UNIVERSITY OF WISCONSIN-MADISON COLLEGE OF LETTERS & SCIENCE

SPRING 2022

Letters&Science

A MYSTERIOUS KINGDOM

page 18

Chemist John Berry's research team landed a patent for work on fuel cells that could potentially change the energy economy.

Contents

DEPARTMENTS

FEATURES

PHOTO: JEFF MILLER

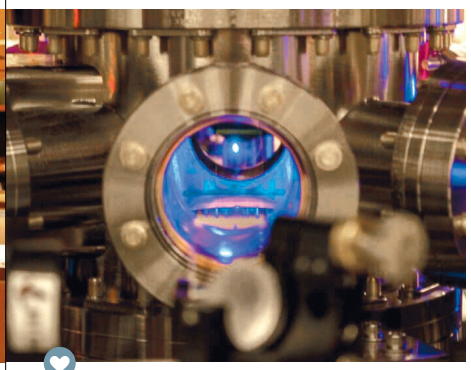
Many L&S students are involved in BadgersVote, a campus-wide initiative that strives to provide UW-Madison students with everything they need to know in order to participate in their elections.

ON THE COVER
Illustration of lichens from *Art Forms in Nature*, a book of lithographic and halftone prints by Ernst Haeckel.

#WeAreLS

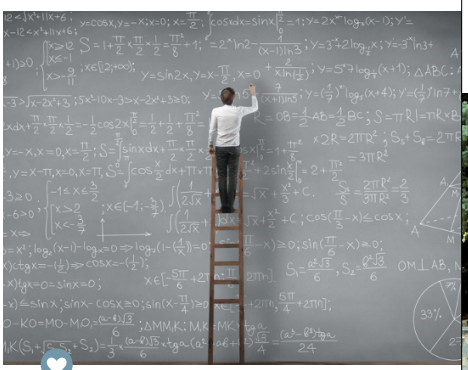
Congratulations to all our December L&S Grads! Many of you are already pursuing what you're passionate about through professional opportunities. We're so proud of you! #uwsuccessworks #uwgrad #WeAreLS #shareyoursuccess

@UWMadisonLS December 21, 2021



Professor of Physics Shimon Kolkowitz, who just scored a prestigious Sloan Fellowship to support his research, leads a team that has developed an ultraprecise optical lattice atomic clock, a tool that will allow physicists to test ways to search for gravitational waves and attempt to detect dark matter.

@UWMadisonLS February 16, 2022



It all adds up: According to a recent study by @amermathsoc, over the past two decades, @UWMadison is fourth in the nation when it comes to producing math PhDs.

@UWMadisonLS January 4, 2022

The new Wolff Fellowship allows a deserving L&S senior to embark on a year of travel and service, post-graduation, without worry about expenses.

@UWMadisonLS January 13, 2022

Letters&Science
SPRING 2022

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FROM THE DEAN

Power of Research

Promoting L&S research excellence is one of my top priorities as dean of L&S. The profound importance of curiosity-driven research is its impact on future generations. The knowledge, technology and understanding we sometimes take for granted today are rooted in research discoveries made years, decades or even centuries ago. Second only to the university's medical school in research awards and expenditures, L&S is an innovation leader, launching new initiatives, winning patents (like the one you'll read about on page 24), and exploring urgent problems such as climate change and global pandemics. Our faculty and graduate students are also delving into what we call basic, or "blue sky" research, which means work that is not necessarily tied to an immediate application, but rather pushes the boundaries of our knowledge about our planet and our universe.

Allow me to boast a little more about our research prowess (these are fun pride points for you to share with your friends and family about your alma mater). The College of Letters & Science plays a critical role in propelling UW-Madison to #8 in the national research rankings for public and private universities. In the 2021 *U.S. News & World Report* ranking of "best graduate schools," UW-Madison's programs were named among the best nationwide — and we are #5 among U.S. universities in granting doctorate degrees.

We know we need state-of-the-art facilities to attract top faculty and spark cutting-edge research. While significant needs remain across the college, we are thrilled with our new Chemistry Tower (which opened in January), and we're entering the design phase for Irving and Dorothy Levy Hall (which will replace our aging humanities building) and for our new School of Computer, Data & Information Sciences.

Every year, our faculty and graduate students are recognized with top research fellowships and high honors for lifetime achievement in their fields. They are members of the world's largest scholarly societies, including the American Association for the Advancement of Science and the American Academy of Arts and Sciences. Our faculty (and our alumni, too!) form companies (more than 400 startups have spun out of UW-Madison research projects) and work on international teams such as the IceCube Collaboration, a group of 300 physicists from 53 institutions in 12 countries who are opening new windows for exploring our universe through the detection of neutrinos in the ice of Antarctica.

Research happens in every discipline across L&S. In this issue of the magazine, you'll read about fascinating, interconnected work on fungi (the "webs of life"), research into cognitive processes that may lead to help for depression, and humanities research that explores the electronic frontiers of music. You'll also hear from our political science experts, whose research into the practice of democracy illuminates our understanding and appreciation of this fragile system.

I'm proud to be part of an "R1" institution that's regarded as one of the preeminent research powerhouses in the world. I hope you are, too. Thank you, as always, for all you do to keep our research engine humming. The world desperately needs breakthroughs that will propel us into a better future. We are working on it.

Eric M. Wilcots
Dean and Mary C. Jacoby Professor of Astronomy, College of Letters & Science

1

PHOTO: WINNIE KARANJA

Women in STEM

Bold, beautiful illustrations of female figures who made history in STEM fields animate a 56-card series created by Winnie Karanja's Represented Collective, a Madison media organization dedicated to showcasing the contributions by women and BIPoC to the science, technology, engineering and mathematics fields. The project is one outcome of a partnership with UW-Madison called Humanities Education for Anti-racism Literacy (HEAL) in the Sciences and Medicine, funded through the Andrew W. Mellon Foundation's Just Futures Initiative.

Karanja, a fierce advocate for fueling young girls' interest in science and technology, says the cards are intended to inspire the next generation. "They are also a way to pay tribute to those women whose work is fundamental to the technologies we now use every day," she says.

BIPOC artists, including UW-Madison alum Jessalyn Mailoa (Art/Psychology '21), were commissioned to create the cards, and a UW humanities PhD student, Sarah Gamalinda, researched the backgrounds of the women featured, in her role as Public Humanities Fellow with Represented Collective. An exhibit featuring enlarged prints ran from March through early April at Dane County Public Library locations.

2

Top Diplomat

Linda Thomas-Greenfield, U.S. Ambassador to the United Nations and a scholar of Africa who earned a master's degree in political science here, will speak at UW-Madison's spring commencement this year. Thomas-Greenfield credits her experience at UW-Madison with solidifying her desire to be a diplomat and the launch of her esteemed 35-year career in the United States Foreign Service. She has been much lauded for her humanitarian work — when the Ebola outbreak erupted, Ambassador Thomas-Greenfield led an international response that effectively slowed and stopped the pandemic.

PHOTO: MARK MAKELA / STRINGER

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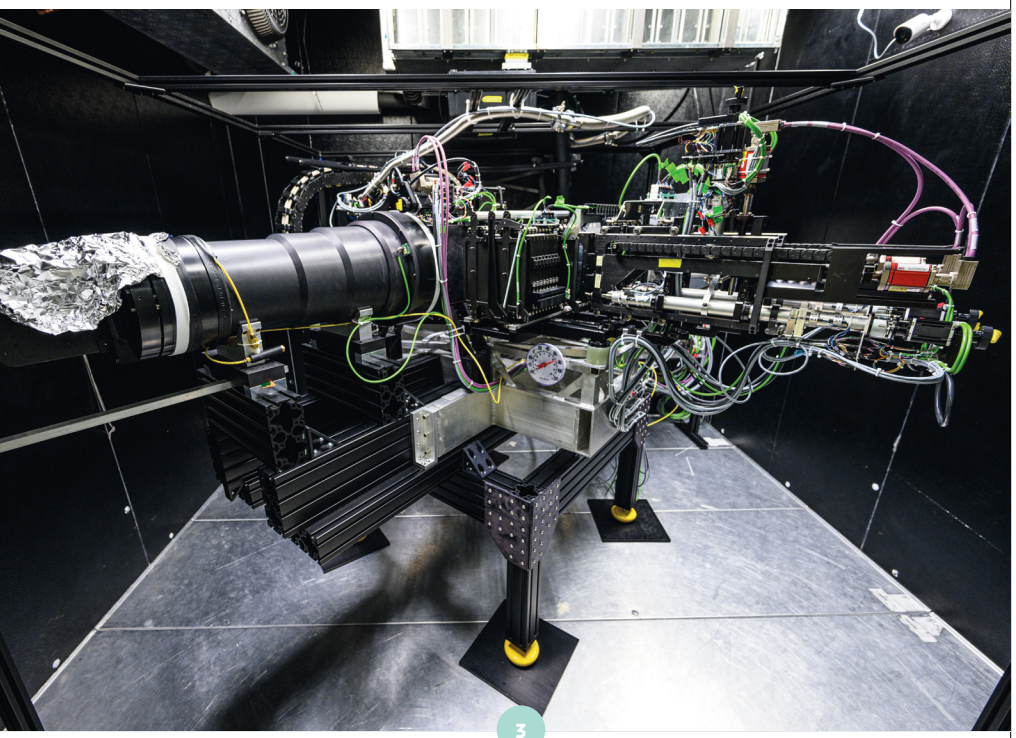


PHOTO: JEFF MILLER

3

Picturing the Universe

Staff in UW–Madison's Washburn Astronomical Laboratories custom-built a near-infrared spectrograph to ship to and install at the Southern African Large Telescope (SALT), where astronomers will use it to learn more about galaxies and the types of stars they contain. A spectrograph, says senior scientist Marsha Wolf, is essentially "a big digital camera" with an extra optical component called a diffraction grating that splits light into colors. A blue color tells us that a galaxy contains populations of young stars, while a red color indicates that it contains older stars that are passively aging. SALT is the largest single optical telescope in the southern hemisphere and among the largest telescopes in the world. It is funded by the South African government and a consortium of institutions worldwide, including UW–Madison.

4

Living History

This year marks the 50th anniversary of the American Indian Studies program at UW–Madison, founded as a result of student activism in 1972. As part of a yearlong celebration, faculty, staff and students affiliated with the program are collaborating on an oral history project that will greatly enhance UW's collection of Native voices and perspectives.

In February, undergraduates Yelih Rodriguez (Oneida) and Willow Lovecky (Taos Pueblo) interviewed their first subject, Ada Deer (Menominee), who graduated from UW–Madison in 1957 with a bachelor's degree in social work. They were joined by History PhD student Zada Ballew (Pokagon Potawatomi), whose historical research had just confirmed that Deer was the first Native American to receive an undergraduate degree from UW–Madison.

"She'd known she was the first Menominee but didn't know she was the first Native American undergraduate," says AIS-affiliated professor Kasey Keeler, one of the project leaders. "To hear those young women laughing and talking with this elder was so rewarding."

Oral histories will be shared throughout the year, including at a fall event welcoming those with ties to American Indian Studies back to campus for a joyful reunion.

Have memories of AIS to share? Contact aisoralhistoryproject@letsci.wisc.edu.

5

066

Number of total unique students served through engagement with the SuccessWorks career services program, in 2020–21

PHOTO: PAULIUS MUSTEIKIS

How does life begin?

PhD student Lena Vincent pursues the biggest question in her research on the chemical origins of life.

BY KELLY APRIL TYRRELL

Astrobiology. It's a word full of so much potential.

"Immediately, to me, it evokes the potential for life beyond Earth," says Lena Vincent, a graduate student at the Wisconsin Institute for Discovery, whose research in the lab of botany professor David Baum focuses on the chemical origins of life.

Vincent stumbled upon astrobiology (which has ties to University of Wisconsin–Madison 1958 Nobel Laureate, Joshua Lederberg) by accident years ago while contemplating the future of her research career at a time when she was spending her days peering through a microscope at cancer cells and observing the patients in and out of the cancer center where she worked.

She recalls being kept up at night by questions like, What is cancer? Why is life like this?

Vincent happened upon the website for the NASA Astrobiology Institute and realized scientists in the field were being funded to ask the biggest questions of all, including, Under what conditions does life begin?

Today, she is on the forefront of the young field of astrobiology. In 2019, Vincent led a study that has become an essential guide for other researchers trying to understand how, from a complex mix of chemicals, life could emerge anywhere that basic building blocks exist. The model is called chemical ecosystem selection.

"One of the driving questions is how life started on Earth," Vincent explains. "That's really what has been the focus of my research."

The idea is that the right basic ingredients mixed together under the right conditions (perhaps like those found in an ancient hydrothermal vent) can form a "prebiotic soup," from which a cascade of interactions between ingredients could ultimately set the stage for life.

Within the soup are chemicals — like amino acids, nucleic acid precursors, sources of phosphate and more — bound to the surfaces of minerals, tumbling around one another, not unlike grains of sand at the bottom of an ancient sea floor. The chemical mixtures are subjected in the lab to changing conditions.

The researchers look for interactions that sustain themselves without additional inputs and, among these, processes that also adapt, evolve and survive. In the lab, they create mixtures of solutions that are then diluted into others, searching for interactions that keep persisting, despite conditions that might otherwise burn them out.

"This very grandiose, big-picture science is actually very simple," Vincent says.

The next step, which the lab is working on now, is to figure out the most essential ingredients. How will they know they have found what they're searching for? No one really knows, exactly.

"The only thing we can do is set the standards for what we think will meet the threshold of what is life-like," she explains. "In terms of understanding fundamentally what is life, what is essential for life, we have no idea because a lot of what happened at the origin of life has been overwritten by evolution."

Asking these questions, Vincent says, may be a fundamental part of being human.

"I think it really is this existential need that everyone seems to have in some way, to varying degrees, to understand what we are and where we came from." ■

FACULTY

Musical Playground

Mead Witter School of Music professor Dan Grabois explodes musical boundaries with EARS.

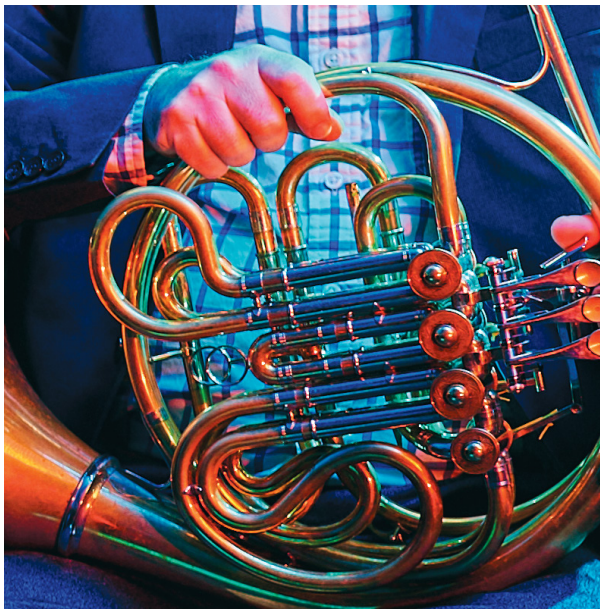
BY AARON R. CONKLIN

Dan Grabois slides a mute into the mouth of his French horn, cradles it, then blows a sound.

What comes out is a note that sounds like it was played on a guitar.

Grabois, a professor of horn in the Mead Witter School of Music, is sitting in the Electro-Acoustic Research Space (EARS), a studio tucked away on the second floor of the Humanities building. Grabois created the space five years ago, using an innovation grant from the Wisconsin Alumni Research Foundation (WARF) UW2020 Initiative, a funding program designed to "support faculty research that transforms the field."

In this case, the research is equipment-based, and it is continuing to transform the possibilities of sound and music. Grabois has filtered the sound he created on the horn through a digital audio software platform called Ableton Live. That software allows Grabois and his music students to record and alter sounds in thousands of ways and then mix and multitrack them into something entirely new. The cutting-edge electronic equipment is meant to dare a new generation to exploit music's limitless potential — to invent, experiment and explore new ways of making sound and art.



PHOTOS: PAULIUS MUSTEIKIS

With funding from WARF, Grabois turned an unused classroom in the Humanities building into a "musical playground" for students.

The EARS space doubles as both a museum of electronic musical equipment and a paradise for forward-thinking music students. Among the pieces of technology staking out space in the smallish room is a 1970s-era Motorola Scalatron, one of only 17 of the microtonal keyboards ever made. There's an old-school Moog synthesizer, a theremin and a vocoder (shades of Peter Frampton!). On the modern side, there's an impressive array of guitar pedals and a continuum fingerboard, a polyphonic synthesizer with a squishy-soft keyboard that creates many of the sounds Grabois incorporates into the music he and his students compose.

"It's a playground for people to open up their imaginations and start creating stuff," says Grabois of the space and its equipment.

Grabois first encountered electro-acoustic music as chair of contemporary performance of the Manhattan School of Music in 2007, when he hired a colleague to begin teaching it to his students. He also plays in the New York-based Meridian Arts Ensemble, a brass quintet that tackles multiple genres, including plenty of rock 'n' roll.

"Rock 'n' roll is largely about dirty, gritty, down-to-earth music," says Grabois. "And the French horn is largely about choirs of angels singing up above us. I realized that I could use electronic effects to change the sound of the horn."

Grabois recognized an opportunity to stretch his students' conception of what constitutes "music." Before applying for the grant, he called around the country, talking to friends and experts about what should go into a cutting-edge electro-acoustic music lab. Full Compass, a Madison company, was able to supply much of the software and equipment.

"We should really be exploring the edge of contemporary music."

DAN GRABOIS

"I founded EARS with no trajectory in mind, and I did that purposefully," says Grabois. "It had an undirected mission, and that's been great. Students come and borrow equipment because they need a MIDI keyboard for a piece they're playing or they need a particular distortion sound."

WARF grants are most often associated with scientific research, making the grant Grabois sought all the more interesting. EARS brings UW-Madison into the company of other major universities that offer training in electro-acoustic music.

"We should really be exploring the edge of contemporary music," says Grabois.

Over its five-year lifespan, EARS has attracted music students who spent time DJ'ing in high school and messed around with composing electronica. They are already familiar with Ableton Live and ready to push the equipment in directions Grabois hadn't even considered. Throughout the pandemic, EARS has been a refuge for students looking to create multi-track compositions, either in groups or on their own.

"They can't believe that this resource is here," he says.

Grabois is also using EARS to realize his own musical vision. He's almost halfway through a cycle of four recordings, the first of which, *Air Names*, uses the EARS equipment to feature his horn work in songs with a Middle Eastern vibe, as well as rock-influenced tunes. The second disc, *Fire Names*, releases soon, and Grabois plans to record the third this summer, featuring contemporary music for horn and piano.

"I feel like I have not begun to even scratch the surface of what can be created in the space as it stands now," says Grabois. ■

TEACHING

Profile Pic

Catalina Toma and her students take a deep dive into the dynamics of online relationships and the role of computer-mediated communication in our lives.

INTERVIEW BY
MARY ELLEN GABRIEL

When I started studying communications technologies in graduate school, they were quite a novelty. My advisor and I did some of the first research on online dating. It's now the number-one modality by which couples meet! The landscape has shifted profoundly in the last couple decades, which has posed challenges for keeping my courses fresh. But I am also very fortunate because there is intrinsic interest and natural attraction to this material. Undergraduates are some of the earliest adopters of these technologies, and they come to me with ideas and thoughts that often result in research topics.

In addition to large lecture courses, I teach an upper-level undergraduate seminar called Dynamics of Online Relationships. My students and I examine how people use texting, social networking sites and online dating to initiate, manage and terminate relationships. For instance, we've discussed the use of communications technology within co-located dating [people who see each other all the time], as well as how couples present themselves on Facebook [single, in a relationship, etc.] and whether that affects the longevity of their relationships. It turns out that the answer is "yes."

We also delve into people's beliefs and perceptions about these technologies. We talk about the history of media and how, whenever a new media emerges, we attribute a lot of power to that media. We think it will change society, for better or for worse! But often our views are overly simplistic. I want my students to think like social scientists. What is fact? What is opinion? What is good evidence? What kind of claims can we make, based on the scholarship, and what kind of claims do we need more evidence for?

Self-presentation and deception are topics that resonate with students, and this is a primary research area for me as well. We talk about how people construct various versions of themselves through profiles on social networking or dating sites, and whether these profiles are accurate. People are really terrible lie-detectors. Our ability to detect deception is around 54 percent, which is not much more accurate than flipping a coin. Students love these topics!

I'm trying to instill media literacy in the realm of interpersonal relationships. In my courses, students are developing an understanding of how the media impacts our ability to fulfill our relational needs and manage our psychological needs. Students move from a simplistic grasp to a more complex understanding: What are the relevant features of media in any given encounter? How are individuals affected differently? As they acquire a more complex understanding of the technology and the psychology, they can recognize those dynamics in the encounters we have in daily life.

Technology changes all the time. My students from 2022 are grappling with issues and platforms that didn't exist in 2010. What is enduring is a way of thinking about these technologies that can be applied to the future. ■

PHOTO: PAULIUS MUSTEIKIS

ILLUSTRATION: POLINA SHUVAEVA / GETTY

Ketamine blocks a chemical connection between brain cells along neural pathways — which could help prevent the brain from making unnecessarily dire predictions.

RESEARCH

Positive Predictions

An anesthetic drug called ketamine shows promise as a treatment for depression.

BY CHRIS BARNCARD

Rather than constantly repainting a new canvas with a picture of the surrounding world each time it takes in information, the human brain appears to build a working model supported by predictions constantly checked and rechecked against the sights and sounds it already expects.

Researchers in the lab of UW–Madison psychology and neuroscience professor Yuri Saalmann demonstrated the top-down nature of this world view by disrupting it with tiny doses of an anesthetic drug called ketamine. Their study, published recently in the *Journal of Neuroscience*, reveals the importance of a specific type of connection between brain cells and may also explain ketamine's promise as a treatment for depression.

Much like the sound of a bark would make the listener expect to see a dog, the scientists taught volunteers to associate each series of three-syllable nonsense words with a picture from an assortment of three unique animal-like shapes called greebles. But the researchers skewed the predictive qualities of the sounds by making a greeble follow its matched sound 85 percent of the time, 50 percent of the time or 33 percent of the time.

"The stronger our listeners understood a sound was predictive of a certain shape, the quicker they could tell us if the shape we showed them matched the sound they'd just heard," Saalmann says.

That's because the most predictive sounds caused a flash of recognition in the form of a spike of activity in the higher-order regions in the front of the brain, followed by a signal — a kind of internal heads-up — sent down connected brain cells to the parts of the brain that directly take in sensory information.

That is, until the study subjects received a small dose of ketamine.

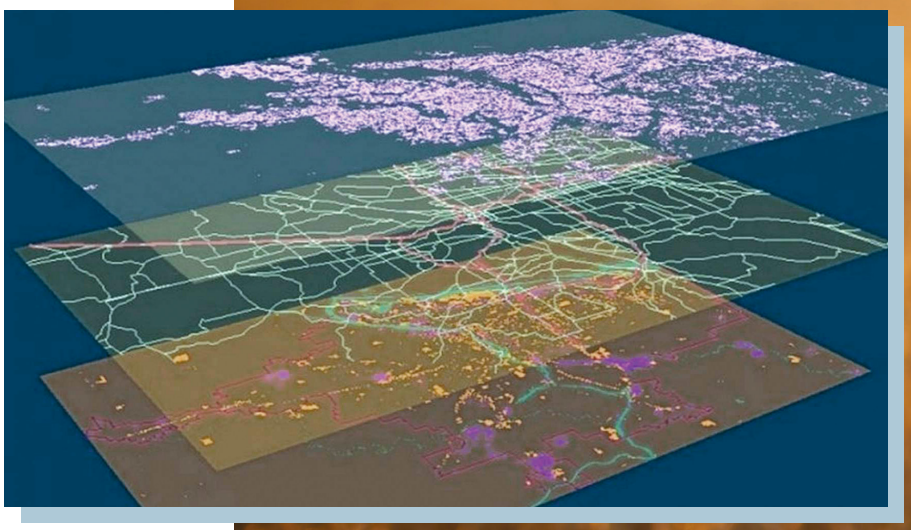
"The drug blocked that whole set of processes," says graduate student Sounak Mohanta, "and slowed the subjects' reactions until they were all relatively equal."

Ketamine interfered with a specific communications channel by blocking NDMA receptors, a type of chemical connection between brain cells common on the neurons along the important pathways from the frontal lobe to sensory centers.

"The priming signal is lost. The brain no longer benefits from the top-down predictions, and errors happen," says Saalmann.

This could actually benefit people with disorders, including depression and schizophrenia, in which the brain makes unnecessarily dire predictions. By interrupting that process, ketamine could keep people from anticipating the worst or hallucinating things that aren't there. Already, ketamine has been shown to relieve depression-like symptoms in animal and human studies, and is being used for clinical studies of depression.

"Blocking the negative predictions that are prominent in depressed patients could be how ketamine helps," Saalmann says. ■



CAREERS

Badger Network

For a Madison firm mapping the future of broadband access in rural places, L&S students and alumni are key to success.

BY JENNY PRICE '96

When people ask Alex Nelson '18 to explain his job, he offers a simple description of complex work: geographical problem-solver.

With degrees in cartography and geographic information systems (GIS), Nelson is part of the expanding team at Madison-based Millennium Geospatial, which has hired a number of alumni and student interns from the College of Letters & Science since opening its doors three years ago.

Nelson is part of the company's efforts to develop GIS maps for utilities seeking to expand broadband coverage to rural areas in Wisconsin. More than 400,000 people in the state don't have any access to high-speed internet.

"We're providing them with internet, probably for the first time, and they've been waiting years to get it," Nelson says. "So it feels cool to be a part of a team that's helping out."

The problem won more attention and attracted millions of dollars in federal funding after the COVID-19 pandemic had adults and kids trying to work and learn from home with spotty or no internet access.

"They're working on real live problems and real live communities," says Kevin Maes, Millennium's vice president of engineering. "We're building networks. We're literally making connections, and people are getting broadband based on the plans that we're making."

In many cases, utilities don't have the information they need to expand broadband service in rural areas — a regular map doesn't tell a complete enough story. With GIS tools, his firm can make a map with multiple layers, linked to

PHOTO: ARTIE MEDVEDEV / GETTY

UW-Madison students and recent graduates are using their GIS skills to ensure better access to broadband in rural areas.

spreadsheets and tables loaded with data that can guide decision-making. "We're trying to find more efficient ways to build," Maes says. "How do you stretch your dollar to get more broadband out to rural residents?"

Maes founded Millennium after a 20-year career in the telecommunications industry because he couldn't find a firm to make the kinds of maps he needed to do his work. The idea took shape several years ago during a GIS software conference, where he heard a Starbucks executive explain how the company used the technology in California to predict unseasonably hot weather, plan marketing campaigns promoting iced coffee and other cold drinks, and secure supply chains to meet demand.

"That's when I started to realize you can combine different things that aren't even related at all and use them for your strategy," Maes says.

By making its home in Madison, Millennium has access to a pool of talent it can train to support its mission. The firm has a team of 30, including interns, and half are UW graduates.

"There's a reason I'm here," Maes says. "The university is amazing. The people that we've gotten from UW are amazing."

When the pandemic put her Peace Corps deployment on hold after she graduated with degrees in Spanish and environmental science with an emphasis in GIS, Lily Zander '21 spotted an internship listing with Millennium on the UW Job Board. She was motivated to apply because of the firm's focus on community economic development and its work expanding broadband to rural areas. "That's exactly what my position would have been with Peace Corps," Zander says.

Zander hopes to use her GIS skills to eventually launch an agricultural technology startup. "It's a really great tool for analyzing that data and presenting it in a way that we might not have been able to, and for presenting solutions to problems that before we weren't able to see," she says.

Interns at Millennium work alongside employees and have the opportunity to help with or take on their own projects. "It doesn't take very long for an intern — they can be here three months and they can train the next intern," Maes says.

At UW-Madison, cartography and GIS majors take courses including graphic design, web mapping to big data analytics and mobile application development, with lab work that uses industry-standard cartography and GIS technology. But Maes said the company also got a huge early boost from students in other majors — including biology, geology and physics — who bring different and important perspectives beyond a traditional approach.

"It's the willingness to try to dig through something to figure out a solution for it," Maes says. "You've got to have that initial thing — and that's really what we look for." ■

STUDENTS

Ready for Takeoff

The College of Letters & Science's STEM Runway program helps students from underrepresented groups find their science path and thrive.

BY AARON R. CONKLIN

PHOTOS: PAULIUS MUSTEIKIS

José Madera has no problem embracing the "runway" metaphor.

Madera, an assistant dean in the College of Letters & Science's Center for Academic Excellence (CAE), is talking about the College's new STEM Runway program, a nascent network of research- and career-based opportunities designed to encourage first- and second-year students in traditionally underrepresented groups to pursue majors in science, technology, engineering and mathematics.

"I think of it as students starting one place and then going somewhere else," Madera says. "It's like being at one of those historic airport lounges with the exciting wall of flights to far-flung places. We're trying to let the students decide which gate they want to go through. But we're here to facilitate it."

That facilitation means introducing some new programming, as well as making sure current and prospective students know about the support and programs already in place, to spark and nurture interest in STEM.

One example of new programming: Last year, three rising L&S sophomores spent their summer participating in on-campus and remote research opportunities in oncology, astronomy and psychology, supported by funding from Letters & Science alumni David Hammond (BA, History/Poli Sci, '93) and Jennifer Hammond (BA, Journalism, '93) through Dean Wilcots' new Diversity, Equity and Inclusion Fund. Sherry Wong, Nasya Miller and Pamela Elubiaozor were paid to work 25–30 hours a week on summer research projects with faculty, exploring issues like ethics in research and how to properly use a research database.

"Sparking the interest of these talented students at the earliest possible moment is one of the best ways we can address diversity in STEM fields," says Dean Eric Wilcots. "And that's one of our top priorities."

The summer research program (known officially as Letters & Science Summer of Excellence in Research, or LASER) builds on the framework established by the Undergraduate Research Scholars (URS) program, which has been pairing freshmen in L&S with faculty and research projects for more than two decades.

URS Director Hannah Bailey was instrumental in finding and arranging summer opportunities for the initial LASER scholars, each of whom had already participated in URS. The new summer opportunity, says Madera, took them to the next level.

"For us, LASER is the right model because students are basically putting into practice what they have already learned in the classroom and through the URS experience," explains Madera. "It's important for students to have these very early experiences where they can see themselves as being in charge of something they can create or discover and push their own limits."

That has been the case for Wong, a computer sciences major from New York who was paired with Professor of Astronomy and Physics Ellen Zweibel. Wong used her coding skills and interest in astrophysics to create computerized simulations of galaxies that revealed what happens when magnetic fields collide and release bubbles of gas. Wong plans to present her findings at the American Astronomical Society in California later this year—a rare and exciting opportunity for an undergraduate.

"Succeeding in college is really dependent on that mentorship," says Wong. "Mentorship helped me navigate my long-term academic plans. The advice you get from mentorship like this is something I rarely see in class."

While Wong was studying the stars, Miller, an L&S student from Milwaukee, was embedded in an oncology lab, testing therapies on prostate cancer cells and learning the procedures and protocols of medical research.

"I was really challenged as a free thinker, to make my own decisions in different situations, and problem solving was very important," says Miller, who's found parallels between her lab experience and the classes she's taking in chemistry and math. "I didn't have those skills before LASER."

Continuing to riff on the airport metaphor, Madera talks about the wheels that already exist in L&S to carry students down the STEM Runway. In addition to the URS program, there's the Summer Collegiate Experience that prepares incoming freshmen from underrepresented groups for college life, including introducing them to careers in STEM-related fields. There's SuccessWorks, the state-of-the-art career center in L&S that focuses on identifying interests, networking with alumni, and exploring various fields. There's the McNair Scholars Program, which helps promising L&S seniors from underrepresented groups prepare for graduate school.

"Letters & Science is all about liberal arts education and exploring," says Madera. "It's about testing your limits and experiencing opportunities. And then you come back and say, 'Oh, this is where I want to go.' STEM Runway basically gets students connected and moving along the path of opportunities from the moment they set foot here on campus." ■

"I was really challenged as a free thinker, to make my own decisions in different situations, and problem solving was very important. I didn't have those skills before LASER."

NASYA MILLER

"Mentorship helped me navigate my long-term academic plans. The advice you get from mentorship like this is something I rarely see in class."

SHERRY WONG

CULTURE

Listen to the Music

Black artists are in conversation across genres in the struggle for progress.

BY MARY ELLEN GABRIEL

ILLUSTRATION: IRENE RINALDI

Think back to the music you listened to in your teens. Maybe your parents didn't like it. Perhaps they called it "noise." But to you it was love — power — the future.

Sometimes it's a generational thing — parents just don't understand. But sometimes new musical genres, just like new literature, can represent a threat to the power structure. Yanie Fecu, a professor of English who specializes in comparative race and ethnicity studies, says that the dimension of language and the classification of sound offer fertile ground for creating and cementing a racial hierarchy.

"Music is a form of organized sound," says Fecu. "But the real difference between music and noise is determined by the people who have power."

While Black culture may have birthed the most popular musical genres in America — from ragtime to reggae, from jazz to blues, from rock 'n' roll to hip-hop — each genre emerged to initial suspicion and derision from mainstream (read: white) culture.

In her popular course Empire of the Senses, Fecu asks students to focus on their hearing (among other senses) to investigate representations of racialized experience in global Black literature and music.

"I think it's vital that we help students understand that racism is not something that is only perpetuated through the visual register," she says. "The way we spread racial ideas is by also perpetuating ideas about how people sound, how they smell, how they speak, the words they use."

The class focuses on a mix of literature, music and film. For example, students deconstruct a song by Rihanna (a Black artist from Barbados). The lyrics of her 2016 song "Work" draw on Jamaican patois.

"Whether or not music critics liked the song, the reviews tended to refer to Rihanna's use of 'nonsense' and 'gibberish,'" says Fecu. "But part of what Rihanna's doing is making some listeners aware that they are not the only listeners. Their language, their interest is not her priority in this song. She is prioritizing a Caribbean audience."

As artists become more famous, Fecu points out, they are sometimes seen as somehow "less Black." The comedy show *Saturday Night Live* skewered this trope in a skit called "The Day Beyoncé Turned Black." When white audiences feel that the music is speaking to them in some way, Fecu says, it "somehow de-racializes the musician."

Students analyze short stories, novels and poetry alongside song lyrics, music videos, and documentaries by American and Caribbean artists. The seminar is intended to help students engage critically with ideas that present Black diasporic culture as rich and varied and always changing.

"'Black people are not a monolith' is something a lot of well-meaning white people will say, but they don't necessarily know what that means," says Fecu. "Taking a course like this exposes what that means. You see these artists — Caribbean, Afro Latina, African American — having these conversations amongst themselves: What will best allow our people to progress?" ■

News&Notes

PHOTO: STEVEN VERBURG / WISCONSIN STATE JOURNAL

Limnologist Hilary Dugan

Hold the Salt, Please

Hilary Dugan, an assistant professor in the Center for Limnology, headed a team that examined the amount of salt being carried into Lake Michigan from its 234 tributaries. Their research revealed that these rivers and streams contribute slightly more than 1 million metric tons of chloride into the lake each year, setting the lake's salinity level at 15 milligrams per liter — a significant increase over the last decade. While those levels are not likely to jeopardize the Great Lake's status as one of the world's largest freshwater lakes, they could eventually have a negative impact on the habitat of the wildlife that currently thrive there.

"If we pay attention to salt pollution, this is a problem we can fix," says Dugan, who investigates alternatives to spreading road salt in winter.

A Scorching Literary Debut

Dantiel W. Moniz, an assistant professor in the Department of English's Creative Writing program, was a finalist for a 2022 PEN America/Jean Stein Book Award — referred to by some in the publishing industry as "the Oscars of books" — for *Milk Blood Heat*, a disparate collection of short stories about Floridians facing, as the book's publisher puts it, "moments of violent personal reckoning."

For Science!

Seven of the thirteen UW–Madison faculty members elected to the American Association for the Advancement of Science (AAAS) hail from the College of Letters & Science, including Dean Eric Wilcots, the Mary C. Jacoby Professor of Astronomy. Members are recognized for their efforts to advance science and society.

Other AAAS inductees include Stephen Carpenter (emeritus, Integrative Biology/Limnology), Mark Hill (emeritus, Computer Sciences), Somesh Jha (Computer Sciences), Jignesh Patel (Computer Sciences), Jennifer Schomaker (Chemistry) and Monica Turner (Integrative Biology).

Ditch the Delayism

In late February, the White House convened a roundtable of experts that included Professor of Geoscience Andrea Dutton to discuss countering "delayism" and communicating the urgency of climate action. Dutton, a recognized international expert on sea-level rise, provided evidence of the risks involved in continuing to do nothing given what experts know about the predicted impact of climate change over the next 3–5 decades.

HONOR ROLL

Ruth Litovsky, the Oros Family Chair in Communication Sciences and Disorders and an audiologist who directs the Binaural Hearing and Speech Lab at the Waisman Center, became the first woman to be awarded a Silver Medal in Psychological and Physiological Research by the Acoustical Society of America.

Emily J. Blanchard (PhD, Economics '04) was recently named chief economist for President Joe Biden's Department of State.

Professor **Michael Morgan** (Atmospheric and Oceanic Studies) was nominated by President Biden to serve as Assistant Secretary for Environmental Observation and Prediction, Department of Commerce.


A MYSTERIOUS KINGDO

From mushrooms to mildews, fungi form the webs of life. UW experts are working to expand our knowledge of their roles and powers.

BY MARY ELLEN GABRIEL

Fungi are having a moment. The 2021 Netflix documentary "Fantastic Fungi" explores how fungi "literally hold our ecosystems together." Studies of mushroom-based hallucinogens to treat post-traumatic stress disorder (PTSD) are underway across the globe. From books about trees "talking" to one another via their fungal relationships to a proliferation of Facebook groups for wild foragers — not to mention the mushroom motifs popping up on shower curtains, clothing and pillows — it's hard to miss the giant wave of interest and enthusiasm for organisms that, traditionally, have been more ignored or feared than revered.

Scientists who study fungi in the Department of Botany scratch their heads over this trend. They'd like to think it's at least partly a reflection of how discoveries in the field of mycology ("fungus science") have highlighted the awesome interconnectivity of fungi within the diversity of life on Earth. But what they'll also tell you is that we don't know that much about fungi.

"Fungi are really the black box," says Anne Pringle, who is the Mary Herman Rubinstein Professor of Botany and studies the ecology and evolution of fungi. "If you want to study a group of organisms that people do not understand very well, you turn to fungi."

PHOTO: EWA SAKS / GETTY

Mushrooms, as any forager can attest, are mysterious enough — what makes them pop up when they do? — but at least these macro-fungi are a little easier to spot than the micro-fungi, which include yeasts, rusts, mildews, spores and smuts. Growing inside substrates (even in the built environment), living inside us (or other animals), creeping along underground, fungi present little outward morphology that humans can easily interpret and understand. Nevertheless, they are hugely important and absolutely everywhere.

"You interact with them all the time," says Pringle. "You may not know it, but if you use laundry detergent, the enzymes in that are derived from fungi. If you drink pop or beer, or eat bread, you are interacting with fungi."

For Pringle and her students and colleagues, fungi present endlessly fascinating angles to study. The organisms — neither plant nor animal nor bacteria — occupy their own kingdom and play three key roles on Planet Earth: pathogens (commonly thought of as "bad" fungi, because they often kill their hosts), mutualists (living in association with plants, giving and receiving from them), and decomposers (occupying what Pringle calls "the least appreciated role"). All three types are studied here and not just within L&S. Our botany researchers collaborate with colleagues across campus, as well as with other institutions and groups across the nation and the world.

> **"You interact with them all the time. You may not know it, but if you use laundry detergent, the enzymes in that are derived from fungi. If you drink pop or beer, or eat bread, you are interacting with fungi."**
>
> ANNE PRINGLE

Here at UW, the Fungal Supergroup — a consortium of labs — meets monthly to talk about what's happening in their areas. Along with Pringle and her Botany colleagues, those in attendance might include researchers from the School of Pharmacy's new Transdisciplinary Center for Research in Psychoactive Substances, studying mushrooms' active ingredient, psilocybin, in clinical trials to treat PTSD and depression. They might include medical mycologists from the School of Medicine and Public Health, who are working on treatments for fungal diseases in humans, as well as plant pathologists from the College of Agriculture and Life Sciences who are studying the impact of fungi on crops.

"There are few places on the globe with the collection of expertise with fungi that we have here at UW-Madison," says Pringle.

Sharing fungal research can be a race against the clock to track a pathogen's impact on human or animal populations. For Savannah Gentry, a graduate student in the Pringle Lab who studies fungal disease in snakes, collaboration has helped her understand more about the particular fungus she studies. There's an urgency to her work: Snake populations have been declining worldwide, and they are important as both predators and prey in the ecosystem. Gentry is authoring a paper with Jeff Lorch, a microbiologist at the U.S. Geological Survey National Wildlife Health Center in Madison, on the ability of snake fungal disease to "jump" to other species of reptiles and worked with the UW-Madison School of Veterinary Medicine to set up her experiments (which showed, concerningly, that yes, there can be "spillover" into other animal populations).

Gentry, who also gives talks to herpetology societies in the upper Midwest, says it's invaluable for graduate students to have a range of conversations and outside perspectives.

Denny Wang studies the Amanita mushrooms invading California.

Savannah Gentry studies fungal disease in snakes.

PHOTOS PROVIDED BY SAVANNAH GENTRY AND DENNY WANG

Fly agaric mushrooms attract (and kill) flies, and can cause hallucinations and psychotic reactions in humans.

PHOTO: TOMEKD76 / GETTY

"When you're talking with the community, you get wonderful, fundamental questions that maybe you haven't thought about in a while," she says. "I really value the whole framework of the Wisconsin Idea — the intersectionality that bridges communities in the name of science."

In 2018, Professor Pringle was named a National Geographic Explorer and became part of a group of groundbreaking scientists, conservationists, educators and storytellers supported in their work to "illuminate and protect the wonder of the world." In this role, Pringle is working with Colombian collaborators to share the results of research with community partners in Bogotá, Colombia, where a "sustainable city" initiative that includes massive tree-planting is underway. Pringle is investigating whether newly planted trees need something called mycorrhizal biofertilizer in order to thrive. It's a question that the landscaping and agricultural community often ignores, as practitioners get swept up in the "craze" for beneficial fungi.

"What people are doing is buying products from a garden store or agricultural company with no idea what's in that package, saying, well, if fungi are doing all these amazing things in the environment, they must be able to do things for me, too," she says.

"When you're talking with the community, you get wonderful, fundamental questions that maybe you haven't thought about in a while. I really value the whole framework of the Wisconsin Idea — the intersectionality that bridges communities in the name of science."

SAVANNAH GENTRY

In Bogotá, Pringle and her colleagues are challenging assumptions and applying what they already know to find the best solutions. "We're asking, is this like sprinkling salt into the ocean — there's already enough mycorrhizae in soil and you don't need more? Or, if trees do need this to thrive, can we use local fungi, instead of buying commercial products with potentially invasive fungi?" she says.

When humans decide to love something, we often love it blindly and a little too much, without considering its role in the ecosystem. Such is the case with the edible golden oyster mushroom, non-native to Wisconsin but cultivated throughout the state. It's escaped farms and taken over parks and woodlands. Pringle studies two problems created by the invasion: displacement (other species are getting pushed out) and disruption (the golden oyster may be disturbing carbon cycles in ways we don't quite

understand) and is collaborating with the Northern Research Station of the Forest Service here in Madison.

"It is such a pleasure to work with the Forest Service folks," says Pringle. "They have a completely different perspective on forests and ecosystem dynamics."

Another genus of mushroom is invading California. Often called toadstools, Amanita mushrooms can be stunning and sometimes quite toxic. Yen-Wen Wang (who goes by "Denny"), a graduate student in the Pringle Lab, studies two species of Amanita mushrooms: death caps and fly agarics. A single death cap mushroom can kill a person. Fly agarics, on the other hand, are hallucinogenic (they're also cute and red, and featured everywhere in popular culture, from pillows to stationery to the Super Mario games).

Wang, who studies population genetics in fungi, says he was drawn to UW-Madison because of the rich history of scholarship in these areas. He points to UW geneticists James Crow and Sewall Wright, as well as Kenneth Raper, a microbiologist and mycologist who pioneered the study of a cellular slime mold, as key figures who laid important groundwork.

"There is no doubt that the success of these biologists established the status of UW-Madison in these areas, and this continues to attract more students and faculty to work here," he says.

UW has been documenting fungal and lichen biodiversity all the way back to the mid-1800s, and nowhere is this more evident than at the Wisconsin State Herbarium, housed on the lowest level of Birge Hall. The herbarium is the repository of one of the largest lichen collections in the western hemisphere (lichens are a symbiosis of fungi and algae), according to director and botany professor Ken Cameron (who is also a world-renowned expert on orchids).

"If you want to epitomize the fragility of the web of life, you just have to look at the orchid. It needs a certain insect to pollinate it, a fungus to feed it, the fungus itself needs a healthy clean ecosystem—you break one link and this whole thing collapses."

KEN CAMERON

Coral root orchids, native to Wisconsin, can't make chlorophyll and rely on a complex relationship with fungi to survive.

PHOTOS: (TOP) NNEHRING / GETTY; (BOTTOM) JYOTSNA SHARMA / U.S. FOREST SERVICE

"Lichens are often thought to be a 'canary in the coal mine' when it comes to detecting air pollution and climate change," says Cameron. "Our collections are getting a lot of attention, and we loan them out to institutions and scientists around the world."

The herbarium also has the second-largest collection of micro-fungi in the world. In 2016, staff discovered something unexpected: examples of fungi collected by George Washington Carver.

The prominent botanist, who had been born a slave and rose to lead the agricultural department at Alabama's Tuskegee Institute for 47 years, collected specimens of fungi that infect plants, and he shared at least 59 of them with the botany department at UW-Madison.

In the 1960s, the herbarium gave away its entire collection of macro-fungi to the Field Museum in Chicago, so there are no mushrooms on hand, but has doubled down on its preservation and sharing of micro-fungi. Multiple grants from the National Science Foundation have enabled the herbarium to create a digital database of its collection.

"Like libraries and bookstores, we feared that digitizing everything would mean people would never come look at actual items anymore," says Cameron. "But we've seen the opposite — the more information we make available digitally, the more people want to come and see it."

Cameron, though not a mycologist by training, encounters fungi in his work since orchids (his specialty) can't survive without them. That includes the coral root orchid, a Wisconsin native so dependent on fungi that it can't make chlorophyll.

"If you want to epitomize the fragility of the web of life, you just have to look at the orchid," Cameron says. "It needs a certain insect to pollinate it, a fungus to feed it, the fungus itself needs a healthy clean ecosystem — you break one link and this whole thing collapses."

Mycologists are working with soil scientists, microbiologists, farmers and others in the agricultural realm to understand the full scope of the role fungi play in the ecosystem. For generations, growers have battled fungal "scourges" with a variety of measures (some harmful). The economic impact of fungi on a crop can be significant. Cameron points to a 1912 federal ban on growing currants to prevent the spread of white pine blister rust (which flourished on currants, a willing host). It's legal to grow currants again in Wisconsin, but our state's hop industry — once leading the country — took a hit from downy mildew in the 1920s, and production moved to the West Coast. There's evidence that hops are making a comeback, though. A better understanding of fungi and fungal relationships can only benefit future efforts to grow crops, treat diseases in animals and people, and understand our own dependence on a kingdom so mysterious, yet so essential to life. ■

PHOTO: PAULIUS MUSTEIKIS

CHANGE

John Berry is a transition metal chemist. That means he experiments with elements in "the big middle part of the periodic table" that are able to bond with one another in strange and interesting ways, producing electronic properties that can initiate new types of chemistry—including in the field of catalysis. That's the area Berry's been exploring, with Department of Energy funding. Now, through a novel catalytic process involving the oxidation of ammonia through bonds with a quirky element called "ruthenium," Berry's lab has discovered a way to spontaneously produce nitrogen. It's incredibly exciting because no added energy is required, and the process can potentially be harnessed to produce electricity—cleanly. An important paper in *Nature Chemistry*, a patent from the Wisconsin Alumni Research Foundation (WARF), and funding from DoE are powering Berry and his students to work on fuel cells that could pave the way to a nitrogen-based fuel economy.

INTERVIEW BY MARY ELLEN GABRIEL

Through a novel catalytic process involving ammonia and ruthenium, Berry's team discovered a way to spontaneously produce nitrogen. The process can potentially be harnessed to create clean power.

PHOTOS: (LEFT) PAULIUS MUSTEIKIS; (RIGHT) KAYLA WOLF / WISCONSIN STATE JOURNAL

Congratulations! How does it feel to have a patent for work that could change the world?

I am extremely naïve about patents [laughs]. To be honest, after our paper was published, people have been crawling out of the woodwork to talk with me about this. There are several interesting applications being put forward. I think the most promising thing we will be able to develop is these fuel cell catalysts — where you have a fuel cell that runs off ammonia as a fuel, used to power all sorts of things, like automobiles. There is a huge impact to be made by switching from carbon-based fuels to nitrogen-based fuels. When you burn carbon-based fuels, carbon dioxide is a byproduct, and that's a greenhouse gas. When you burn ammonia, you make nitrogen. That's not a greenhouse gas — it's already 80 percent of the atmosphere. There are actually a lot of efforts underway to modify internal combustion engines to efficiently use ammonia. Where this is really taking off is in the maritime shipping industry. There is a company in Australia that is putting an ammonia-powered boat on the water — a container ship. This shift to ammonia power is already in the wind.

But your team's work goes further, in terms of not creating any noxious by-products.

Right. Running ammonia through internal combustion engines [as a container ship would do] can be a little dirty — they can't oxidize the ammonia to 100% nitrogen without creating some nitrogen oxides that are not so great [for the environment]. Our process happens at an electrode, and because we have atomic control over how the catalyst operates, we get 100% selectivity for nitrogen. We wouldn't be making greenhouse gases. We'd only be making N_2. That's the advantage of fuel cells over internal combustion engines. But it's still a ways off.

How far off?

Well, my current student hopes to have measured a potential from a prototype fuel cell before he graduates. Hopefully within a year! But the discovery we made is more on the fundamental side. In my lab, for example, we need to retrain ourselves in all kinds of new areas. We've never built fuel cells before!

Where did this line of research start for you?

My PhD advisor at Texas A&M was a famous inorganic chemist named Al Cotton. He discovered the metal–metal multiple bond back in the 1960s. When you put two transition metals together, you get a lot of possibilities for what can happen electronically. When I came here 15 years ago, I wanted to apply what we know about metal–metal bonds to the field of catalysis — which is just a means of taking a chemical reaction and making it happen faster and more efficiently.

One thing we've been looking at in my lab is how multiple bonds form — for example, the ability of a metal to form a multiple bond to a non-metal element like nitrogen. Turns out nobody had really explored that before. When we started, it opened up a new direction in transition metal chemistry.

Why had nobody explored this before?

I don't know! It's interesting — we weren't thinking too much about energy creation until we started thinking more deeply about ammonia and nitrogen. About seven years ago, I had a student who told me, "By the time I finish my PhD I want to have a patent." I bit my tongue because I almost said, "You joined the wrong research group for that!" But he started all this chemistry, and now we have filed a patent with WARF.

Why might you have said "wrong group"?

My heart is in fundamental science. I've never really chased applications and I don't have an entrepreneurial bone in my body. I knew there were inorganic chemists trying to make ammonia from nitrogen — ammonia is very important in agriculture — so I said, let's do it the other way around. Instead of making ammonia from nitrogen, let's try to get nitrogen from ammonia. Maybe, by doing it backwards, we could learn something new. My student got started on the idea of using the metal–metal multiple-bonded compounds to bind ammonia. We had the idea that we could potentially remove hydrogen atoms and electrons one at a time from the ammonia and turn it into nitrogen.

The Department of Energy funded a grant for us to start working on this effort as a way to discover more about ammonia synthesis, even though we took a "backwards" approach to it.

We go where the science takes us. I think it's really important to have people motivated by potential applications. But I think it's equally important to have people who are willing to do things just because they've never been done before."

John Berry

And so, from doing something "backwards" to see what might happen, you made a discovery that could change the carbon economy.

We go where the science takes us. I think it's really important to have people motivated by potential applications. But I think it's equally important to have people who are willing to do things just because they've never been done before. We thought we would need to input energy to make nitrogen from ammonia. What we discovered was that we didn't need to do that at all. As soon as you add ammonia to our catalyst compound, it spontaneously makes nitrogen. Something like that had never been seen before.

And ruthenium was used for the catalyst? What can you tell us about it?

I've had this fascination with ruthenium for a long time. It's an element with a notoriously difficult chemistry. "The chemistry of ruthenium is chemistry for connoisseurs!" is a statement attributed to Nobel laureate Sir Geoffrey Wilkinson, the PhD advisor of my PhD advisor. It's not for everyone. But that's what attracts me. I don't like to work on easy problems [laughs]. If an element has a track record of being difficult, that's the element for me!

There's just one fly in the ointment, and it's ammonia, right?

Yes. The ammonia synthesis industry, which operates on an absolutely massive scale worldwide, talks about different "colors" of ammonia: brown, gray, turquoise, blue, green. Nitrogen plus hydrogen equals ammonia. In principle, there's no carbon necessary. Except that right now our best source of hydrogen is natural gas, a fossil fuel. Ammonia created using natural gas is called "gray" ammonia. The efforts to sequester the carbon from this process give what is called "blue" ammonia. But of course, everyone wants to get to "green" ammonia. If you can use a solar panel and a catalyst that splits water into oxygen and hydrogen, and feed the hydrogen into an ammonia synthesis plant — that whole process doesn't have any carbon in it.

The potential is there! ■

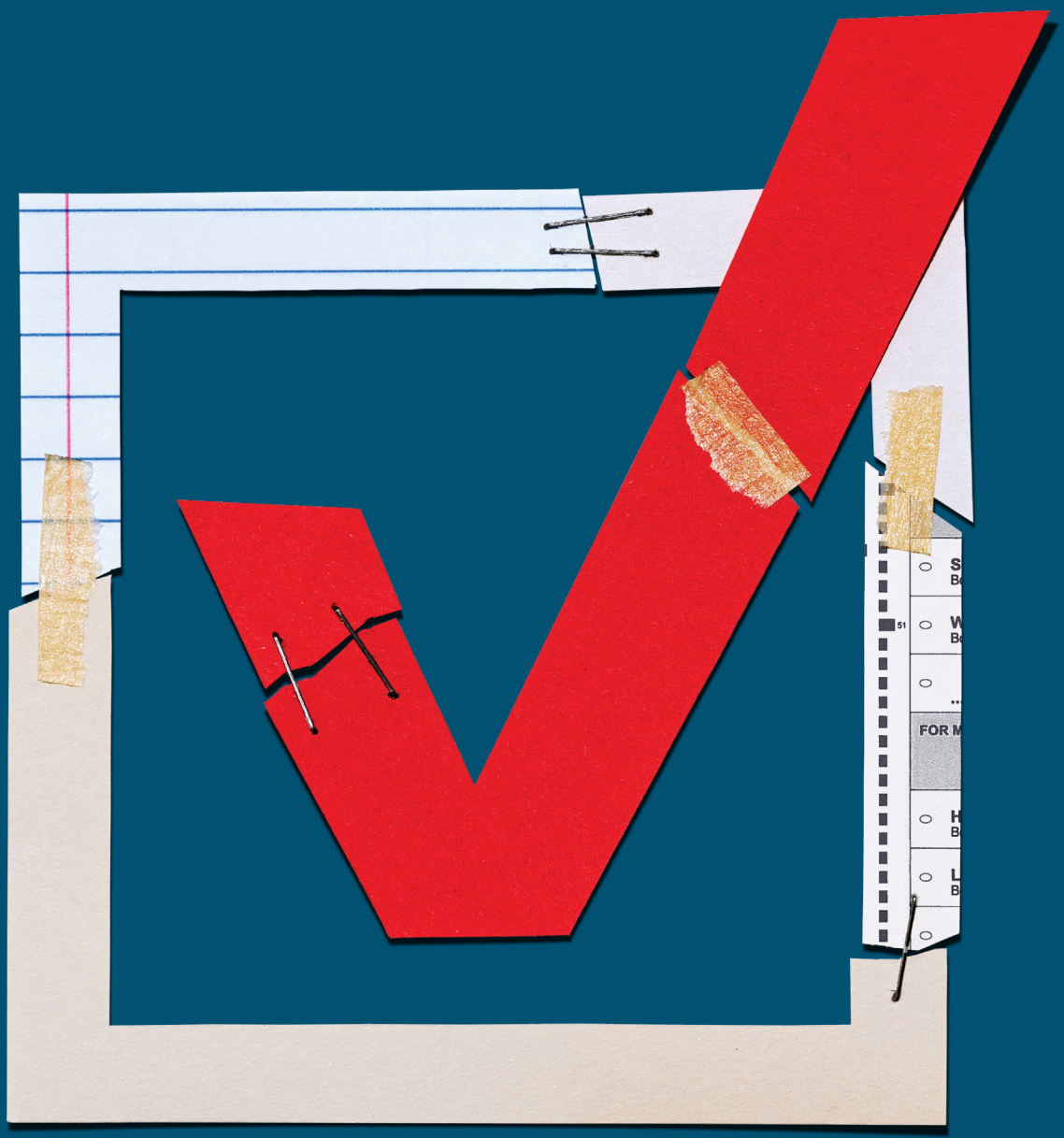


ILLUSTRATION: MATT CHASE

~~Perfecting~~ ~~Defending~~ ~~Lamenting~~ Practicing Democracy

We have been at this for almost 250 years. If history has taught us anything about keeping democracy alive in the U.S., it's the importance of staying involved and informed.

BY AARON R. CONKLIN

Ken Mayer begins his Introduction to American Government class by reminding his students that there are two fundamental components to a modern democracy: periodic free and fair elections, and what political theorist Robert Dahl called the "democratic bargain" — the notion that the parties and/or candidates who lose an election willingly and peacefully surrender power to the winners.

"Without those two components, you don't have a democracy," says Mayer. "And the part that is really under threat here is the bargain part."

Mayer is referring to the 2020 presidential election in which the Democratic Party's nominee, Joe Biden, was declared the winner, a result unacceptable to many in the opposing party. More than a year later, groups, including a Republican-led, taxpayer-financed investigation of Wisconsin's election, continue to suggest that the election's process and results are illegitimate. Throw in raging debates over gerrymandered voting districts designed to entrench party majorities and a spike in voter identification laws that many claim will discourage Black, Latino and low-income

voters, and it's easy to understand why many scholars and journalists are warning that the practice of democracy in the U.S. is in peril.

"If you go back to the beginning, the long arc of American history has been about expanding suffrage and adopting democratic values more fully," says Barry Burden, Lyons Family Professor in the political science department and the director of UW's Elections Research Center. "For most of us who have watched this stuff closely, the last few years have been shocking, because it's taking things in a direction that we didn't think was possible."

However, 246 years is a long time, and it's worth looking back at our growing, changing nation as it has struggled with its "grand political experiment" from the founding days to the present. Needless to say, the practice of democracy has never been smooth.

"Unfortunately, it's politically advantageous to mobilize people by saying, 'You need to vote for me or those other folks will take over, and our way of life, the things that we value, our sense of morality will be gone.'"

KATHY CRAMER

When the United States was founded, only a quarter of Americans — the ones who were white and male and who owned property — were eligible to vote. Over the last two centuries, suffrage has been extended to women, Blacks and citizens over the age of 18. In 2022, convicted felons are the only U.S. citizens excluded from the vote.

The 2020 presidential election's result wasn't the first one to be disputed. Mayer points to the election of 1800, when Thomas Jefferson, the Democrat-Republican candidate, narrowly beat John Adams, the sitting president from the Federalist Party. The election took weeks to resolve and was eventually decided in the House of Representatives.

"It was very, very controversial," says Mayer. "There was actually some thought at the time that this was the end of the American experiment, that this proved that democracy doesn't work — we had a good 12-year run, but it's not going to work."

But the experiment continued. Jefferson delivered his legendary "We are all Democrats, we are all Republicans" inaugural address to usher in a long, slow process of healing. Though his party held power for most of the next decade, it also found ways to work with the losing side to move forward.

Burden notes that the 1800s, just like today, were an era of close competition between the major political parties, as well as eras of deep polarization.

"Those two conditions foster a kind of scorched-earth governing approach," he says. "And that can mean trampling on established democratic routines that are now inconvenient for the victorious side getting things done."

The two major political parties have each taken their turn at obstructing the practice of true democracy. For example, for more than 100 years, from the close of the Civil War through the Jim Crow era, Southern Democrats held power by blocking Black voters from voting or holding office. Today, Republican-affiliated groups have challenged the results of what the courts have deemed a "free and fair election."

The use of sophisticated mapping software has made gerrymandering almost frighteningly easy today, but the concept has been around since Governor Elbridge Gerry first configured maps to his advantage back in 1812. The practice of voter registration wasn't part of America's political process until the 1800s, implemented largely to prevent newly arrived immigrants from countries like Ireland and China from being part of the political process. Prior to that, individuals simply showed up on election day and asked for a ballot.

"These efforts are created in a way to try to prevent certain groups of people from being part of the system," says Burden.

In 2020, things like signature matching requirements and restrictions on the use of absentee ballots and drop boxes made voting more difficult in many states. In 2021, Montana became the first state to end same-day voter registration.

When she was working at UW-Madison's Morgridge Center for Public Service, Kathy Cramer made a set of

1800

The presidential election between John Adams (left) and Thomas Jefferson was so closely contested that it took multiple votes to resolve, and was eventually decided in the House of Representatives.

1812

Former U.S. Vice President and Massachusetts Governor Eldridge Gerry was the man who first gave us tortured voting districts designed to keep himself and his political friends in power. The practice of "gerrymandering" remains a political flashpoint, in Wisconsin and elsewhere.

1920

It wasn't until Congress ratified the 19th Amendment to the Constitution that American women were finally guaranteed the right to vote.

1964

For more than a century after the Civil War, Southern Democrats blocked Black people from voting or holding office. Alabama governor George Wallace, a noted opponent of the Civil Rights movement, helped spark what came to be known as "the Southern Strategy," an effort by the Republican Party to appeal to white voters through racism against Black people.

2021

Today, partisan arguments continue to rage about voting rights, gerrymandered voting districts, election security and the legitimacy of the 2020 presidential election.

posters with a pointed warning reminiscent of the ones you used to see in your dentist's office about caring for your teeth: Ignore your democracy and it will go away.

Cramer, a professor of political science and the Natalie C. Holton Chair of Letters & Science, is the author of *The Politics of Resentment: Rural Consciousness and the Rise of Scott Walker*. She argues that the electorate is spending too much time hating the other side instead of recognizing that attacks on the other side are distracting us from key issues, like economic disparity.

"Unfortunately, it's politically advantageous to mobilize people by saying, 'You need to vote for me, or those other folks will take over, and our way of life, the things that we value, our sense of morality will be gone,'" says Cramer. "When we're in this situation of talking about the other side being evil, we are more supportive of things, especially with respect to elections, that prevent those people from getting power, and that undercuts democracy."

So, how do we practice democracy in a hyper-partisan age, when the rhetoric has grown so shrill that many of us just want to tune it out? Burden likens maintaining democracy to keeping a fire going — adding to it, watching it and monitoring it. That means remaining active in the electoral process, as well as staying engaged by paying attention to local newspapers and media. Burden also advises volunteering to work at the polls.

"Anyone who does it comes away with a new appreciation for it, how safe the system is and how mundane it is," he says. "It's a boring administrative process, and that's exactly how it should be."

The practice of democracy, it turns out, is just that: practice. It's never perfect, and never finished. It will hold only as long as we all keep doing it — together. ■

Service Minded

Cora Marrett reflects on a career shaped by curiosity and coalition-building.

BY AARON R. CONKLIN

In the spring of 1979, two weeks after the devastating meltdown at the Three Mile Island Nuclear Plant in Pennsylvania, Cora Marrett (PhD, Sociology, '68) got a call from the White House. The personnel office asked her to join a multidisciplinary commission then-President Jimmy Carter was putting together to recommend meaningful responses to the catastrophe.

Marrett, who at the time was a professor in UW-Madison's Departments of Sociology and Afro-American Studies, initially said no.

"I had assumed it would focus very heavily on nuclear engineering and nuclear medicine," says Marrett, who has been a member of the College of Letters & Science's Board of Visitors for several years. "When I learned that it would be headed by a mathematician, that there were to be engineers, a housewife and a journalist, I thought, 'Well, now, this is interesting.'"

PHOTOS: PAULIUS MUSTEIKIS

Marrett received a personal "thank you" from President Jimmy Carter for her service on the Three Mile Island Commission.

Marrett's time on the commission ended up being one of the defining experiences of an expansive 50-year career that also includes stints in leadership positions at the National Science Foundation (NSF) and the National Academy of Science and more than 30 years in the Department of Sociology here. The Three Mile Island Commission produced important findings, but Marrett's biggest takeaway was the power and value of interacting with, and learning from, others.

It's a lesson Marrett, who grew up as the youngest in a family of 12 children in a tiny tobacco town in Virginia, has applied throughout her time in academia and with government agencies. Her story is a winding journey of discovery sparked by curiosity and powered by dedication to public service.

"I've always wanted to give people a sense that one's career path doesn't have to be that clear," says Marrett. "I've valued the stops and starts, because not everything works out as you might have wanted it to."

Marrett began in academia. During an early teaching stint at the University of North Carolina at Chapel Hill in the early 1970s, she became part of a government-based project to identify the factors that fueled housing segregation. Her paper outlining the causes of social stratification sparked national discussion on the topic.

It was also her first project tied to the National Research Council (NRC), a part of the National Academy of Sciences, an organization Marrett would serve extensively later in her career. She calls the NRC "the place that started bringing together my great interest in service."

The connections Marrett made on the Three Mile Island Commission in 1979 opened a host of opportunities for her — including serving on the Board of Governors for the Department of Energy's Argonne National Laboratory in Illinois. She spent six years there in various leadership positions, gaining experience with federal budgets and bureaucracy, administration, and staffing decisions.

"I've always wanted to give people a sense that one's career path doesn't have to be that clear. And a sense of direction may not be there from the beginning. I've valued the stops and starts, because not everything works out as you might have wanted it to."

CORA MARRETT

"What it showed me were the kinds of people and activities you've got to interact with, and the need to develop a greater sense of being comfortable in those kinds of settings," she says.

Throughout her public agency work, Marrett always maintained ties to academia. She served her first stint at NSF while on leave from UW-Madison.

The experience gained in one realm did not always carry immediate weight in the other. Marrett recalls interviewing to become provost at the University of Massachusetts, the job she held before returning to Wisconsin to become the vice president of academic affairs for UW System in 2001.

"The hiring committee said, 'How in the world do you think you could be an academic administrator? You've never even been the chair of a department,'" Marrett says. "That got my back up a bit."

Marrett was granted emerita status at UW in 2011, but any actual sense of "retirement" is illusory. Joe Biden recently named her to the President's Committee on the National Medal of Science. In addition to her work with the L&S Board of Visitors, in recent years, she has also taught a course on the modern meaning of the Wisconsin Idea. That course attracted students from different walks of life. That, as always, remains her driving force.

"I cannot overstate the importance of the lessons I learned from others and the connections I have made with others," she says. "That still continues to be important for my life." ■

Trail Blazer

After forging her own path as a woman in business, Nancy Borghesi commits to identifying needs at her alma mater — and helping students find their own ways forward.

BY KATIE VAUGHN '03

Nancy Borghesi (BA, Economics, '69) arrived at UW-Madison with a proud sense of history. Her parents, grandfather and great-grandfather had all been Badgers.

From the start, Nancy was drawn to economics and math, often tutoring other women in her dorm. And when she met David Borghesi (BBA, Business; Accounting and Information Systems; Accounting, '70), a first-generation college student who would become her husband, she learned he shared her affinity for numbers.

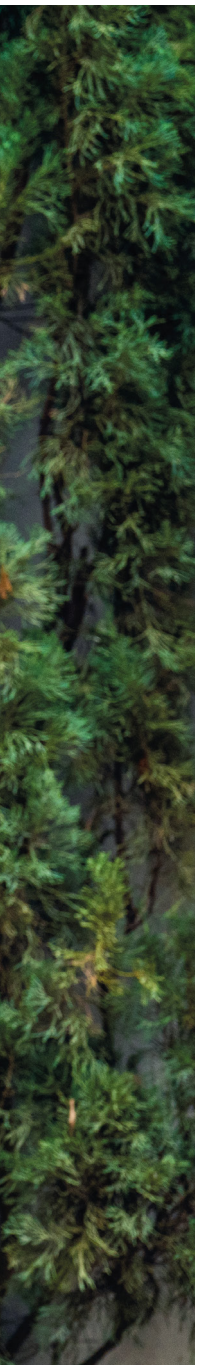


PHOTO: STACY HOWELL

"But I don't think we could have been in more different environments," Nancy says.

David's accounting major came with a well-plotted career path: Pass the CPA exam and land a job with a major firm (he went with Arthur Andersen). For Nancy, an economics degree, especially for a woman at the time, meant charting her own course.

"I knew I wanted to go into computers even though they were a new animal in '69," Nancy says. "System design was a new field, and women were not in it. Interviews were troubling — it was very hard to be taken seriously. So I ended up, like many of my peers who wanted professional careers, starting with the government."

After working at the Navy Regional Finance Center and then earning an MBA at Northwestern University's Kellogg School, Nancy opened new doors. She worked as a systems and business process consultant for Arthur Young in Chicago for 10 years, and then at CCC Information Services, an auto claims information processing and software startup, for 16 years, retiring as senior vice president of consulting services.

"It wasn't easy, all the way along being one of the first," she says. "I think women have a much better shot to be who they want to be today. It was a lot more difficult in the '60s."

But some of that adversity proved useful in her role at the software startup.

"You have to be a self-starter," Nancy says. "You have to be able to do what needs to be done and not believe there is a fixed career path. Because in a startup, there isn't one. You have to be flexible and you have to be able to see opportunities."

After joining the College of Letters & Science Board of Visitors in 2008, Nancy was drawn to the new energy focused on career services for L&S students.

She understood that while liberal arts students had endless options in what they could study and how they could apply their degrees, it could be challenging to articulate their expertise or connect to opportunities. And old-school career prep wasn't going to cut it.

So when the Borghesis learned about plans for an innovative center for personal and professional development, they became among its first supporters. They appreciated how SuccessWorks lets students explore, experiment and hone their passions and their paths, all the while connecting them to alumni, internships, jobs and more.

"What I love about the program is it's multidimensional," David says. "Quite frankly, other schools could learn a lot from what SuccessWorks is doing."

The Borghesis, who now live in Hilton Head, South Carolina, and spend summers in Door County, Wisconsin, are also enthusiastic supporters of the Center for Academic Excellence, which provides an inclusive community, academic support and opportunities for students who have historically been underrepresented in higher education.

"CAE resonated with us because it's supporting students directly," Nancy says. "It's focused on helping students overcome obstacles that may have been in their way and ensuring their future success."

Through her service on the Board of Visitors, Nancy has learned about needs and opportunities within the college. And in her characteristic fashion, she has boldly asked questions, provided generous support and helped create new paths forward to help students thrive.

"I've always been the strong female voice in senior management, so that doesn't intimidate me," she says. "I like to know I've taken a specific need and addressed it." ■

The Best Investment

When Nancy and David Borghesi graduated, one thing was certain: They would give, no matter how small the amount, to their university every year.

It's a promise they've kept, and greatly expanded upon, since 1969, and their generous support has spanned programs across campus.

In addition to donating to their respective colleges, they pay special attention to the deans of the College of Letters & Science and the School of Business and their priorities. "They're the ones who know best," Nancy says. "How they see the future is a vision we want to support."

At L&S, the couple helped fund the Borghesi-Mellon Workshops in the Center for the Humanities, which create opportunities for students and faculty to work on interdisciplinary topics outside of the classroom.

David says their philanthropy is inspired by Nancy's family's long legacy of giving. And the accounting and economics graduates believe that such support makes strong financial sense.

"Giving to the university is one of the best investments you can ever make in the future of the United States," David says. "The more people that we can educate at that high of a level, the better our country is going to be."

The Ubuntu Approach

BY SHERIFF M. ISSAKA

As a first-generation college student in a new country, there were so many unknowns with respect to culture, conduct, academics, interests, foods, accents and more. However, these pale in comparison to navigating a colossal college machinery of more than 45,000 students to find an understanding of myself and the world.

I identified early on that merging my African background with my computer sciences training would help facilitate my navigation and growth process.

I didn't hesitate to tackle difficult and challenging topics. After presenting on the bigotry promulgated by artificial intelligence (AI) systems, including denying people kidney transplants, tagging them as apes and giving them longer prison sentences largely because they were Black, my class instructor introduced me to Reginold Royston, an assistant professor of African Cultural Studies whose work, he said, might interest me.

Sheriff Issaka, from Ghana, is a senior majoring in Computer Sciences with certificates in Entrepreneurship and African Studies. He was an undergraduate researcher with Professors Reginold Royston and Michael Ferris, in the African Cultural Studies and Computer Sciences Departments, respectively.

He was not wrong. Professor Royston's work sought to merge two seemingly unrelated fields: technology and African Studies. Through the Undergraduate Research Scholars (URS) program, I worked with Professor Royston on examining technologies and their transnational influences, with a focus on AI in sub-Saharan Africa. This research, driven by a qualitative and humanities-based approach, allows me to analyze technologies with an eye towards equity and accessibility, and to see technologies as channels through which issues of gender, race, creed and class can be perpetuated or mitigated.

After a year of working with Professor Royston and advancing my technical and analytical understanding of AI, I started my second research project with Professor Michael Ferris of the Department of Computer Sciences.

In this research, I use data from dairy farms across the Midwest to create machine learning models that attempt to effectively predict how well cows convert feed into milk. This research gives me a fundamental understanding of advanced technologies and algorithms.

Both of my research mentors' insistence on optimal results pushes me to learn and grow daily. This growth process involves understanding that those most affected by technologies are those least represented in their creation, and that I am not too small to influence change.

Inspired by this premise, I started the AI4AFRIKA@UW project, which allows undergraduate students to engage in research geared towards creating responsible, equitable and accessible technologies. Currently, students on this project are building machine translation systems for African languages, creating a mobile application that is optimized for minimal hardware and internet, and building a chatbot that provides instant and reliable information on mental and menstrual health issues. Researchers on this project are guided by the African ideology of "ubuntu" that affirms the positive values of community, difference, anti-racism, hospitality and openness to others.

As I wrangle data and scratch my head to build robust systems and analysis for my research projects, I know that every second spent brings me closer to understanding myself and my community. Leveraging these humanities and technical dimensions beyond my research, I am able to navigate my world knowing I am growing into a better student, a better leader and a better member of society. ■

ILLUSTRATION: ERIN ROBINSON

We are fortunate to have generous alumni who care deeply about the liberal arts and who remember how their College of Letters & Science experience shaped their lives in so many lasting ways.

Your gift ensures that our students continue to have access to the world-class education that L&S provided to you.

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Last Word

When does spring officially arrive in Madison? When Lake Mendota's ice melts, of course. According to the Wisconsin State Climatology Office, the lake was declared "open" (meaning a visible majority was ice-free) on April 2 this year, after 87 days of ice cover. Monitoring Madison lakes for their annual freeze and thaw dates and keeping written records of those dates goes back 165 years. It's one of the longest continuous ice datasets in the world. The assessment of "ice-over" and "ice out" is still, today, made by climatologists eyeballing them with binoculars from the same vantage points each year (much the same way as it was done in the mid-19th century, which keeps the observational practices consistent and the datasets relevant). Visit Water Blogged (blog.limnology.wisc.edu) for more science and stories from the Center for Limnology.

PHOTO: COLTON MANSAVAGE