department of Education, the number of school-age children with ASD grew from fewer than 90,000 in 2000 to more than 500,000 in 2014. Of these young people, about 49,000 graduated from high school.

Bridging the Gap

The Sunshine Project is one initiative that embodies LSU's commitment to translational research. Stanley and her colleagues in music education work to close the feedback loop between local teachers, school districts, and professors in other areas of the university to ensure all of these groups have access to the researchers' findings and the ability to incorporate these findings into instruction for the people who need them most.

Stanley modeled the Sunshine Project after similar projects led by colleagues at Ball State University in Indiana. Over the course of a year, Stanley and Slay had regular Skype meetings with Ryan Hourigan, director of the School of Music at Ball State, to learn how his program operated. The LSU Buddies received training prior to the start of rehearsals, then each Sunday afternoon, the "Cast Members" and their "Buddies" met for two hours, focusing less on the end product, Stanley said, and more on the process.

The children were grouped by age rather than level of functionality, allowing them to make friends and learn socially appropriate communication, like when it's okay to yell and when it's not, how to express anger and disappointment, and yielding to other people's ideas.

"I think there's a tendency to look at children and say, 'Let's match you with people who can do what you can do,'" Stanley said. "Whereas with this, we're taking people and looking at them like, 'Who will it be good for you to interact with socially?'"

The Buddy-Cast Member partnership, Stanley said, helps the children visualize their future at a university. And parents of children with special needs, Stanley added, are rightfully becoming more demanding about their children's education. Gone are the days of allowing schools to imply that children with exceptionalities just can't do school.

The idea of a respite for the parents was an unanticipated but enlightening result of the Sunshine Project, Stanley said.

"It had never really occurred to me that when your child has special needs and has very little opportunity to be independent of you, how few of those respite opportunities you have as a parent," she said.

Credit: Ann Marie Stanley, LSU

The Sunshine Project is a music and performing arts program designed to teach and engage children with social, emotional, and learning exceptionalities.

The parents were initially hesitant to leave their children, Stanley said, but by week three, they were amazed that they could drop their child off for rehearsal and leave. A core group of parents did stay during rehearsals, discussing common issues and sharing resources. Stanley plans to further seed these interactions in the future.

In the end, the project exceeded Stanley's expectations. The production's theme was Music Around the World, and its main soundtrack came from the television show *Cheers*, "Where Everybody Knows Your Name," which the children sang together:

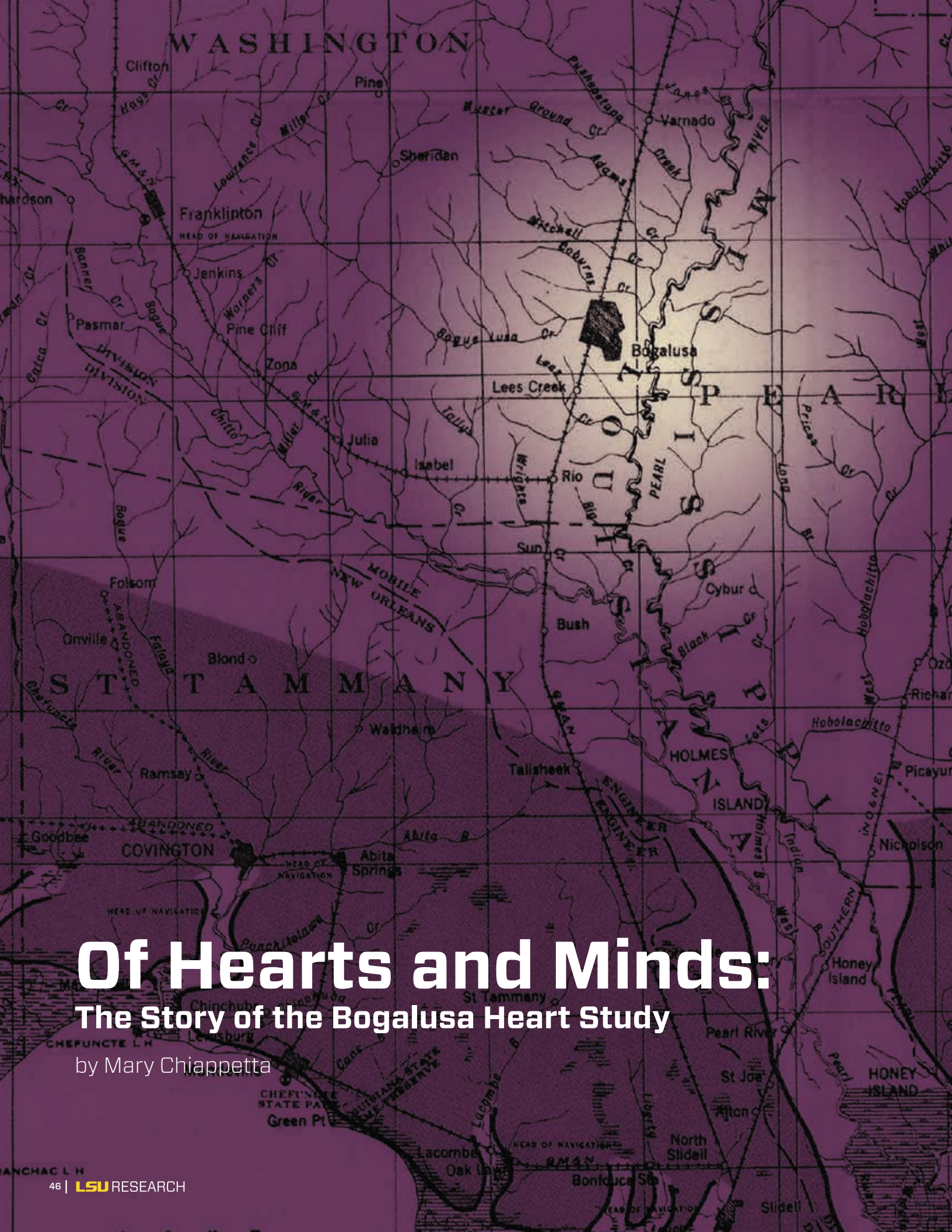
You want to go where people know
The people are all the same
You want to go where everybody knows your name.

The lyrics summed up the Sunshine Project's vision—letting people be who they are and feel connected to others through it.

The final performance space overflowed with attendees. The children showcased a range of improvisatory performances, including African drumming, yoga to music, singing in five different languages, theatre games, and a play written by the high school students in which everyone had a line and a part. The children's pride in their performance was phenomenal, Stanley said.

Stanley plans to repeat the Sunshine Project every spring semester. She foresees involving the East Baton Rouge Parish schools and community more by opening projects focused on reciprocal peer coaching and collecting data from "Buddies" who have graduated and entered the workforce to learn how the Sunshine Project informs their work.

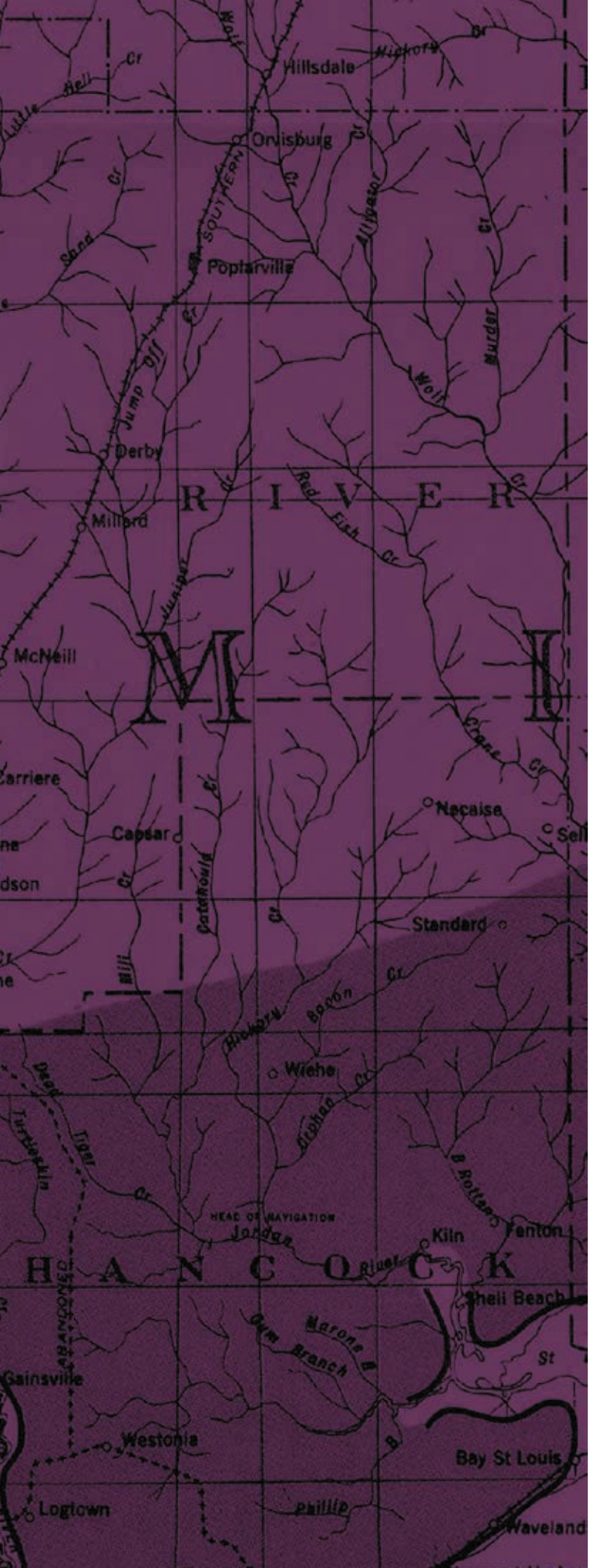
"The next step is seeing what people do with our findings, and let that awareness inform the next research and community outreach we do," Stanley said. ■



Of Hearts and Minds:

The Story of the Bogalusa Heart Study

by Mary Chiappetta



In a small, rural town in the southeastern corner of Louisiana, an unprecedented research study was born. The landmark Bogalusa Heart Study, named for the town in which it originated, was one of the first long-term studies to track the health outcomes of people from childhood all the way through adulthood. Now, nearly 50 years after it began, the rich dataset reveals that health experiences early in life might impact health outcomes across the lifespan.

"It's possible that what happens to us in childhood ripples forward to middle age in ways we don't usually think about," said Owen Carmichael, director of the Biomedical Imaging Center at LSU's Pennington Biomedical Research Center. He is one of the scientists using the lifetime of data produced by the Bogalusa Heart Study to examine health impacts later in life.

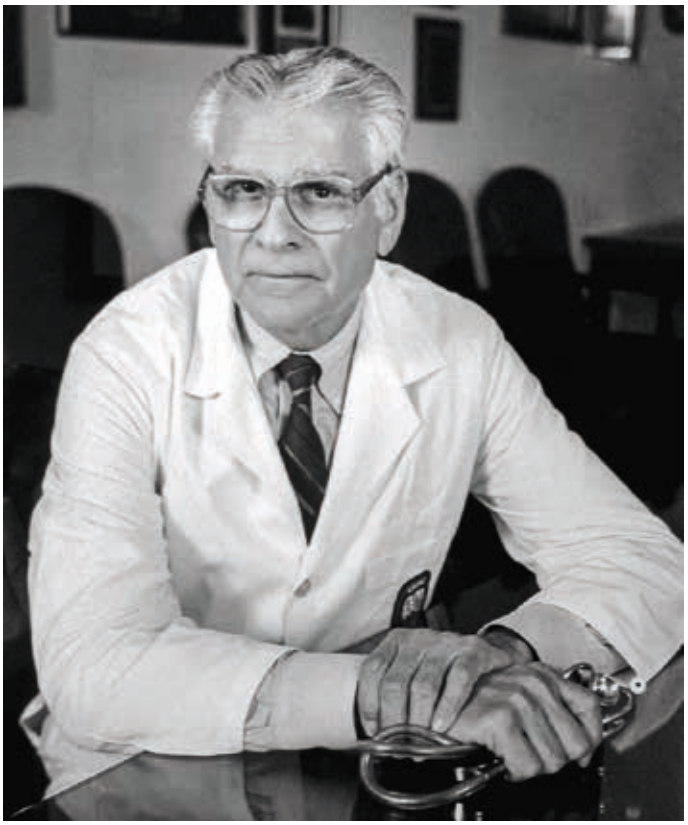
Carmichael is focusing on how our health in childhood can influence our health in middle age, especially when it comes to our brains. For Carmichael, his interest in the influence of early health experiences on cognitive function is personal.

"My grandfather died of Alzheimer's disease when I was a kid. He had the classic case of Alzheimer's disease, which meant a slow and steady deterioration over the course of a decade," Carmichael said. "I got to observe that, in a painstaking way, and see what kind of an effect that has on family and friends. That's what really pushed me into Alzheimer's disease research in general."

Motivated by this personal experience with Alzheimer's disease, Carmichael connected with Dr. Lydia Bazzano, a researcher at Tulane University who has been involved with the current iteration of the historic Bogalusa Heart Study since 2010 as the study's principal investigator. By connecting with this study, Carmichael is about to advance the rich history of patient data collected over the lifespans of the study's participants. With the study participants now middle-aged, when any cognitive impairment may be starting to appear, they could hold the key that unlocks the connection between childhood and adult health using an unusual connection: blood glucose levels.

"Research suggests people who have diabetes in middle age have a higher risk of Alzheimer's and other signs of poor brain health late in life," Carmichael said. "The question we haven't been able to answer until we started looking at data in the Bogalusa Heart Study was how far back in your life does high blood sugar start to have an effect on brain health."

Credit: U.S. Army Corps of Engineers Lower and Middle Mississippi Valley Mapping Program.



Credit: LSU

LSU Boyd Professor Dr. Gerald Berenson founded the Bogalusa Heart Study.

Credit: Sean Gill

Sean Gill, who has been a Bogalusa Heart Study participant since childhood.

Visionary

Under the visionary leadership of the late Dr. Gerald Berenson, a pediatric cardiologist and LSU Boyd Professor, the Bogalusa Heart Study broke new ground in research by recruiting children in the 1970s for this lifespan study. The children underwent full health screenings, such as blood pressure and cholesterol tests, which was unheard of at the time and usually reserved for adults.

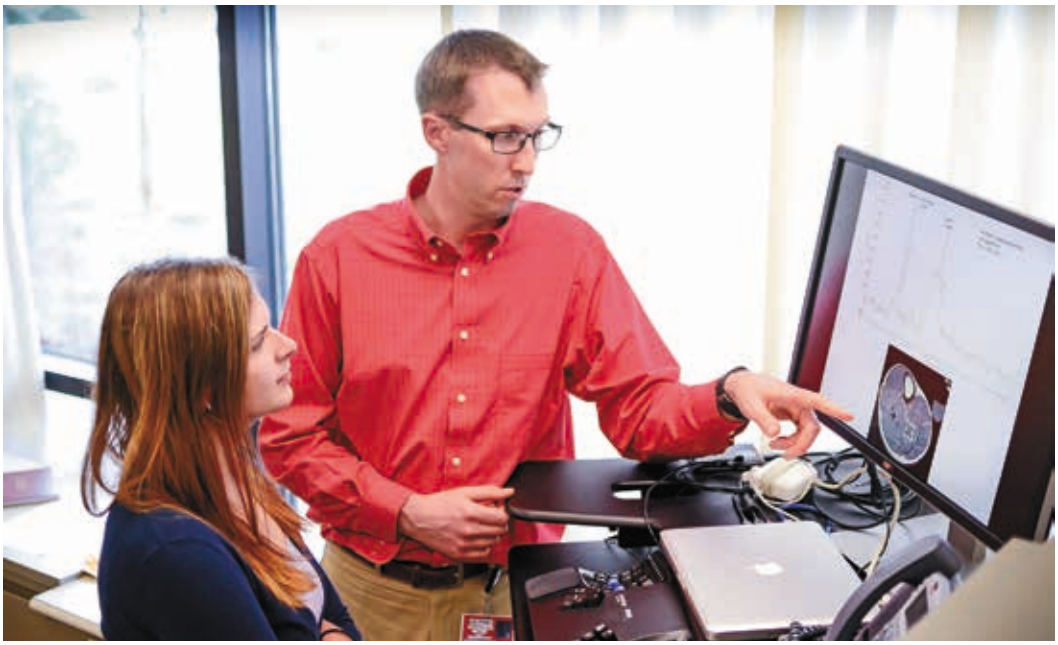
"That was really the key step: this researcher being stubborn and sticking to the idea that heart disease and diabetes start, possibly, at a very young age," Carmichael said. "Dr. Berenson stuck to his guns in the early '70s by getting these different measurements, which really had been reserved for adults at that time because it was never thought children could show signs of heart disease, diabetes, and so on at such a young age."

Berenson's work yields insight into how the warning signs of health issues later in life might actually be evident from the earliest years of childhood. The Bogalusa Heart Study followed and collected the blood pressure and cholesterol levels of the participants at least every two years from childhood through adulthood. Now, most of the participants are in middle age.

Following in Berenson's groundbreaking footsteps, Carmichael and his collaborators at Tulane University, Mary Bird Perkins Cancer Center, and Pennington Biomedical looked at a subset of now middle-aged Bogalusa Heart Study participants who had elevated but still normal blood glucose levels as children and found that many of them have now developed brain lesions called white matter hyperintensities. These lesions are associated with cognitive decline and other poor health outcomes in much older adults.

"We see these white matter lesions in brain scans of people who are in their 70s, 80s, and 90s, and these are associated with poor outcomes such as Alzheimer's disease, stroke, and also early mortality," Carmichael said. "But the conventional wisdom was

> "If the researchers can learn one little thing that will help them save a life, it's worthwhile to participate in it."
>
> Sean Gill
> Bogalusa Heart Study participant



Credit: LSU Pennington Biomedical Research Center

Owen Carmichael, director of the Biomedical Imaging Center at LSU's Pennington Biomedical Research Center, and graduate student Krystal Kirby review a scan.

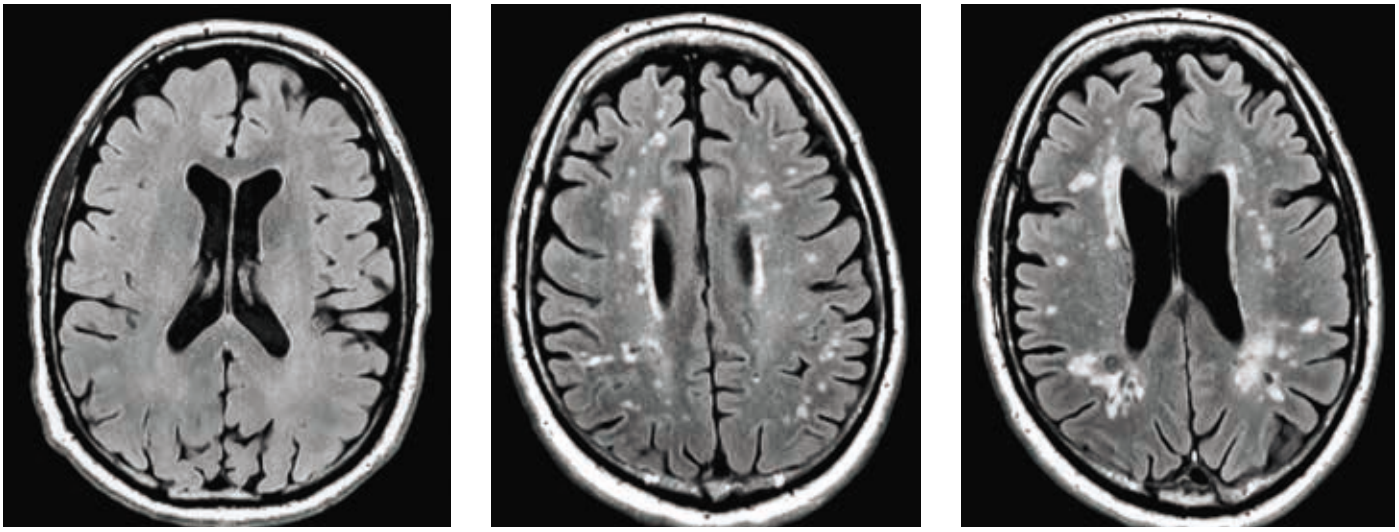
always that there should be very, very little, close to none, in patients in their 40s and 50s."

To further investigate this connection, the researchers obtained funding from the National Institutes of Health to expand their study. Using the data acquired through the Bogalusa Heart Study and applying Positron Emission Tomography, or PET, and Magnetic Resonance Imaging, or MRI, brain scans, the new study will follow 200 of the participants in the original study into more advanced age over the next five years.

Participant Sean Gill grew up with the Bogalusa Heart Study. He volunteered in second grade because he thought it would "just be a fun thing to do." Remarkably, he and hundreds of other child volunteers have stayed with the study their entire lives, and Gill said he plans to remain with it into the future.

The researchers hope this new research will yield insight into treatment plans that could shape the health of children in more promising directions later in life. For Carmichael, the goal motivating his research is to help mitigate the devastating effects of cognitive decline later in life, especially if more aggressive control of blood glucose levels in childhood might stave off Alzheimer's disease or other debilitating conditions.

"I'm hoping to set the stage for studies that isolate the people who were resilient to having high blood sugar as kids, to figure out what made them resilient," Carmichael said. "If we can put that in a bottle, maybe we can find a way to help people overcome the bad things that happened to them in childhood and reverse negative health outcomes later in life." ■



Credit: Owen Carmichael, LSU Pennington Biomedical Research Center

Three Magnetic Resonance Imaging, or MRI, brain scans that show a healthy brain (left) and two with brain lesions called white matter hyperintensities (center and right) common in people in their 70s or older. These lesions, however, are less common for people in their 50s, the age of the study participants. People with more of these lesions are more likely to experience a number of health issues, from Alzheimer's disease and stroke to falls and Parkinson's disease.

THE SECRET WORLD OF BOTANICALS

By Ferris Wayne McDaniel

Credit: Illustration by Margaret Stones, LSU

A virtually endless reservoir of untapped compounds in plant extracts may hold the key to better understanding the development and treatment of Type 2 diabetes. More than 400 million people are living with the disease worldwide, and the incidence rate of diabetes in Louisiana is twice the national average. Jacqueline Stephens and a small team of researchers at the LSU Botanical Dietary Supplements Research Center are dedicated to advancing knowledge of this pervasive disease.

"Diabetes is the leading cause of blindness in the world, the leading cause of non-accident-related limb loss, and is why many people need kidney dialysis. The cost of this healthcare burden is enormous," Stephens said.

One of three botanical centers in the country funded by the National Institutes of Health[1], Stephens' botanical lab, co-directed with Elizabeth Floyd, is part of Pennington Biomedical Research Center's overarching mission to learn about and treat nutrition-related and metabolic diseases, like diabetes and obesity.

Stephens' team studies various factors at the molecular level, where hundreds, if not thousands, of processes can go wrong and trigger a metabolic disease state. Because more than 85 percent of people with Type 2 diabetes are obese and because obesity is excess fat accumulation, Stephens specifically studies fat cells, which are important in the action of insulin and a variety of other hormones that contribute to metabolic processes. If one function of fat cells is disrupted, systemic dysfunction occurs and can impact glucose and lipid metabolism.

In some instances, Type 2 diabetes can be reversed with weight loss, Stephens explained. However, it is important to consider the differences between a healthy fat cell—where even people who are obese don't develop diabetes—and an unhealthy fat cell that promotes the development of diabetes. Stephens' lab investigates genes and proteins that can lead to predisposition to or confer protection from Type 2 diabetes.

"A lot of pharmaceutical companies are seeking new compounds to target different proteins, but there's a limit to what they can make synthetically," Stephens said.

"We're testing a variety of plant extracts to determine which ones have anti-diabetic activity, so hopefully we can identify a compound that could be a potential therapeutic or even a drug some day for Type 2 diabetes or other metabolic diseases."

Jacqueline Stephens
LSU Department of Biological Sciences professor and the Claude B. Pennington, Jr. Endowed Chair in Biomedical Research

Credit: Katherine Seghers, LSU

Jacqueline Stephens conducts diabetes research at the LSU Botanical Dietary Supplements Research Center.

According to the Center for Biological Diversity and the National Cancer Institute, at least 70 percent of new drugs introduced in the U.S. over the past few decades were derived from natural sources. For example, Metformin, a medication that's often the first line of defense for treatment of Type 2 diabetes, came from a derivative of the French lilac, Stephens explained, which people were using for teas to treat diabetes long before drug development.

Last year, Stephens gave a lecture in Tajikistan, an economically fragile nation in Central Asia with a medical school only 80 years old, where a plant named *Artemisia scoparia*, which Stephens currently studies, is used for its anti-diabetic activity. According to her, Eastern medicine incorporates the use of botanicals to address health problems, serving as an important treatment option in poor countries that lack access to modern medicine.

Plant extracts, Stephens said, typically contain several hundred distinct compounds. Her team is hoping to find at least one compound that might have potential to be developed into a drug. To perform these studies, they collaborate with the Rutgers School of Environmental and Biological Sciences, which fractionates *Artemisia scoparia* into individual compounds.

"We've been working on this for more than five years, and we've got some fractions of these plant extracts we know have [anti-diabetic] activity," Stephens said. "They've only got two or three compounds in them, and they appear to be novel compounds, so we're having a group in Chicago elucidate the exact structure of these compounds."

There are likely many plants containing potential anti-diabetic activity yet to be discovered. *Artemisia scoparia*, along with innumerable other plant species, have long existed in people's lives, but the technology and methods to leverage their medicinal properties to the fullest is relatively modern. Countless more species await researchers like Stephens to discover their medicinal compounds, but with the United Nations' report published last May, which detailed the global acceleration of species extinction rates, medical breakthroughs in botanical research are at risk of never happening.

Preserving and Revitalizing

Laura Lagomarsino, LSU assistant professor of biological sciences and director of the Shirley C. Tucker Herbarium, said the United Nations' report highlights the importance of understanding basic biodiversity.

Credit: Katherine Seghers, LSU

Laura Lagomarsino is the director of the Shirley C. Tucker Herbarium at LSU.

"All scientists agree there are still hundreds of thousands, perhaps millions, of species yet to be described," Lagomarsino said. "And while we still have undescribed species—the diversity in cabinets we have here, we're already beginning to lose those species."

The herbarium houses about 400,000 plant specimens and publishes its collection data online for anyone's use. The herbarium catalogues vouchered specimens and loans those specimens to other institutions for their own research, often for an exchange.[2]

According to Jennifer Kluse, research associate and the LSU Herbarium's collections manager, herbaria were first established to study medicine year-round when plants weren't in season.

Louisiana and the southeast U.S. are located in a biodiversity hotspot, Lagomarsino said, meaning there's a wealth of study systems here. The herbarium can complement ongoing research on our regional ecosystems and beyond and provide locality data for specimens to better understand how distributions of species have changed throughout time.

"That opens up the ability to look at, as climate change goes forward, how distributions will change," she said.

The herbarium's collection, Kluse added, works to capture the biodiversity in the region. By making a list of what has existed over time, conservationists can accurately work to restore those species.

"You need a checklist of what we're going to try to get this place back to," she said. "If you don't have any record of what it was before, then you have nothing. If you want to be accurate, you need hard data."

Access to that data has not always been open; in the past, herbaria have been the work of private citizens and mostly academics. The information simply wasn't as accessible as it should've been. But as more data becomes available, Kluse said, people are beginning to access it and ask questions.

"I think scientists made the realization along the way that if they work quietly, they can discover all this information," Kluse said. "But you can't do much to influence policies if you just keep that knowledge within a distinct group of people. So scientists realized if we don't share our information, it's not going to help anyone or improve things."

While the herbarium isn't usually involved in medical research, the work being done through cataloguing and education—which lends itself to conservation and revitalization of plant species—means plants with potential medicinal qualities have a better chance of surviving extinction and being used by Stephens or other researchers in the future.

"It costs pharma companies billions of dollars to develop drugs," Stephens said. "And drugs are really expensive [for patients]. There are still so many untapped resources and compounds and plants that haven't been investigated, so I think it's worthwhile to study botanicals not just for treatment or therapeutic use for Type 2 diabetes but for all diseases. There's so much there that we don't know yet." ■

[1]*This research is supported by the Center of Biomedical Research Excellence grant NIH8 1P30GM118430-01 from the National Institutes of Health.*

[2]*This research is supported by National Science Foundation grant NSF DBI-1756469.*

Credit: Eddy Perez, LSU

At the LSU Rainmakers event were, left to right: LSU Vice President of Research & Economic Development Sam Bentley, Campus Federal Credit Union CEO Jane Verret, LSU Assistant Professor Kathleen Searles, LSU Associate Professor Susan Weinstein, LSU Professor Katherine Kemler, LSU Professor George Stanley, LSU Associate Professor Mark Wilde, LSU Assistant Professor Michael Polito, and Executive Vice President & Provost Stacia Haynie.

RAINMAKERS

As a top-tier research institution, LSU's research faculty are proven leaders in their field, performing at truly outstanding levels each day. LSU's Office of Research & Economic Development, with the support of Campus Federal Credit Union, takes the opportunity each year to acknowledge some of our many outstanding faculty with the Rainmaker Awards for Research and Creative Activity.

Faculty members chosen as Rainmakers are those who balance their responsibilities in the classroom with securing external funding for their research and broadly disseminating their findings to not only the scholarly community but to society as a whole. They are exemplary representatives of LSU, who garner both national and international recognition for their innovative research and creative scholarship, while also competing for external funding at the highest levels and attracting and mentoring exceptional graduate students.

Each of the following award-winning faculty members has met one or more of the criteria for high-quality research or creative activities and scholarship, which include but are not limited to, publication in a high-impact journal(s); highly cited work; external awards; invited presentations at national and international meetings; high journal publication productivity; critically acclaimed book publication(s), performance(s), exhibit(s), or theatrical production(s); high grant productivity; and, for more senior candidates, outstanding citation records and high-impact invited presentations at national and international meetings. Two awards are granted at each career level, including the Emerging Scholar, Mid-Career Scholar, and Senior Scholar levels.

All Rainmaker recipients receive a one-time stipend of $1,000 and a plaque in recognition of their achievements.

Emerging Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Kathleen Searles, Manship School of Mass Communication and Department of Political Science, College of Humanities & Social Sciences

Kathleen Searles is an assistant professor who holds a joint appointment in the Manship School of Mass Communication and the Department of Political Science at LSU. She is also an affiliated faculty member with the LSU Multidisciplinary Institute for Neuroscience Discovery and the LSU Media Effects Lab. Her interests include news media, campaign advertising, and political psychology.

Credit: LSU

Kathleen Searles

During the last presidential election, she received several grants to support her research using eye-tracking technology, part of a broader agenda that influenced the advertising landscape of the 2016 presidential election. Her work has appeared in a multitude of journals, including *Public Opinion Quarterly*, *The Journal of Computer Mediated Communication*, *Political Research Quarterly*, *Political Communication*, *Journal of Experimental Political Science*, *Information Communication & Society*, *PLOS ONE*, *Journalism*, *International Journal of Public Opinion Research*, *International Journal of Communication*, and *Political Psychology*.

She is currently working on a co-authored book manuscript with Oxford University Press, which investigates the effects of mobile devices on information processing. Recently, she edited two special issues: one for *Public Opinion Quarterly* on news coverage of public opinion and another for *Political Communication* on innovations in methods and measures. She also serves on the editorial board for Women Also Know Stuff, an organization designed to amplify the voice of women political scientists in public discourse and to decrease the gender imbalance in media representation of experts.

Science, Technology, Engineering & Mathematics

Michael Polito, Department of Oceanography & Coastal Sciences, College of the Coast & Environment

Michael Polito is an assistant professor in the LSU Department of Oceanography & Coastal Sciences in the College of the Coast & Environment. He is an ecologist with a focus on the food web dynamics of marine and coastal ecosystems ranging from Louisiana to Antarctica and many places in between. His research uses stable isotope and other geochemical biomarkers to explore species' ecological responses to environmental stressors, such as oil spills and climate change, and to evaluate

Credit: LSU

Michael Polito

the ecological implications of coastal restoration and fisheries management strategies.

He is the recipient of the 2018 LSU Alumni Association Rising Faculty Research Award and the 2016 Tiger Athletic Foundation Undergraduate Teaching Award. His research has been supported by the National Science Foundation, National Oceanic and Atmospheric Administration, Gulf of Mexico Research Initiative, Louisiana Sea Grant, the Louisiana Board of Regents, and other sources. His published research has been profiled by *The New York Times*, *BBC News*, *The Wall Street Journal*, and *Scientific American*, among other national and international publications.

Polito has been an assistant professor at LSU since 2014. Prior to that, he received his PhD in marine biology from the University of North Carolina, Wilmington, and conducted postdoctoral research at the Woods Hole Oceanographic Institution.

Mid-Career Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Susan Weinstein, Department of English, College of Humanities & Social Sciences

Susan Weinstein came to LSU in 2004 after completing her PhD in English at the University of Illinois at Chicago. She is an associate professor in the LSU Department of English and currently serves as associate chair of English and the departmental advisor for the English secondary education concentration known as Geaux Teach English. She teaches courses in English education, ethnographic research methods, literacy studies, social contexts of poetry, and hip-hop studies.

Weinstein's scholarship focuses on teenage writers. She has been researching the field of youth spoken word poetry since 2006 and has published broadly on that topic. She was awarded LSU's Brij Mohan Distinguished Faculty Award for work related to social justice because of her ongoing work with Baton Rouge's WordPlay Teen Writing Project. In addition, WordPlay awarded her its first annual Excellence in Service award in 2010. Currently, she sits on the board of directors of Forward Arts, the non-profit organization that houses WordPlay. She previously taught high school English in Chicago, Illinois and Cochabamba, Bolivia.

Science, Technology, Engineering & Mathematics

Mark Wilde, Department of Physics & Astronomy, College of Science

Mark Wilde is an associate professor in the LSU Department of Physics & Astronomy and the Center for Computation & Technology. He is the recipient of a National Science Foundation Career Development Award and the APS-IUSSTF Professorship Award in Physics. He is associate editor for quantum information theory in *IEEE Transactions on Information Theory* and *New Journal of Physics*. His current research interests are in quantum Shannon theory, quantum optical communication, quantum computational complexity theory, and quantum error correction.

Senior Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Katherine Kemler, School of Music, College of Music & Dramatic Arts

Katherine Kemler is the Charles and Mary Barré Alumni Professor of Flute at LSU and flutist with the Timm Wind Quintet. She is a regular visiting teacher at the Oxford Flute Summer School in England and the Académie Musicale Internationale de Colombes in France.

Kemler has performed solo recitals in London's Wigmore Hall and the Beijing Concert Hall and taught masterclasses in China's Central Conservatory, the Shanghai Conservatory, and the Hong Kong Academy of Performing Arts. She has also soloed with the orchestra, Medicea Laurenziana, throughout Italy. She has performed solo recitals and taught masterclasses at the Sydney Conservatorium of Music, the Adelaide Conservatorium, the University of Western Australia, and the Perth Music Academy in Australia as well as the Ecuadorian Flute Festivals in Quito and Guayaquil, Guatemala, Puerto Rico, Panama, and the Dominican Republic. She recently performed with an LSU colleague at the International Double Reed Society Conference in Grenada, Spain. She has performed at 16 National Flute Association conventions in various major U.S. cities as well as at the British Flute Society National Convention. She was featured on the cover of *Flute Talk* magazine and on the cover of *Flutist Quarterly*, the official magazine of the National Flute Association.

She has recorded four solo CDs on Centaur Records Inc. and made solo broadcasts on BBC Radio 3 and National Public Radio.

Science, Technology, Engineering & Mathematics

George Stanley, Department of Chemistry, College of Science

George Stanley, an LSU Department of Chemistry alumni professor, was born in 1953 and raised in a small town called Palmerton in eastern Pennsylvania. He developed a strong interest in science and chemistry in the fourth grade, which never stopped. Stanley received his BS in chemistry from the University of Rochester in 1975 and conducted junior and senior-year research with Professor Rich Eisenberg on one-dimensional organometallic conductors.

Stanley received his PhD in inorganic chemistry in 1979 with Professor F. Albert Cotton at Texas A&M University with a focus on molecular orbital calculations on metal-metal bonded compounds. He then received NATO & CNRS Postdoctoral Fellowships to study with Professor John Osborn at the Université Louis Pasteur in Strasbourg, France from 1979 to 1981, where he returned to synthetic organometallic chemistry and developed a love of catalysis. He started his academic career in 1981 at Washington University in St. Louis. In 1986, he moved to LSU, where he is currently the Cyril & Tutta Vetter Alumni Professor of Chemistry. He chaired the Inorganic Chemistry Gordon Research Conference in 2005 and was chair of the Industrial & Engineering Chemistry Division of the American Chemical Society, or ACS, in 2018. His society honors include ACS Fellow (2011) and AAAS Fellow (2014). He loves teaching chemistry and is the founding organizer of the LSU ChemDemo service-learning program that has sent nearly 16,000 LSU students out to teach science and chemistry in regional K-12 schools. ■

ACCOLADES

Top Cited Researchers Worldwide

Several LSU researchers rank among the most cited scholars in the world. In an updated list based on information from the Google Scholar Citations database, four LSU professors rank among the 3,160 scholars with an h-index over 100. The h-index, named after physicist Jorge E. Hirsch, is an attempt to measure both productivity and impact of published papers, taking into account a researcher's total number of papers and how many times each was cited by other scholars. An h-index over 100 amounts to 100 research papers each cited over 100 times.

LSU Pennington Biomedical Research Center Professor **Dr. Steven Heymsfield** is on this prestigious list. The relevance of his most cited paper, "Epidemiology of sarcopenia among the elderly in New Mexico," written with Dr. Richard N. Baumgartner on how muscle mass decreases with age, wasn't immediate when it was published in the *American Journal of Epidemiology* in 1998.

"Little did we know so long ago that the problem of sarcopenia would become a major topic of current research. There are two parallel epidemics that people think about now—obesity and sarcopenia—and our paper on sarcopenia was one of the first, defining it as BMI, body mass index. Since then, everyone has used that index," said Dr. Heymsfield.

LSU Boyd Professor **Claude Bouchard**, who is the John W. Barton, Sr. Endowed Chair in Genetics and Nutrition at Pennington Biomedical, has the highest current h-index at LSU. His research centers on the genetics and consequences of obesity and the health benefits of exercise. He co-wrote a paper published in the *Journal of the American Medical Association* in 1995 titled "Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine," which has been cited nearly 10,000 times.

LSU Boyd Professor Emeritus of Molecular & Cellular Physiology **D. Neil Granger** at the LSU Health Sciences Center in Shreveport's most cited paper, "Nitric oxide: an endogenous modulator of leukocyte adhesion," was published in the *Proceedings of the National Academy of Sciences* in 1991.

Paul Frick, the Roy Crumpler Memorial Chair and professor of psychology at LSU, has also earned an h-index over 100. His research investigates the many interacting factors that can lead children and adolescents to have serious emotional and behavioral problems, such as aggressive and antisocial behavior.

According to a report released by Clarivate Analytics, three additional LSU researchers are among the top cited scholars based on journals indexed in the Web of Science Core Collection 2006-2016.

The three LSU faculty included in the 2018 list of 6,078 scholars worldwide are **Charles D. Nichols**, professor of pharmacology at LSU Health Sciences Center New Orleans; **Johnny Matson**, professor of psychology and Distinguished Research Master; and **Brant C. Faircloth**, assistant professor in the LSU Department of Biological Sciences and a research associate at the LSU Museum of Natural Science.

AAAS Names Four LSU Faculty Fellows

Four LSU faculty members have been named Fellows of the American Association for the Advancement of Science, or AAAS, the world's largest general scientific society. The four LSU professors are among the 416 AAAS members, who have been elevated to the rank of Fellow because of their efforts to advance science applications that are deemed scientifically or socially distinguished.

"Congratulations to these four distinguished LSU faculty who are among the top scientific minds in the world. We celebrate their dedication to advancing knowledge in their respective fields as well as their proven commitment to inspiring our students in the classroom every day. This recognition is just another reminder of the breadth, depth, and quality of the expertise we house on LSU's campus, and it's a privilege to count these outstanding scientists among our faculty," said LSU President F. King Alexander.

The four newly elected 2018 AAAS Fellows include:

Prosanta Chakrabarty, associate professor in the LSU Department of Biological Sciences and the curator of ichthyology in the LSU Museum of Natural Science, was elected for his distinguished contributions to evolutionary biology, focusing on the bioluminescent systems and historical biogeography of freshwater fishes, and for effectively communicating science to the public.

Anne Grove, the Gregory Cannaday Burns Professor in the LSU Department of Biological Sciences, was elected for her distinguished contributions in the field of protein-nucleic acid interactions and the mentoring and training of the next generation of scientists.

Credit: LSU

Anne Grove, the Gregory Cannaday Burns Professor in the LSU Department of Biological Sciences, with her students.

Kyle Edward Harms, professor in the LSU Department of Biological Sciences, has been elected for his distinguished contributions to community- and ecosystem-level biology, focusing on the structure, function, and diversity of forests, particularly those in neotropical regions.

Credit: LSU

Kyle Edward Harms, professor in the LSU Department of Biological Sciences, in the field.

Wayne D. Newhauser, the Dr. Charles M. Smith Chair of Medical Physics, professor, and director of the LSU Medical and Health Physics program, was elected for his distinguished contributions to the field of medical physics, particularly for theoretical modeling and predictions of radiation exposures and outcomes following advanced radiation therapies.

Forty-four LSU faculty are AAAS Fellows.

LSU Chemist Among 20 Professors Selected to Improve U.S. STEM Education

LSU Department of Chemistry Assistant Professor Weiwei Xie is one of the 20 inorganic chemistry professors named as a fellow to improve undergraduate education in science, technology, engineering, and math, or STEM, in the U.S. Xie teaches general and inorganic chemistry at LSU. She is among the first 20 Virtual Inorganic Pedagogical Electronic Resource, or VIPEr, Fellows to participate in this ground-breaking study.

The study titled, "Improving Inorganic Chemistry Education," is being conducted by the Interactive Online Network of Inorganic Chemists, or IONiC, with support from the National Science Foundation's Improving Undergraduate STEM Education program. The project will use classroom observations, analysis of student work, student surveys, and faculty interviews to study how changes in the classroom affect student learning, interest, and motivation.

Xie obtained her bachelor's degree from Nankai University, China, and her PhD from Iowa State University of Science and Technology, graduating with Research Excellence. Upon graduation, she conducted postdoctoral research at Princeton University from 2014 to 2016. She was awarded the Beckman Young Investigator in 2018. As a VIPEr Fellow, she will contribute to the enhancement of inorganic chemistry curricula at LSU and across the U.S.

Credit: LSU

LSU Boyd Professor Isiah Warner with his students.

Nature Recognizes LSU Boyd Professor for Mentorship

Nature, the leading, international weekly journal of science, has selected LSU Boyd Professor Isiah Warner for the Nature Award for Mentoring in Science. These awards were founded in 2005 to celebrate mentorship, a crucial component of scientific career development that too often goes overlooked and unrewarded. Through Warner's leadership and mentorship, the LSU Department of Chemistry has become the leading producer of doctoral degrees in chemistry for African Americans in the U.S. Under his direction, the LSU Office of Strategic Initiatives has mentored countless numbers of students across eight programs from the high school to doctoral levels.

"I am delighted at the achievements of our awards winners, including Dr. Warner, and I am especially delighted this year at the diversity of their experiences and of their commitments to mentoring. I know that the judges had a strong field of applicants. It's terrific for *Nature* to be able to celebrate researchers who have been so outstanding in their encouragement of a strong scientific ethos in those who come after them," said Sir Philip Campbell, editor-in-chief of Springer Nature.

Warner is considered one of the world's experts in analytical applications of fluorescence spectroscopy. His research aims to develop and apply chemical, instrumental, and mathematical measurements to solve fundamental questions in chemistry.

Warner has recently been recognized as the 2016 SEC Professor of the Year, member of the American Academy of Arts and Sciences, Fellow of the National Academy of Inventors, American Chemical Society, Royal Society of Chemistry, and American Association for Advancement of the Sciences. He also received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring from President Clinton and the American Chemical Society Award for Encouraging Disadvantaged Students into the Sciences.

Warner is also the Phillip W. West Professor of Chemistry, Howard Hughes Medical Institute Professor at LSU, and has achieved the highest professorial rank in the LSU system—LSU Boyd Professor.

Gabriela González Named 2019 SEC Professor of the Year

Credit: LSU

Gabriela González

LSU Boyd Professor of Physics Gabriela González has been named the 2019 Southeastern Conference, or SEC, Professor of the Year. González is the second professor from LSU to win the honor since the inception of the award in 2012.

A native of Argentina, González is a leader in gravitational wave research, including having served as the global spokesperson for the Laser Interferometer Gravitational-Wave Observatory, or LIGO, Scientific Collaboration, a program that includes more than 1,000 scientists around the world. In 2017, LIGO leaders were awarded the Nobel Prize in Physics after proving predictions made by Albert Einstein nearly 100 years ago.

González's research focuses on LIGO instrument development and LIGO data calibration and diagnostics, critical to increasing the astrophysical reach of the detectors. She made the worldwide announcement that gravitational waves had been discovered and has since been elected to the National Academy of Sciences, among other distinguished societies.

"Dr. González, her students, current colleagues, predecessors at LSU, and worldwide collaborators are advancing technology at an extraordinary pace, which provides us with new knowledge of the cosmos nearly every week. Today, we celebrate her recognition as the SEC Professor of the Year, and for generations, we will celebrate her contribution to science," said LSU College of Science Dean Cynthia Peterson.

In addition to her groundbreaking research, González has mentored doctoral students and post-doctoral fellows as well as spearheaded a local school outreach initiative that has received more than $1 million for K-12 students in the Baton Rouge area.

"Being able to conduct research with one of the world's leading experts in the groundbreaking field of gravitational wave science is an incredible experience. Not only is Dr. González an amazing scientist but she's an incredible mentor and teacher."

Shania Nichols
LSU PhD candidate and González's advisee

The SEC Professor of the Year Award is given annually to one SEC faculty member whose record of teaching and research places him or her among the elite in higher education.

LSU Environmental Scientist Awarded High Honor in China

LSU College of the Coast & Environment Professor Ed Laws was awarded the Friendship Award from the People's Republic of China, which is the highest honor bestowed by the Chinese government upon non-Chinese experts who have made outstanding contributions to China's economic and social progress.

Laws has fostered collaborations with the Qingdao Institute of Marine Geology, or QIMG, and Xiamen University. He has been visiting Qingdao and Xiamen for two to three months every summer for the past several years. According to Nengyou Wu, the director general of QIMG, Laws introduced innovative methods for measuring primary productivity of wetland ecosystems by using the carbon-14 method. This introduction was an innovative impetus to the biogeochemical research of QIMG and helped to establish a key coastal wetland biogeosciences laboratory within the China Geological Survey.

Also, Laws proposed wetland vegetation as a renewable resource, "creating great economic value for the reed paper industry in the region of the Liaohe River Delta in northeast China," Wu said.

Credit: LSU

Ed Laws accepts his Friendship Award from the Vice Premiere of China Liu He.

Laws' textbook, *Aquatic Pollution*, is "not only a classic textbook for both undergraduate and graduate students in many American universities but also a significant reference for environmental researchers and oceanographers all over the world. This book has been translated into Chinese and Japanese and published in numerous countries. Its Chinese version attracts great interest from Chinese students and scholars and has become popular at the China Geological Survey and many of China's top universities," Wu said. ■

Credit: Elsa Hahne, LSU

LSU Alumni Association President & CEO Cliff Vannoy, former LSU Associate Vice President for Research & Economic Development Gus Kousoulas, LSU's San Diego II Alumni Professor of English Bill Demastes, LSU Executive Vice President & Provost Stacia Haynie, the George William Barineau III Professor in the LSU College of the Coast & Environment Kam-biu Liu, LSU Associate Vice President for Research & Economic Development Stephen David Beck, and LSU Vice President for Research & Economic Development Sam Bentley.

GOING THE DISTANCE

Distinguished Research Masters

Since 1972, the LSU Council on Research has presented the university-wide Distinguished Research Master award in recognition of outstanding faculty accomplishments in research and scholarship. The recipients are chosen by the council from nominees proposed by the university community. Each year, one recipient is chosen from the arts, humanities, social sciences, and behavioral sciences disciplines and another from the science, technology, engineering, and mathematics disciplines.

The Distinguished Research Masters award provides winners a salary stipend and the University Medal—the symbol of exceptional academic accomplishment at LSU.

Credit: Elsa Hahne, LSU

William Demastes

Arts, Humanities, Social & Behavioral Sciences

William Demastes, English, College of Humanities & Social Sciences

William Demastes is LSU's San Diego II Alumni Professor of English, specializing in English and American drama. He has written several books including *Beyond Naturalism*, *Theatre of Chaos*, *Staging Consciousness*, and *Comedy Matters* as well as monographs on playwrights Clifford Odets, Spalding Gray, Tom Stoppard, and John Guare. He has edited numerous essay collections as well as the *Best American Short Plays* and modern dramatists' *Research and Production Sourcebooks* series.

He has served as both president and vice president of the American Theatre and Drama Society. At LSU, he has served as an associate dean of the College of Humanities & Social Sciences, director of the Master of Arts in Liberal Arts program, and, most recently, LSU's Faculty Athletics Representative. He has won LSU's Distinguished Faculty Award and the Alumni Association Faculty Excellence Award and has twice won the Tiger Athletics Foundation Undergraduate Teaching Award.

Science, Technology, Engineering & Mathematics

Kam-biu Liu, Oceanography & Coastal Sciences, College of the Coast & Environment

Kam-biu Liu is the George William Barineau III Professor in the LSU College of the Coast & Environment's Department of Oceanography & Coastal Sciences. As a paleoecologist and paleoclimatologist, Liu's research uses lake sediments and fossil pollen, including from ice cores, to reconstruct the patterns and processes of climatic and environmental changes on timescales of centuries to millennia. He has conducted research around the world, including in the Amazon basin, the Andes, the Tibetan plateau, western China, the Yangtze River Delta, subarctic Canada, Central America, and the Caribbean region. He is recognized as a pioneer and leader in paleotempestology, a young field that studies past hurricane activity by means of geological proxy techniques. During the past three decades, he has been using coastal sedimentary records to reconstruct past hurricane activities along the U.S. Atlantic and Gulf of Mexico coasts, the Caribbean region, and the Pacific coast of Mexico over the last 5,000 years.

He has published more than 140 research papers and is an editor and author of the book *Hurricanes and Typhoons: Past, Present, and Future,* published by Columbia University Press. His work has been funded almost continuously by the National Science Foundation over the last 30 years as well as by other funding agencies, including the Inter-American Institute for Global Change Research, the Risk Prediction Initiative of the Bermuda Biological Station for Research, NOAA, and the National Geographic Society.

Credit: Elsa Hahne, LSU

Kam-biu Liu

Liu received the Lifetime Achievement Award in Paleoenvironmental Change from the American Association of Geographers in 2018 and was honored as a SLLW Visiting Fellow by the Chung Chi College of the Chinese University of Hong Kong in 2015. He is a Fellow of the American Association for the Advancement of Science and had served as a member of the U.S. National Committee for the International Union for Quaternary Research. At LSU, he was the recipient of the LSU Rainmaker Senior Scholar Award in 2013 and the LSU Distinguished Faculty Award in 2006. He won the Tiger Athletic Foundation Undergraduate Teaching Award in 2001 and the College of the Coast & Environment Outstanding Faculty Teaching Award in 2010. He has been serving as the Chair of the LSU Department of Oceanography & Coastal Sciences since January 2013. ■

The Distinguished Dissertation awards recipients receive a monetary gift and a certificate of commendation.

MEDIA SHELF

By Beth Carter

Global Perspectives on Educational Testing: Examining Fairness, High-Stakes and Policy Reform

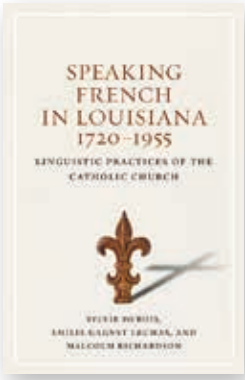
Keena Arbuthnot
Associate Professor of Education

In this book, Keena Arbuthnot analyzes the effectiveness of high-stakes testing on diverse groups of students to determine if the current practices best reflect educational performance for everyone. Because standardized testing now decides so much about a student's educational experience, Arbuthnot says it is imperative to better understand issues of fairness when it comes to these types of tests. *Global Perspective on Educational Testing* redefines test fairness and gives several policy recommendations on how to improve high-stakes standardized testing.

Louisiana Trail Riders

Jeremiah Ariaz
Associate Professor of Photography

African American trail riding clubs have their roots in the Creole culture formed in South Louisiana in the 18th century. Today, trail rides are an opportunity for generations of people to gather, celebrate, and ride horseback. The riders form a distinctive yet little-known subculture in Southwest Louisiana. In addition to sharing an important aspect of Louisiana's cultural heritage, Ariaz's photographs offer a counter-narrative to historic representations of the cowboy and serves as a reminder that black equestrian culture stems from a time when the Louisiana Territory was in fact the American West. The book has been featured in national publications such as the *Paris Review*, *Oxford American*, *Garden & Gun*, and *U.S. News and World Report*. Ariaz was named the 2018 State Fellow for Louisiana and received the Michael P. Smith Award for Documentary Photography from the Louisiana Endowment for the Arts.

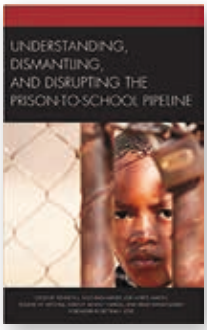


Speaking French in Louisiana, 1720-1955: Linguistic Practices of the Catholic Church

Sylvie DuBois
Gabrielle Muir Professor of French Studies

Malcolm Richardson
Dr. J. F. Taylor Endowed Professor of English

Speaking French in Louisiana, 1720-1955 delves into 300 years of records from the Archdiocese of New Orleans to analyze how the use of French in the church and the state overall impacted the Catholic Church's practices, teachings, and record-keeping. French was prevalent in the Catholic Church in Louisiana until the Civil War, after which the Church saw a turn to English-only masses. The authors evaluated 4,000 letters, written mostly in French, from 1720 to 1859; sacramental registers from more than 250 churches; parish reports; diocesan council minutes; and unpublished material from French archives to develop a clear history of the importance of French language and culture throughout Louisiana's religious history and the impact it still has today.



Understanding, Dismantling, and Disrupting the Prison-to-School Pipeline

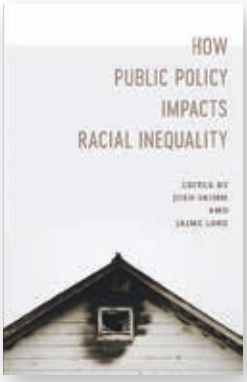
Co-edited by Kenneth J. Fasching-Varner
Shirley B. Barton Endowed Associate Professor of Education

Lori Latrice Martin
Associate Professor of Sociology and African & African American Studies

Roland Mitchell
Interim Dean of the College of Human Sciences & Education

This book analyzes what has been labeled a school-to-prison "pipeline" and the impacts of that pipeline for school and society in the United States, particularly for young men of color. Fasching-Varner, Martin, Mitchell, and colleagues study the links between factors like the criminalization of student

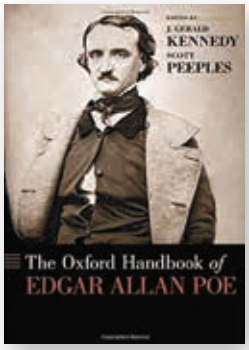
behavior and the introduction of juveniles into the criminal justice system at an early age. *Understanding, Dismantling, and Disrupting the Prison-to-School Pipeline* features contributions from sociologists, counselors, and criminal justice experts who are working not just to accept the narrative of a "school-to-prison" pipeline but to examine how the pipeline may be more accurately thought of as moving "prison-to-school," or from the society back to schools, and the implications that such a framing has for various stakeholders.



How Public Policy Impacts Racial Inequality

Co-edited by Joshua Grimm
Associate Professor of Mass Communication

How Public Policy Impacts Racial Inequality combines scholars from political science and mass communication to provide in-depth analyses on how racial issues and public policy are intertwined. Contributors show how issues like police profiling, income inequality, and housing segregation relate to public policy discussions at the local and national levels. This collection provides an extensive look at 21st century race and policy interactions by also including research on the Trump administration's immigration policies and the growing effects of desegregation.



The Oxford Handbook of Edgar Allan Poe

Co-edited by J. Gerald Kennedy
Boyd Professor of English

This largest compilation is over 800 pages long and features 45 chapters on one of history's most iconic, melancholy poets. The collection of essays from Poe scholars around the country explores Poe's troubled life and career, his poetry, and his lasting impact on today's literature and art. *The Oxford Handbook of Edgar Allan Poe* also has heavy ties to LSU, as Kennedy co-edited the handbook with Scott Peeples, who received his PhD from LSU in 1993. LSU faculty members Jacob Berman and Lauren Coats also contributed essays.

Hacia La vida es sueño como speculum reginae: Isabel de Borbón en la corte de Felipe IV

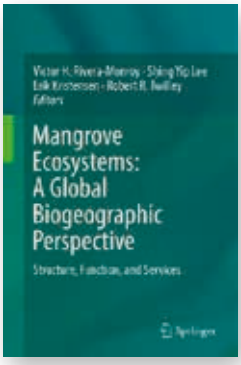
Carmela Mattza
Associate Professor of Hispanic Studies

This Spanish language book examines power relations at the Court of Philip IV in 17th-century Spain, focusing on his first wife Queen Isabel de Borbón, the daughter of Henri IV, King of France, and Marie de' Medici. Isabel and Philip married when she was only 13, but she went on to play an active role in state affairs, including serving as a Spanish regent during the Catalan Revolt of the Franco-Spanish War in 1640. Mattza's book researches Isabel's family history and upbringing and delves into her role as Queen of Spain. It highlights records of Isabel's positive image not only in Spain and its colonies but throughout Europe. Examining documents dealing with her *exequias*, or funeral rites, celebrated throughout the world, this study also shows how the positive image of the queen endured even after her death.

Managing Hurricane Katrina: Lessons from a Megacrisis

James A. Richardson
John Rhea Alumni Professor of Economics

The aftermath of 2005's Hurricane Katrina-dominated media coverage, public debate, and policy discussions has persisted for years after the storm devastated the Gulf Coast. Nearly all assessments pointed to failures from federal, state, and local governments. *Managing Hurricane Katrina* offers a more nuanced examination of the storm's aftermath and analyzes those agencies' successes and failures. Richardson and colleagues study data from Katrina to provide a comprehensive analysis for government response to the next megacrisis and how to build an effective response network after such a tragedy.



Mangrove Ecosystems: A Global Biogeographic Perspective

Co-edited by Victor H. Rivera-Monroy
Associate Professor of Oceanography & Coastal Sciences

Robert Twilley
Louisiana Sea Grant College Program Executive Director and Professor of Oceanography & Coastal Sciences

Mangrove forests are one of the most productive wetlands and are vital indicators of ecosystem health around the globe. Rivera-Monroy and Twilley, along with researchers from Hong Kong and Denmark, conducted a collaborative multi-author and multidisciplinary international study to determine just how critical mangrove wetlands are. The book includes not only the ecological benefits of mangroves but the socio-economic benefits as well. Mangroves protect coastal communities from storm surge and the effects of climate change, and they are also home to some of the world's greatest biodiversity.

Florida Weather and Climate: More than Just Sunshine

Co-authored by Robert V. Rohli
Professor of Oceanography & Coastal Sciences

The Sunshine State is home to two of the world's major climate types: tropical wet-dry and humid subtropical. In this book, Rohli and fellow researchers study the forces behind Florida's surprising weather patterns like thunderstorms, wildfires, droughts, and hurricanes to discover why Florida has some of the most varied weather in the nation. *Florida Weather and Climate* takes a look into weather systems and climate change that affect Florida's ecosystems and includes maps and diagrams for a clear and accessible guide.

Reading Architecture: Literary Imagination and Architectural Experience

Co-edited by Angeliki Sioli
Assistant Professor of Architecture

Reading Architecture answers questions such as: Why write instead of draw when it comes to architecture? Why rely on literary pieces instead of traditional architectural writings and drawings when it comes to studying buildings and urban environments? This book builds on the existing interdisciplinary bibliography on the connections between architecture and literature but focuses mainly on literature's capacity to describe the lived experience of place. It sheds light on the importance of a literary imagination for architects, and it looks into contemporary architectural subjects through a wide variety of literary works from around the world. Whether through novels that employ historical buildings or sites interpreted through specific literary methods, it suggests a range of methodologies for contemporary architectural academic research. ■

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FIERCE ASKS A QUESTION AND FINDS A SOLUTION

At LSU, we embody the promise of tomorrow, breaking through boundaries to knowledge and unlocking solutions to some of the world's most pressing issues. Our researchers lead the charge to restore our coast, advance new forms of healing, and educate and empower the next generation of leaders, creators, and cultivators.

You can help advance academic excellence by supporting students, faculty, staff, and projects like those highlighted in this issue. If learning about the research happening at LSU has inspired you to give to the LSU Foundation, please visit **lsufoundation.org/give** or call 225-578-3811.

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