UNIVERSITY OF WISCONSIN–MADISON COLLEGE OF LETTERS & SCIENCE

SPRING 2025

Letters&Science

THE FUTURE OF HEALTH

page 16

Monica Turner (right) and Arielle Link conduct research at the Berry-Glade Fire Burn Area just north of Grand Teton National Park.

PHOTO: ALTHEA DOTZOUR

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FEATURES

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In Langlade County, Antigo Construction has five UW–Madison alumni on the leadership team.

COVER ILLUSTRATION: INA JANG

#WeAreLS

L&S Student Night was a success! From cheering in the stands to repping L&S pride with bucket hats and bandana swag, the energy was unmatched. #WeAreLS #OnWisconsin

@UWMadisonLS February 7, 2025

Professor of Botany Simon Gilroy has spent a lot of time sending vegetables into space to conduct experiments on how plants behave in zero-gravity conditions.

@UWMadisonLS March 24, 2025

Yep, that's the Washburn Observatory. Recreated in Minecraft by digital architect @mitch_builds.

@UWMadisonLS February 5, 2025

Scenes from the Languages of the World Day at Union South, where Wisconsin high school students attended introductory language lessons and workshops.

@UWMadisonLS March 5, 2025

PHOTOS: SHANHONG YU (L&S STUDENT NIGHT), NASA (BOTANY), MITCH BUILDS (MINECRAFT), MARGARET SHREINER (LANGUAGES OF THE WORLD DAY)

Letters&Science

SPRING 2025

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FROM THE DEAN

A Commitment to Discovery

This magazine has been in the works for months. We picked out this lineup of stories before the holiday season at the end of 2024. There was uncertainty about the future at the time, but it was impossible to predict all the obstacles that higher education would face in the new year. Take our cover story, "The Future of Health," on page 16, for example. We were excited to tell the story of how researchers across the College of Letters & Science are doing groundbreaking work around topics that include medicine, health policy and personal wellness. But we couldn't have known that we would be publishing this magazine shortly after major federal funding cuts would threaten grants toward critical research projects like the ones we highlight here. We couldn't have known how important it would be to share this story now, because this is the type of essential work that is being affected. A common thread you will see in many of these magazine stories is that the amazing research happening in L&S is supported by a partnership between you — the taxpayer — and the federal government through agencies like the National Institutes of Health, the National Science Foundation and the National Oceanic and Atmospheric Administration. As this magazine goes to press, it is this long partnership that is at risk.

Despite the storm of uncertainty we've weathered this spring semester, our important work continues. As the liberal arts college of a major research university, L&S is uniquely positioned to tackle some of the biggest questions facing our society. You'll see this in stories such as "In Their Element" on page 26, which profiles three leaders in sustainability science that are experts on water, fire and air. Or turn to page 10 to find a story about how the interdisciplinary nature of L&S allows researchers in psychology, computer sciences and journalism to team up to build what they call "The AI Terrarium." Our students are involved in influential research, too. On page 14, you can read about two graduate students who traveled to Antarctica for an ecological study.

The research happening in the College is remarkable, but we're also excited to share stories about our alumni, who are making a difference in our world today. In L&S, we teach problem-solving, communication skills and a lifelong pursuit of curiosity. These qualities are assets for anyone working in business, public service, technology and beyond. When we see our alumni living that out, it's a powerful thing. On page 22, you'll travel to Langlade County, where a group of Badgers is carrying out the Wisconsin Idea through their concrete fracturing business, Antigo Construction. The business has worldwide impact by playing an essential role in our transportation system, but it started with the Shinners family in a small town in rural Wisconsin. Or read the story of Meghan Morgan Juinio ('94) on page 32. She's a video game executive paving the way for the next generation of women to work in the industry. And on page 34, Casey Durandet ('89, MS'91, PhD'95) shares how the legacy of her professor and mentor inspired her to give back and ensure that the next generation of Badgers has opportunities to conduct physics research.

As we continue pursuing impactful research, providing an outstanding student experience and uplifting the accomplishments of our incredible alumni community, we are grateful for your support of L&S and our mission. Thank you for championing the College of Letters & Science.

On, Wisconsin!

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

Neurobiology student Shalya Gulati (center) went to Tanzania the summer after her freshman year to take a class on wildlife conservation.

PHOTO: AMY HUANG

1

World Travelers

Chances are good that during their undergraduate careers, students in the College of Letters & Science will spend some time — a semester, maybe a summer term — studying in a foreign country. That's because UW–Madison remains one of the top schools in the country in terms of student participation in study abroad programs. According to UW–Madison's International Division, nearly 3,000 students participated in one of 300 different international programs available in countries around the world during the 2023–24 academic year.

Some students even managed to fit in more than one study abroad experience. Jess Randall, a two-year L&S Dean's Ambassador majoring in biology and global health, traveled to Belize during the summer of her freshman year as part of a first-year interest group and conducted research on the impact of microplastics in coral reef environments. Later in her academic career, Randall spent a semester studying abroad in Rome, taking classes about how politics, society and the culture of food are intertwined.

"I think that's the most amazing part of study abroad," Randall says. "No matter what you are going to do or what your goals in life are, if you embrace that opportunity to go to another place, whatever you do there and whatever you learn there will either indirectly or directly impact your future and the way you view the world."

The L&S majors with the highest study abroad participation during the 2023–24 academic year were, in order: political science, psychology, economics, journalism, Spanish and computer sciences. The top locations for UW students studying abroad were Spain, Italy, England, Denmark, France, Ireland, Australia, Costa Rica, Germany and Japan.

2

MEDIA MENTION

"Just because some *Paranthropus robustus* individuals were the unfortunate victims of predators, it would be completely unfair to conclude that whole species was somehow bumbling."

PROFESSOR OF ANTHROPOLOGY TRAVIS PICKERING (MS'94, PHD'99)
talking with *Discover Magazine* on new fossils he helped uncover of one of the smallest – and perhaps unluckiest – early human relatives

3

30%

That's the percentage of UW–Madison undergraduates who major in more than one area. The College of Letters & Science is home to four of the five most popular fields in which to double-major, including computer sciences, data science, economics and psychology.

PHOTO: ALTHEA DOTZOUR

4

Under Construction

The L&S construction zones will be wrapping up work soon. First up is Morgridge Hall, the new home of the School of Computer, Data & Information Sciences (CDIS), named for UW–Madison alums and longtime philanthropists John ('55) and Tashia ('55) Morgridge. The building's exterior structure is now fully complete and scheduled to open to students and faculty this fall. Not far behind is Irving & Dorothy Levy Hall, the future hub of the humanities. Fueled in part by the generous support of brothers Marv ('68, JD'71) and Jeff ('72) Levy, the building is slated to open in the summer of 2026 and will be home to eight L&S departments.

Morgridge Hall will welcome its first class of students in the fall 2025 semester.

5

Art Party

The party is just getting started for the Department of Art History, which is celebrating 100 years since its founding. It kicked off with a series of three panel discussions that brought distinguished alumni back to campus to talk about the values of digital and public humanities, transformative curatorial practice and campus art museums as learning labs. "We've been inviting alumni back to help us think forward about how we can continue to serve students and the public," says Anna Andrzejewski, a professor of American art and architecture. It will culminate with the official centennial celebration on Sept. 25–26. Learn more at *arthistory.wisc.edu/arthistorycentennial*.

What's the

Even with the best tools and knowledge, forecasting can miss key pieces of the puzzle. The research happening in Mayra Oyola-Merced's lab can help explain why and lead to a future with more accurate forecasting.

BY ALLI WATTERS

"**If you've ever seen *Star Wars*,** they're like the midi-chlorians of our atmosphere," says Mayra Oyola-Merced, an assistant professor in the Department of Atmospheric and Oceanic Sciences. "They can switch between the dark side and light side of the force."

She's talking about aerosols, which are tiny particles that are suspended in the atmosphere. They can come from natural sources (such as dust) or be man-made (for example air pollutants). Recent research, including important contributions from Oyola-Merced's work, has revealed that they play a significant role in cloud formation, weather and climate. These tiny aerosols can be the explanation for why clear skies turn cloudy, or fluffy cumulus clouds transition into gray, stormy days.

They also play a huge role in extreme weather events.

Oyola-Merced says a prime example of this shows up in Africa, where winds lift dust particles up from the Sahara Desert floor and push them over the ocean. The dust gets into the Caribbean, eventually leading to the U.S. East Coast where they tamper with the hurricane season. Research shows that the more forecasters pay attention to dust storms in the Saharan region, the better they can predict tropical weather patterns in America.

"It's the butterfly effect in action," Oyola-Merced explains. "A small difference somewhere can ripple across the system. The fact that our forecasts routinely capture reality as closely as they do is a remarkable achievement."

Hurricane season and extreme weather events play a huge role in Oyola-Merced's interest in forecasting research. Born, raised and educated in Puerto Rico, she has a lot of life experience with tropical storms. Creating more accurate forecasting practices that can help protect lives, property and business interests has always been at the heart of her work here at UW-Madison and during her time serving in government roles at the National Oceanic and Atmospheric Administration (NOAA) and the United States Naval Research Laboratory (NRL). Oyola-Merced had a breakthrough after moving to the Midwest. Despite generally good air quality at the surface, she found that during certain times of year, wildfire smoke can linger aloft — coinciding with severe storms and highlighting aerosols as a hidden driver of Midwest severe weather.

"When you compare hailstorm and tornado reports with aerosol patterns, the alignment is striking," Oyola-Merced says. "I had been thinking about this since my student days, but seeing it so clearly was a real 'whoa' moment."

Forecast?

Despite Oyola-Merced's years of suspicion, historically aerosols have not been factored into weather forecasts as highly as other parameters such as wind, humidity and temperature. She believes that plays a large role in why forecasting can be frustratingly fickle — and she wants to change that.

One way to do this is by looking at times when predictions did not line up with reality. In the Midwest, she sees that in 2023.

"There was one day in June when the National Weather Service issued severe weather warnings across Wisconsin to make sure people were prepared," Oyola-Merced says. "But the storms never developed. It stayed unexpectedly cool for summer — I was even wearing a light jacket."

The opposite happened, too, in cases when severe weather spun up seemingly out of nowhere. But why were the forecasts so far off? Oyola-Merced has the answer: aerosols. More specifically, smoke. That year, there were massive wildfires in Canada that heavily impacted U.S. air quality. Photos of New York's hazy skyline made headlines worldwide, but other areas, including Madison, were also impacted. And while the haze from the smoke was visible, the full impact went unseen for months because those aerosols went up into the atmosphere and traveled through currents around the globe, leaving confusing weather patterns in their wake.

"Today's models aren't fully equipped to capture these aerosol influences. Our goal is to bridge that gap and help make forecasts even stronger."

MAYRA OYOLA-MERCED

"Changing the clouds and their properties can actually change how much severe weather a region experiences," Oyola-Merced says. "But today's models aren't fully equipped to capture these aerosol influences. Our goal is to bridge that gap and help make forecasts even stronger."

For Oyola-Merced, that means factoring in wildfire smoke not just from California, but also from Canada and the Yucatán Peninsula, and understanding how long-range aerosol transport can influence Midwestern hailstorms and severe weather. It also means recognizing how aerosols can dry out the atmosphere, contributing to drought conditions and eventually helping to improve early warnings. The goal is simple: When the forecast says sunny, people can trust it — and plan without fear of a sudden downpour.

"It's not an easy problem, because aerosols are tiny," she says. "But they are here, and they are altering weather patterns, and that's something we need to observe." ■

TEACHING

Facing the Music

Jeremy Morris opens his students' eyes to the intricacies of the modern music industry.

BY AARON R. CONKLIN

It starts with Britney Spears.

More specifically, "...Baby One More Time," the pop star's debut hit from 1998. That's the song Jeremy Morris, a professor of media and cultural studies in the Department of Communication Arts, uses to launch his uber-popular course *Music Industries and Popular Culture*. Now in its second year, the class generates a sizable waiting list each time he teaches it.

The course grew out of Morris' long-running podcasting and music class, in which he typically spent 10 weeks teaching the former topic and a mere two on the latter, specifically on the impact of digital music. His students unequivocally wanted more.

"They were like, we don't really have a class on the music industry, how to get into the music industry or what the music industry looks like in the greater realm of communication and media jobs," says Morris, who is also a director of graduate studies. "Everybody nodded approvingly whenever I said, 'Oh, should I do a whole class on that?'"

Morris based the structure of his class on writer and podcaster Rob Harvilla's popular podcast series "60 Songs That Explain the '90s." In each episode, Harvilla digs into how the song and the artist fit into and defined the era.

Morris begins each class session the same way, using songs as jumping-off points for the industry and cultural themes he's discussing with his students. Spears serves as an entrée to the late 1990s — the era in which CDs, teen stars and boy bands were ascendant, right before the internet and music streaming upended everything. A live version of Taylor Swift's "Cruel Summer" jump-starts a discussion on the business of concerts and how Ticketmaster and Live Nation's dominance has caused ticket prices to skyrocket. Doja Cat's "Vegas," a song that heavily samples Elvis Presley's "Hound Dog," covers copyrights and responsibilities.

"I'm trying to get them to think about, assess and map what the structure of the contemporary popular music industry looks like and get them to analyze and think critically about the role that music and music circulation play in their everyday lives," says Morris. "I want to spark some questions for them about what it means to work in this space and what kinds of implications there are for culture and for people's social identities."

The class also includes a technical aspect. Morris asks students to pull a Harvilla by assigning them to pick a song and create their own 15-minute podcast in Adobe Audition to talk about how it connects to a trend or topic that's been covered in class. He also asks them to map the various roles that are part of the industry, from performers to the music supervisor who places popular songs in television commercials.

"I think students fundamentally enjoy talking about music, so it's nice to have a space where we can do that."

JEREMY MORRIS

Many of Morris' students are transformed by the experience. Kylie Kurzban, a junior who ducked into the inaugural class as a sophomore in pursuit of her digital studies certificate, ended up launching the Wisconsin Music Business Club (WMB), which is the first student club of its kind. Last semester, WMB hosted several events featuring guests from the music industry. Kurzban also used the things she learned in Morris' class to land a summer internship at SiriusXM.

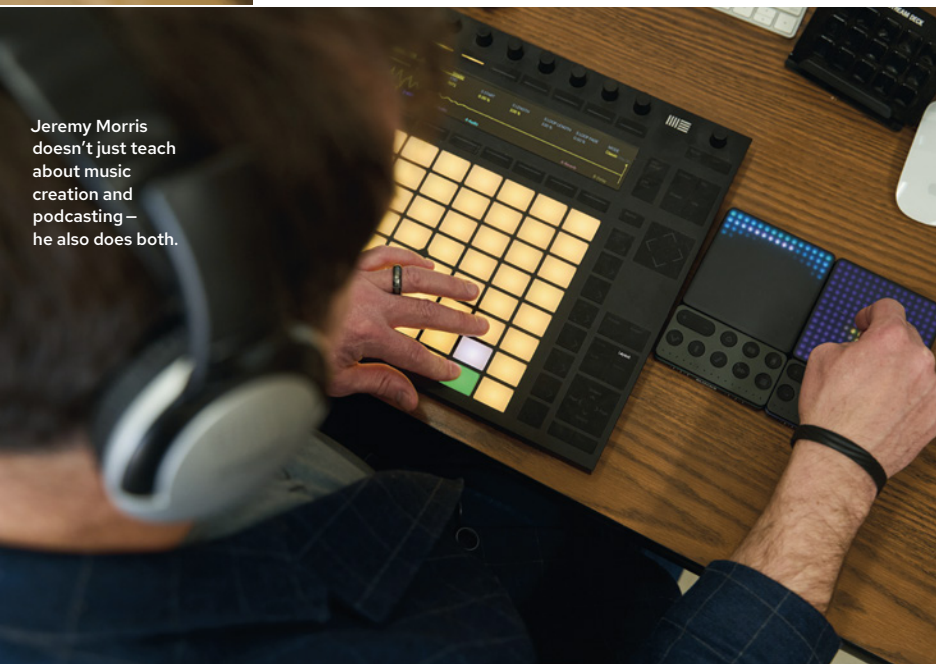
"It was my favorite class I've taken at Wisconsin," says Kurzban, a Californian who's hoping to get a gig in music programming. "I went into it with such a blind perspective on music. I only knew it as a consumer, and I walked away from it knowing so much more as a whole."

Morris knows there will be no shortage of topics to cover in future years as the class evolves. Artificial intelligence is continuing to transform the music industry, as regular music lovers gain the ability to use voice clones of popular artists (Drake, Sabrina Carpenter, etc.) to create their own ersatz digital hits.

"I think the music industry finds that extremely frightening," says Morris. "What regulations and policies are going to come out around that? What kinds of things are we going to see in terms of artists being able to license their voice and allow people like you and me to create a song with the use of their voice?"

The trick, he knows, will be finding enough time to cover it all.

"This is the problem with the course — trying to cram everything into 50 minutes and letting my students have 10 or 12 of those minutes to talk about Taylor Swift, because so many of them want to," jokes Morris. "I think students fundamentally enjoy talking about music, so it's nice to have a space where we can do that." ■



Jeremy Morris doesn't just teach about music creation and podcasting — he also does both.

PHOTOS: PAULIUS MUSTEIKIS

RESEARCH

The Artificial Ecosystem

Six things we've learned from the AI Terrarium.

BY ALLI WATTERS

Picture a terrarium. It's a controlled environment that contains and sustains life. But what if that life was artificial intelligence? The AI Terrarium is an interdisciplinary research study led by Timothy Rogers, a professor of psychology. He's working with researchers across the College of Letters & Science and at other universities to bring to life research that leverages AI to create realistic, simulated personas that imitate the beliefs, language and behaviors of real humans. Here's what they've learned so far.

AI can roleplay. And not just as a member of your Dungeons & Dragons campaign. When instructed, AI can roleplay as different types of people. Take, for example, a Midwestern farmer. Researchers could prompt AI with questions to get an idea of what that person might say. "If the AI is accurate, this could provide an opportunity to simulate, for instance, results of surveys or responses to different public messaging strategies," Rogers says.

That said, AI isn't as human-like as it seems. Sure, chatbots may seem like they are having a reasonable, human-like conversation with you, but one key way you can clock an AI is if it is quick to change its mind. That's not common with humans, who often stubbornly cling to their opinions regardless of counter arguments. Rogers says this can limit the effectiveness of using AI to simulate human responses, which is why a crucial goal for this research is to understand how to make the AI respond in more human-like ways.

It's more than demographics. Thanks to large survey studies from Dhavan Shah ('89), the Jack M. McLeod Professor of Communication Research and Louis A. & Mary E. Maier-Bascom Chair in the School of Journalism and Mass Communication (SJMC), and Sijia Yang, an associate professor in SJMC, researchers know that people's attitudes on important topics tend to be related to sociodemographics like age, race, gender, class and income. And while all of this information can be used to shape how AI roleplays, it surprisingly does not lead the AI to produce beliefs or opinions characteristic of the corresponding groups. "For example, if we want AI to roleplay as a strongly religious person, it is more effective to tell the AI to act like someone who believes that miracles are real than to ask it to roleplay based on the demographics of highly religious people," Rogers explains.

How humans change their beliefs is not well understood. To figure out how to make AI more human-like, you first have to understand, well, humans. That's where Rogers' expertise in psychology comes in. He's collaborating with Jerry Zhu, a professor of computer sciences, and Robert Hawkins, an assistant professor of linguistics at Stanford University, to create computationally grounded models of human learning and behavior that help explain when and why people dig in on their beliefs despite facing contradictory evidence. One of these new models suggests that people jointly weigh trust and consensus significantly when updating their opinions.

It's essential to study influence. Historically, research has focused on how and why people change their beliefs, but the AI Terrarium is taking a new approach – studying the people doing the persuading. That's why Rogers' team is developing new mathematical theories coupled with behavioral experiments to better understand mutual, competitive influence under more realistic models of how people behave.

AI is learning from humans *and* humans are learning from AI. It's a symbiotic relationship. Perhaps the best illustration of this is looking at social media algorithms. The AI is learning what videos and ads will be most effective with the scroller while the scroller is taking in information from the content being served to them. Researchers have learned that these complex systems can be steered by specific inputs, but the question is: How can it be steered to support the greater good? "We need to understand the central dynamics of this system to ensure that such steering pushes society toward beliefs and behaviors that aid everyone," Rogers says.

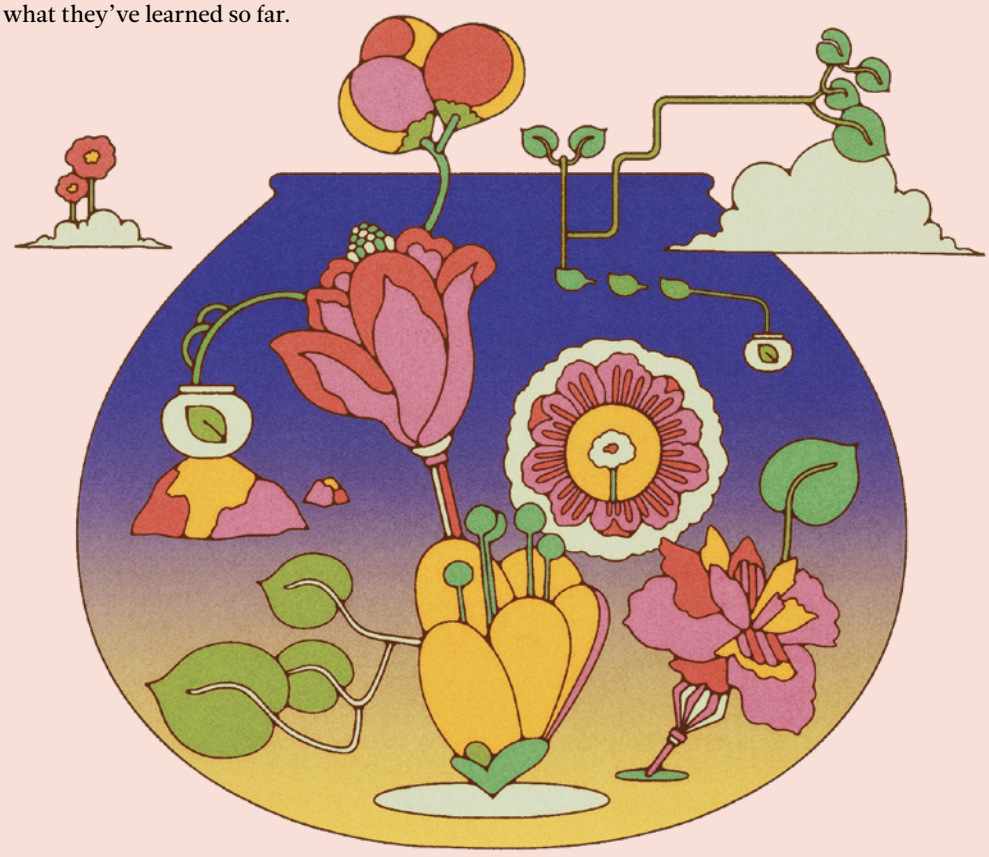


ILLUSTRATION: KATE DEHLER

Immersive experiences include University of Wisconsin Marching Band performances and concerts at the Hamel Music Center.

CULTURE

For Show

Virtual reality is transforming the way the Mead Witter School of Music can share their performances.

BY ALLI WATTERS

I'm on the turf of Camp Randall surrounded by percussionists sporting the University of Wisconsin Marching Band uniform. Corey Pompey, the associate director of bands and an associate teaching professor in the Mead Witter School of Music, is conducting as we play the familiar chords of "On, Wisconsin." I look down and it appears that I'm the one playing the snare drum, and as I turn my head every which way I see the whole organization. Trumpets, clarinets and trombones are all within my field of vision as well as the folks on the sidelines and in the stands watching us perform. It all feels so immersive — so real.

Except I'm not actually there. I'm sitting in the Humanities Building with Mead Witter School of Music Communications Manager Eric Murtaugh and Director Dan Cavanagh, who is also the Pamela O. Hamel Music Board of Advisors Chair and a professor of jazz studies and composition.

I take off the virtual reality headset and am instantly grounded back in reality. "Music in 2025 is no longer confined to the concert hall," Cavanagh says with a smile.

When Cavanagh first heard about Apple Vision Pro, which was released early last year, he immediately saw its potential for students, faculty and staff. He also saw an opportunity to increase accessibility to performances and a recruiting tool to attract top talent to the University. So, he tasked Murtaugh and Videographer Harry Browne with bringing this state-of-the-art technology to the music department.

While the marching band is a fun example of what the Apple Vision Pro can do, a more subtle performance from a symphony orchestra shines brightest. The musicians are on stage in the glossy, copper-lined walls of the Hamel Music Center performing with rich harmonies, dynamic crescendos and sweeping soundscapes.

"Music is a uniquely human experience, and to experience music in its fullest potential is to be in the concert hall with an audience experiencing those same emotions," Cavanagh says. "And the Hamel Music Center is really a crown jewel of Madison and the University — it's one of the best concert halls in the United States."

That's what people get to see when they stop by the Mead Witter School of Music booth at music conferences across the country. They not only see — but also get to experience — that UW-Madison has skilled musicians and a state-of-the-art concert hall, and is on top of their game when it comes to adapting to modern technology.

"The energy shifts when someone puts on the Apple Vision Pro," Murtaugh says. "The wow factor is there, and you can't get that with a brochure." ■

PHOTO: JEFF MILLER

FACULTY

Code to Recovery

John Curtin's lab is using artificial intelligence to help people who struggle with alcohol or substance abuse avoid relapses.

BY AARON R. CONKLIN

When you're addicted, almost everything can be a trigger. A location. A song on the radio. A memory. The smallest thing can unleash an irresistible craving that leads to relapse.

It's what makes overcoming addiction to alcohol and substances a lifelong daily battle for the millions who suffer from it. And it's one of the things that has driven John Curtin, a professor in the Department of Psychology, to spend the last decade developing technology-based tools that can assist users in avoiding relapse. Today, Curtin and his colleagues are deploying machine-learning algorithms to hone and give feedback on the effectiveness — and fairness — of the tools they have developed.

"Broadly, we're interested in supporting people through their recovery from alcohol and other substance-use disorders," says Curtin. "The research community is very clear that alcohol and substance-use disorders are chronic disorders that require lifelong management. We don't seem to treat them that way very well. We often provide initial treatments to help people stop or reduce their use, but long-term continuing care is rarely available. It's very difficult to pay attention throughout the rest of your life to the integrity of your recovery without additional support."

People in recovery from addiction need to pay attention to a laundry list of concerns to maintain healthy balance: stress levels, positive events, the social network

“It’s the first time we’re actually going to be able to give a tool to the participant that can potentially help them with their recovery.”

JOHN CURTIN

PHOTO: PAULIUS MUSTEIKIS

they’ll encounter when they leave the house, their daily lifestyles. The resources each individual needs to support their recovery vary wildly, especially over time.

Back in 2014, Dave Gustafson (’62, MS’63, PhD’66), an engineering professor who heads the Center for Health Enhancement Systems Studies (CHESS), created an app-based intervention program to help manage these concerns. In many ways, the app was extremely effective: It cut heavy drinking days in half, and it almost doubled the odds of abstinence over the first year of recovery for individuals following inpatient treatment.

But Gustafson noticed that many of the people who lapsed or relapsed during the first year hadn’t used the app in the days leading up to that lapse, and others hadn’t used the supports in the app that he thought would have been most effective for them. Gustafson approached Curtin and his lab with a simple question: Could you predict precisely when someone might lapse back to alcohol or substance abuse, and could you identify why and how best to support them?

The answer was yes. Backed by the first of several grants from the National Institutes of Health, Curtin was able to use the signals they were monitoring to begin predicting relapses for alcohol abuse. These signals included ecological momentary assessments (EMA). At various intervals, a set of questions was pushed out to users’ smartphones to gauge things like stressors, cravings and emotional state. The app also tracked a patient’s location, calls and texts.

“Those signals, by themselves, are useful for understanding how broadly healthy the individual is and how healthy their recovery is,” says Curtin, who got into addiction research in part because of what he calls a “dense family history” of alcohol and substance abuse. “We can see over time the shifts in their patterns and their movements.”

All that data was fed into machine-learning algorithms that developed predictions as to precisely when a patient was at risk of relapse. Over time and over grant cycles, Curtin’s lab has been able to use the algorithms in combination with interpretable AI techniques that allow them to understand why the models are making the predictions that they’re making — and how they might be improved.

“For one individual, it may be predicting that in the next day, they’re at high probability of lapsing, because they’ve had a number of stressful events recently,” explains Curtin. “For someone else, they may be at high probability of lapsing because they’ve been craving a lot.”

The interpretive models also suggest factors that could be contributing to the probability of relapse and recommend personalized interventions to address them based on the data being collected. Under the latest grant, the algorithms will collect data and provide messages to participants daily over a six-month period. At the end, Curtin will be able to measure how useful they find it and how willing they are to engage.

“That’s what we’re most excited about,” says Curtin. “It’s the first time we’re actually going to be able to give a tool to the participant that can potentially help them with their recovery. Everything up until now has been building the system, and now we can start to release and try to implement the system.”

The team is now working on addressing issues of algorithmic fairness. For example, the difference between predictors in an urban versus a rural setting can be stark, and algorithms are historically bad at making predictions for people of color, because the data used to train them aren’t always broadly representative. Curtin has intentionally addressed this problem in his research because he wants to make sure that this resource is a tool that anyone who is struggling with addiction can benefit from, regardless of their background.

“We need to be able to serve everyone with the tools that people can use to help with this, and that’s really what we’re hoping to be able to do,” he says. ■

STUDENTS

Ice-Cold Research

Two graduate students just returned from an epic—albeit frigid—ecological study in Antarctica. Here's what they learned from their time on the ice.

BY MARGARET SHREINER

The wind howls loudly, and strong gusts rattle the Korean War–era Jamesway hut from side to side as cold air seeps in. Researchers dress in big red parkas and white bunny boots before bracing the piercing air to perform routine maintenance at the nearby lake. The few tents that line the edge of Lake Bonney in the McMurdo Dry Valleys house the few researchers who study and monitor long-term ecological changes in Antarctica.

Last fall, graduate students Kayla Hubbard and Charlie Dougherty ('23) were among these select scientists, conducting research under Associate Professor of Integrative Biology Hilary Dugan.

"I have done three seasons, and this season has been the windiest I've seen," says Dougherty, who is earning his master's degree in freshwater and marine sciences.

Their task was to measure long-term changes in the frozen lakes in the area. Shifts in water level and ice cover are often caused by climate variation, but there haven't been big enough shifts lately to justify some of the numbers they were seeing. So, what's causing it? That's the question Dougherty sought to answer.

Dougherty focuses on permanently ice-covered lakes in the McMurdo Dry Valleys and specifically on how the ice on these lakes thickens and thins over time. These lakes are unique. Unlike most lakes that melt each summer, these lakes retain their ice cover all year, thinning in the summer and thickening in the winter. Using satellite imagery, he found that clean ice and snow reflect solar radiation, but the dark patches created by wind-blown sediment hinder the lakes' ability to reflect solar rays, increasing energy inputs into the lakes. These findings suggest that wind, along with regional temperatures and cloud cover, plays a major role in thinning ice layers on the lakes.

Hubbard's research is on Antarctic hydrogeology and how groundwater interacts with lakes beneath the frozen surface. This topic is relatively under-researched in Antarctica, so in the coming years it could give more insight into hydrological connections between glaciers, lakes and even the ocean.

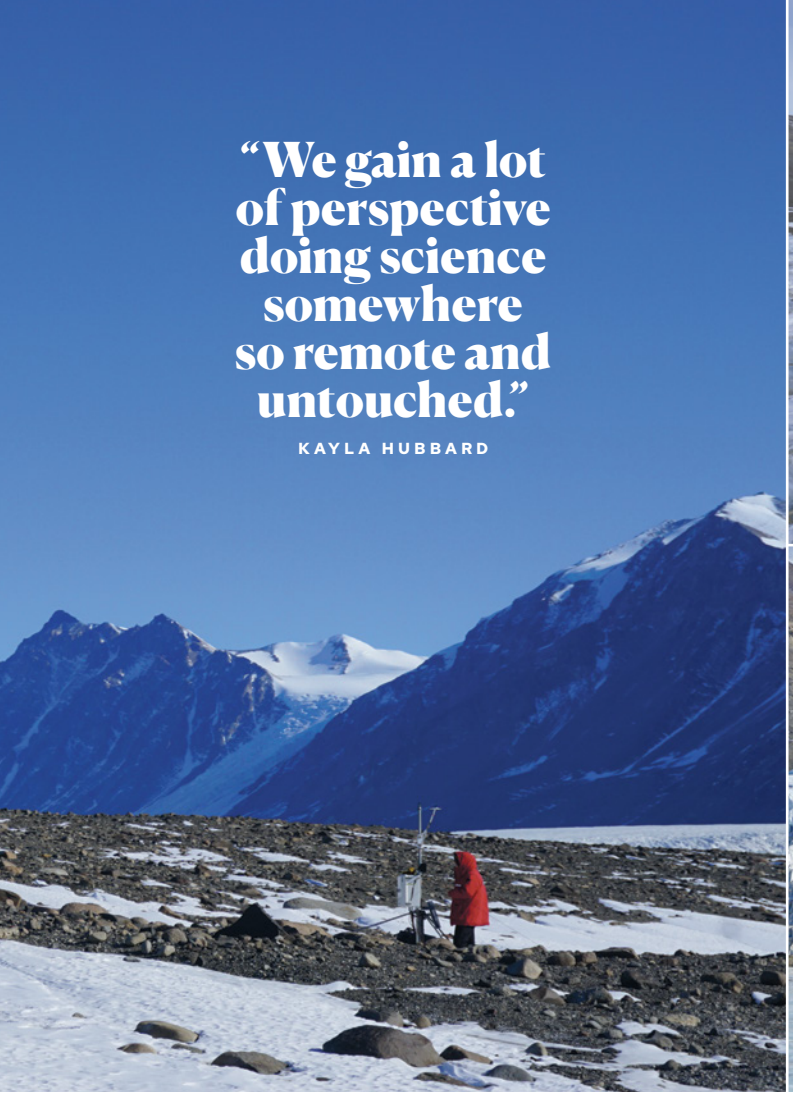
"It's a privilege to be able to work in such a unique and harsh environment," says Hubbard, who is completing a PhD in geoscience. "We gain a lot of perspective doing science somewhere so remote and untouched. [Antarctica] is so different from anywhere else on this planet, and that is amazing."

Despite the cold, there are benefits to doing research in such a remote environment. The McMurdo Dry Valleys are extremely sensitive to climate change. The glaciers, streams and ice-covered lakes are among the first to react when there are even small shifts in climate conditions. Hubbard and Dougherty's work may provide insights into geographical responses to human impact on the climate. Their research is part of a larger National Science Foundation–funded Long-Term Ecological Research project that has studied the valleys since the '90s.

"These long-term projects enable us to do science in a way that is impossible in normal grant cycles," Dugan says.

Hubbard and Dougherty's schedule for when they could travel to other lakes via helicopter or perform routine maintenance depended heavily on the environment. The day-to-day weather in Antarctica is extremely unpredictable, forcing researchers to remain flexible.

The grittier work happened at nearby lakes. That's where Dougherty and Hubbard had to drill through 12 to 15 feet of ice to retrieve last year's sensors and deploy new ones. They use regular ice-fishing augers, and the drilling process could take anywhere from 30 minutes to an hour, leaving them tired and covered in engine soot.



Kayla Hubbard (left) and Charlie Dougherty were part of a Long-Term Ecological Research study in Antarctica.

The sensors placed in the lake serve several different purposes. Light sensors measure the amount of sunlight penetrating lakes in the Dry Valleys, which was imperative to their work of understanding ecological conditions, and what organisms can live there. Even beneath more than 10 feet of lake ice, algae can survive and photosynthesize.

Hubbard and Dougherty also replaced and maintained pressure sensors to track how much the lake levels rise and fall. These sensors, along with temperature and conductivity sensors, were necessary for Hubbard to track the interaction between groundwater, subglacial discharge and lakes in the Dry Valleys.

Once the hole is drilled, researchers could spend two to four days melting ice around the sensors before replacing them. This required precision to ensure everything was swapped correctly and nothing froze in the process. The sensors record data all winter, so they must make sure everything is perfect before they leave.

“Those were our big days, and then the rest of our week was mostly spent building up to that,” Dougherty says.

Everyone who travels to Antarctica is held to environmental regulations outlined in the Antarctic Treaty guidelines to ensure that the natural habitat is not disturbed.

“How do we do science more efficiently and effectively to lower our carbon footprint while still being there? There’s been a lot of effort put toward reaching that goal,” Dugan says.

To protect the environment and lower carbon footprints, Dougherty and Hubbard were required to follow strict procedures. And while the scientists would prefer not to use fossil fuels to conduct maintenance and experiments, it’s a necessary part of the system set up to do the work as efficiently as possible.

“We try to strike a balance between finding new, innovative solutions and using methods from Antarctic researchers before us that we know work,” Hubbard says.

While adjusting to icy, dry Antarctica weather was challenging, and the work in the field was grueling, for Dougherty and Hubbard it was a life-changing experience.

“Working in Antarctica has given me the best education in environmental science anyone could hope for,” Dougherty says. Hubbard adds, “It’s really rewarding to complete a field season in Antarctica knowing that we were able to overcome challenges and still be successful.” ■

THE FUTURE OF HEALTH

From every possible angle, researchers across the College of Letters & Science are focused on critical topics that will change the way the world looks at medicine, health policy and personal wellness.

BY AARON R. CONKLIN
AND MARGARET SHREINER

ILLUSTRATIONS: INA JANG

Making a Mark

Eszter Boros and her lab team are transforming the way physicians can treat and diagnose deadly cancers.

THE GLOWING MARKER speeds through the patient's bloodstream, ineffably drawn toward the tumorous tissue like a bright, miniature homing missile. Once it arrives at its appointed destination, the surgeon looks at a monitor and knows exactly where the cancer is and where to begin removing it.

Welcome to the future of medicine, brought to you by the UW–Madison Department of Chemistry.

The ongoing development of this cutting-edge tool is the result of work done in the radiopharmaceutical laboratory of Eszter Boros, the Hall-Fisher Associate Professor of Chemistry and an affiliate faculty member with the Department of Medical Physics in the School of Medicine and Public Health, and it's just one example of the many ways researchers in the College of Letters & Science are advancing health, medicine and health policy. UW–Madison Chancellor Jennifer Mnookin's RISE-THRIVE initiative drives state-of-the-art research like this, which is funded by federal entities such as the National Institutes of Health. Elsewhere in the Department of Chemistry, researchers are finding ways to block the proteins in our bodies from aggregating and leading to diseases like diabetes and Alzheimer's. Meanwhile, researchers at the La Follette School of Public Affairs are exploring the ways that social genomics, a field focused on the complex relationship between social factors and the human genome, can have a dramatic effect on human health and lifespan. Over at the Sandra Rosenbaum School of Social Work, faculty members are busily mapping how the very environments in which we live can inflame our bodies and steer us toward dangerous disease states,

especially as we age. They're also searching for interventions to combat these issues.

Bioluminescent chemical markers aren't the only tools the Boros Lab is developing to help doctors treat different types of deadly cancers. Using what's known as radiometal chemistry, they're also studying ways to deliver targeted doses of radiation directly to cancer sites.

If you've ever heard of a standard positron emission tomography (PET) scan, you understand the essential concept. A PET scan depends on the presence of a radioactive isotope decaying and producing gamma rays that can be detected by a scanner to help with finding tumors or diagnosing diseases. Boros is an inorganic chemist, which means she works with metallic elements and ions rather than organic materials.

ESZTER BOROS
Hall-Fisher Associate Professor of Chemistry

> "It's very optimistic and ambitious. But because we have the expertise on campus, I think we can be ambitious."

"A metal ion doesn't just know where a cancer is on its own," explains Boros. "These radioactive isotopes need to be incorporated into molecules that are cancer-seeking, and that requires chemical tools."

Boros and her lab partner work with the Department of Medical Physics in the School of Medicine and Public Health to create those tools. Medical physics produces radioactive isotopes, and the Boros Lab then builds chemical cages around them, attaching the cage to a small molecule that can bind to a cancer cell. The chemical cage is injected into the patient's bloodstream, carrying its radioactive payload directly to the cancer site. The emitted gamma rays make it possible for doctors to scan the patient and monitor what's happening.

Unraveling which isotope and chemical combinations make for the best delivery systems occupies a large part of the Boros Lab's time.

"That's essentially what we do," explains Boros, who came to UW–Madison two years ago after a six-year stint at Stony Brook University in New York.

"From scratch, we develop methods to incorporate these isotopes that have been in the field for 20 years," Boros says. "We spend a lot of time trying to better understand their chemistry."

Boros and her team of graduate students mine the bottom rows of the periodic table to find the radioactive elements most likely to be effective — elements that, unless you're a chemist, you probably haven't thought much about. Rare earth elements like scandium (Sc) and yttrium (Y), europium (Eu) and terbium (Tb). Transition and main-group metals like titanium, gallium, copper, manganese and cobalt are also effective, says Boros.

"If there's an interesting chemistry problem to solve and turn into a new radiopharmaceutical, we're interested in it," she says.

The Boros Lab is closely watching the work of cancer biologists and biochemists who are identifying new cell surface receptors, potentially opening the doors for even more new ways to selectively deliver radioactive payloads.

"That's really where the personalized medicine aspect of this comes in," says Boros. "Identifying a biomarker that works for a specific patient for a specific cancer. Identifying just the right type of vehicle that delivers these radioactive payloads is going to be very powerful."

Most of the team's proof-of-concept work has been done with prostate cancer, a slower-developing cancer. Boros is anxious to test its efficacy in breast and ovarian cancer, which more often present in an advanced state, making therapies such as surgical resection and chemotherapy impossible.

"Having diagnostic imaging that shows the extent of disease, and then deploying radiotherapy, where we can then administer a second isotope that emits a particle that selectively kills cancer cells, is something that's much more useful in a situation where there are too many cancer sites in the body," explains Boros. "The radiopharmaceutical, because it's cancer-seeking, can actually selectively deposit in the cancer cells."

Much of the Boros Lab's research has taken place with mouse models. But the lab is also interested in isotopes that start first in human subjects. One of the therapies they're considering involves titanium oxide, a biocompatible chemical that shows up in the deodorants many of us use every day. Boros' team has developed a molecular form of titanium that could be paired with a radioactive isotope to use for diagnostic imaging.

"The more tools we can demonstrate that are functional in humans, the more we can justify developing other chemistries and other isotopes that can be effective for these applications," Boros says.

These radiopharmaceuticals involve very small amounts of material, which means researchers aren't concerned with metal toxicity. They do pay close attention to levels of radioactivity to make sure healthy tissues aren't being damaged. Since targeted radiotherapy predominantly hits cancer cells, patients generally don't suffer from a lot of the side effects that typically accompany conventional chemotherapy.

Like most scientific advancements, development is often a slow and onerous process. Boros is hoping that the diagnostic titanium tracer could move into human trials in the next four years. The next step is finding a way to automate the procedures used to make the radiopharmaceuticals. That's another area in which medical physics can help.

"It's very optimistic and ambitious," says Boros. "But because we have the expertise on campus, I think we can be ambitious."

—Aaron R. Conklin

Nature and Nurture

Jason Fletcher and Lauren Schmitz study how our environments impact gene expression and how certain policies can predict health issues and biological aging.

JASON FLETCHER
Vilas Distinguished Achievement Professor of Public Affairs

LAUREN SCHMITZ
Associate Professor of Public Affairs

WITH STRICT REGULATIONS on smoking and tobacco use, why are smoke breaks still normal? Why do some people age more rapidly than others? In depression cases, why do patients respond to treatment options in varied ways?

Biology offers only part of the answer to any of these questions. Environmental, genetic and social factors together influence public receptiveness to health campaigns, policy or even certain medications. The study of all these factors is called social genomics, and two researchers in the La Follette School of Public Affairs are leading experts on the topic.

"When we negate part of the story by focusing only on nature or only on nurture, it's like tying one hand behind our back — we can't solve the full problem," says Jason Fletcher (MS'03, PhD'06), a Vilas Distinguished Achievement Professor of Public Affairs.

Fletcher's research on social genomics seeks to bridge the gap between genomes and the environment to determine how public policy, childhood and genetic factors impact health and aging. He points to the smoking example and historic policies that established smoke-free zones, taxes on cigarettes and public anti-tobacco health campaigns as a prime example of how his research could better inform these efforts. While this approach was effective with some members of the population, others were left behind, like people with a family history of addiction in their genetics.

"Everybody in a specific area has those same top-down policies, yet they potentially are more effective on some people than others," Fletcher says.

A more clinical use of Fletcher's research looks at the application of social genomics in depression treatment. When physicians are weighing their options between therapy and antidepressant medications, Fletcher says they should also be looking at factors like family background, current environment and genetics. Knowing this will help predict how effective different treatments will be.

Lauren Schmitz, an associate professor of public affairs, also researches social genomics. Specifically, she looks at epigenetics, which is the study of how genes are turned on and off without changing the DNA sequence. While a person's genetic code is fixed, their environment can alter how specific genes work, leaving a genetic marker called DNA methylation.

"If we look at people's DNA methylation, it's highly correlated with aging," Schmitz says. "We can use people's epigenome to measure their biological age."

Schmitz looks at how epigenetics can be used to help evaluate health disparities among people of different socioeconomic backgrounds. For example, children whose mothers were malnourished may over-respond to calorie-dense food when they are born, causing metabolic disorders like diabetes or cardiovascular diseases.

Other prominent cases of epigenetics include regular exposure to lead pipes or pesticides. If a person is exposed to lead pipes throughout their life, this alters DNA methylation, leading to changes in brain development, cognition or behavior. Similarly, pesticides modify genetic expression patterns, which could disrupt endocrine and neurological functions. The exposure to these toxic substances is not evenly distributed among the general population, meaning some communities are more likely to be impacted.

Schmitz hopes that this data can help examine how certain policies, like parental leave, impact someone's gene expression throughout their life, ultimately determining their biological clock.

"We used to have to wait for people to die to understand why some people are dying faster than others, and now we can see, kind of in real time, what's going on in your body," Schmitz says.

Currently, there are gaps between research in social genomics and real-world implementation, largely due to a lack of representative data for all communities.

"We need data that actually represents diverse populations, and we're making progress there," Fletcher explains. "Right now, we're still years away from having truly equitable clinical applications of this research."

—Margaret Shreiner

WEIDI QIN
Assistant Professor of Social Work

Stress, Out

Weidi Qin is looking out for older adults in her research that analyzes how neighborhood life factors into long-term health.

MEDICAL EXPERTS have long known that inflammation is one of the primary factors that leads to chronic and debilitating conditions like heart disease and diabetes. They're also aware that one of the primary things that leads to inflammation is stress. Stress looks different to everyone, but to older Americans, one of the biggest sources is the neighborhood environment in which they live.

Weidi Qin, a gerontologist and assistant professor with the Sandra Rosenbaum School of Social Work, studies the socio-structural determinants of cardiometabolic health in older adults. Her latest project looks at pathways linking older adults' perceptions of their neighborhood disorder to health behaviors and the C-reactive protein, a general biomarker for inflammation.

Qin was born in China and raised by her grandparents, which cultivated her interest in and comfort around older adults. She examined data from the Health and Retirement Study, a national longitudinal survey of adults aged 51 and older in the U.S. that collects extensive data on socioeconomics and health.

"Do they see any graffiti?" asks Qin. "Because graffiti can sometimes be seen as a proxy of crime and perceived unsafe conditions in the neighborhood. Litter on the ground is another one, which indicates whether the streets are walkable and whether the environment is friendly for outdoor exercise."

Negative neighborhood perceptions can impact an older individual's ability to get regular physical activity (leading to even more inflammation) and connect with neighborhood social networks. Interestingly, Qin's findings suggest that physical activity accounts for the effects of neighborhood disorder on elevated inflammation among white participants, but not among Black participants.

"Older African American people may seek alternative coping mechanisms, such as reaching out to their family and friend networks for social support to help buffer the negative effects," she says.

Qin's eventual goal is to identify potential interventions for older adults living in neighborhoods that have disorders. One of her next projects will be to examine neighborhood and health among older African American Milwaukee residents.

"Older adults are a special population," says Qin. "They may have mobility and frailty issues, so it is important to consider their distinct needs in the neighborhood context." ■

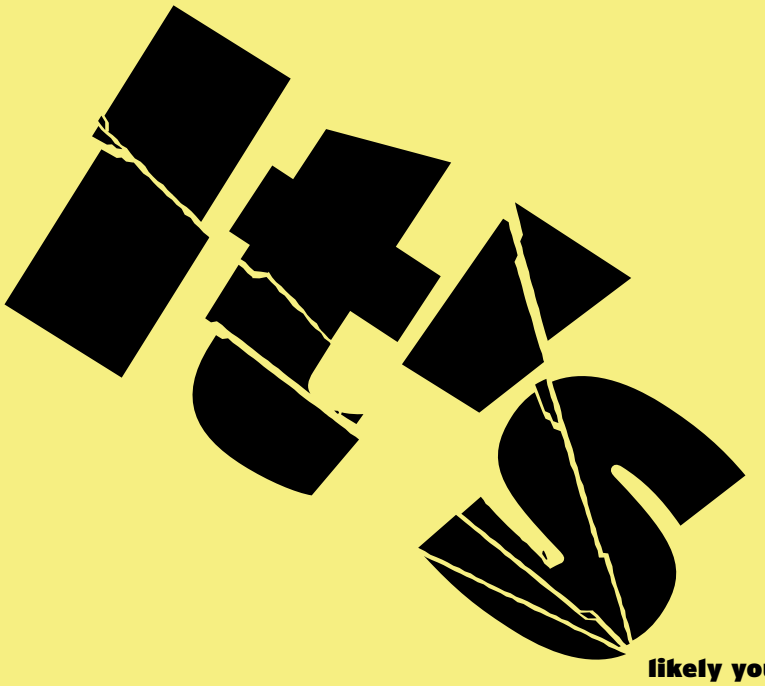
—Aaron R. Conklin

A CONCRETE SOLUTION

From a small up-north Wisconsin town, these Badgers are running a global corporation that plays an impactful role in building transportation infrastructure and supporting their local community.

BY ALLI WATTERS

PHOTO: COURTESY OF ANTIGO CONSTRUCTION



likely you've seen their trucks on the interstate. They're readily distinguishable with their Badger-red branding and hefty concrete crushers welded to the back. The heavy machinery is designed to crack, break and rubblize pavement. They travel the globe to perform a niche service in the transportation industry that recycles worn out concrete and makes our roadways drivable. But as the bold, all-caps lettering on all sides of the semis advertises, these trucks hail from Antigo, Wisconsin.

Situated about three hours due north of UW–Madison's campus, Antigo is a small, close-knit community in Langlade County. It was founded in 1878 and nicknamed the "gateway to Wisconsin's Northwoods." Thanks to the city's proximity to lush forests, this area historically thrived during the height of the lumber industry. It also shares its name with the official state soil, Antigo Silt Loam, which has long been a boon for the local agricultural business — specifically potato farming.

Over the years, the economics of the area have shifted, but drive through the intersection of 5th Avenue and Superior Street today and you'll still find a charming downtown with a classic movie theater and a locally owned flower shop. And two minutes down the road, you'll stumble onto the family-owned-and-operated Antigo Construction's humble headquarters. Humble, because it's not every day that an internationally renowned company plants its flag in an area better known for ice fishing than city life.

"You often hear the phrase that people learn work ethic on a farm," says Antigo Construction President Matt Shinners ('87), who majored in political science and economics when he was a student in the College of Letters & Science. "Well, you don't have

> **Having an effective transportation system is a value to society. And even though in the grand scheme of things, we're a very small part of that — we're an important part.**
>
> **MATT SHINNERS**
> ANTIGO CONSTRUCTION PRESIDENT

to learn it on a farm, but that work ethic, that familiarity with engines and ability to repair equipment — there's a good base of that in our part of the state. And if someone has an interest in seeing the country, or even seeing the world, we're able to provide excellent employment opportunities."

Matt and his brother Chris Shinners ('88) are the leaders at Antigo Construction, cementing the legacy that their father, George Shinners ('61, MS'64), laid the groundwork for years ago when he took an entrepreneurial leap and founded the company. But to truly understand how rooted the construction genes are in this family, you must first start with the family tree of their mother, Jane Shinners ('64). Her grandfather moved to Wisconsin from Bohemia, and he had a business carving out foundations for buildings using a team of horses.

"That's when horsepower actually meant horsepower," Matt says with a smile.

George, who majored in psychology during his undergraduate career, learned a lot about the business working for his father-in-law's construction company. But it was a trip to Germany in 1982 that sparked the inspiration that would lead to his thriving business. He was on a factory tour when he saw it stashed in a corner — a concrete breaker. It was the first one he'd ever seen, so he asked about it. Within a year, he was renting the German-made equipment, and by 1989, Antigo Construction was manufacturing their own to use around the U.S. and Canada. Fast-forward more than three decades later, and the Antigo-branded machines have traveled as far as South America, India, Belgium, Poland, the Czech Republic, China, Saudia Arabia and beyond. They've even opened an Antigo Construction hub in England to service the United Kingdom, Ireland and continental Europe.

"Our father is the one who took the big leap and bought a couple of breakers, but we're continuing that on to make it bigger and better," says Chris, who is an owner and project manager for Antigo Construction. "We're proud to represent this company."

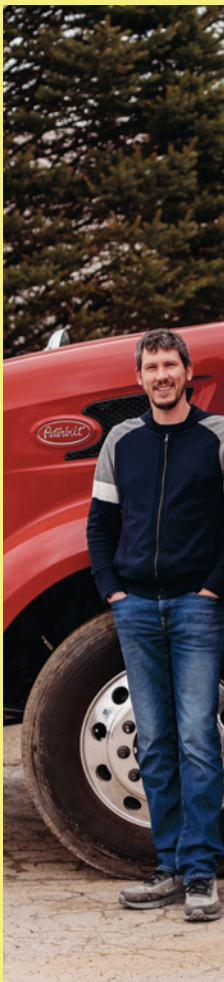
And that sense of fulfillment isn't just from Chris and Matt. Walk around the office, and you'll hear a lot of talk from staff about how they take satisfaction in being the absolute best at what they do. You might also spot some Bucky Badger gear, since the brothers have fellow alumni David West ('91), Jason Jansen ('93) and Mark Reimer ('04) on the staff with them.

"We're the worldwide leader in what we do, and it's really neat to be able to work all over the country and all over the world while working for an awesome little family company like this," says West, a project manager. "There's really no better feeling than seeing a highway project completed," adds Jansen, a project manager. "I like our little niche of how we break the concrete so that it can be reused in a lot of different ways and recycled," adds Reimer, Antigo's estimating manager.

Here's how it works. Anyone who's ever driven over a pothole knows that concrete doesn't last forever. But before installing new pavement, contractors must first reckon with the old stuff. That's where Antigo Construction comes in. Their equipment breaks down the old concrete so that it can get removed or — in the case of rubblization — broken down in place to the point that it can be recycled as a base layer and paved over.

They're not involved in the paving of new asphalt or concrete, but the equipment needed for Antigo's crucial contribution to the construction process is expensive to make and maintain, which is why they're able to

PHOTO: DELTA WAUPEKENAY



specialize in such a specific service. And concrete is everywhere, from interstates to airport runways to military bases. Once Antigo Construction even took a job for the garage where the president's plane, Air Force One, gets stored.

"Having an effective transportation system is a value to society," says Matt, whose son now works for Antigo Construction, making it a three-generation family company. "And even though in the grand scheme of things, we're a very small part of that — we're an important part. And by doing our job well, I think we allow other contractors to produce new pavements that will last a long time and serve their communities."

The team at Antigo Construction takes pride in being organized and efficent and in getting the job done with excellence. They meticulously track the locations and routes of their machinery, even marking up a map on the wall of their office with pins to keep tabs on where all of their staff and equipment are. The brothers credit some of the team's success to having five Badgers on the leadership team.

"My thought is that if you get through that school, you can pretty much go on to do anything you want," Chris says. "You're very trainable, you have good work ethic and study habits. You have everything you need to succeed."

The Shinners have long been supporters of the University, the College of Letters & Science and programs like the Center for Academic Excellence, which offers a six-week summer residential experience to support freshmen who might find moving to such a large campus jarring, including students from smaller communities like Antigo.

Both Matt and Chris look back at their time on campus as the place where they learned the skills needed to lead this company. They also look at their company story as an example that showcases the positive ripple effects of the Wisconsin Experience.

"Students who go to UW–Madison and choose to stay in the state help our economy," says Matt. "We're just one example of the value that brings to a community." ■

From left to right: Mark Reimer, Matt Shinners, Chris Shinners, David West and Jason Jansen

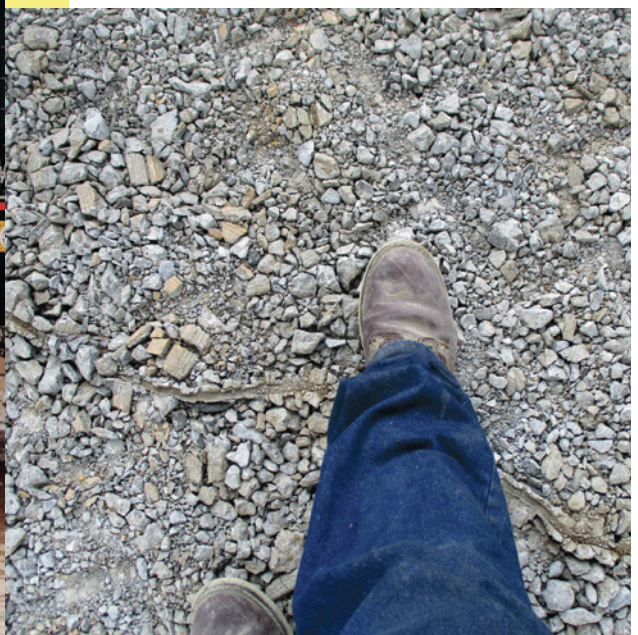


PHOTO: COURTESY OF ANTIGO CONSTRUCTION

IN THEIR ELEMENT

Water. Fire. Air. When it comes to today's biggest environmental challenges, these are the elements at the heart of the issues. Meet three L&S experts who are at the top of their field in finding sustainable solutions.

BY ALLI WATTERS

Emily Stanley studies lakes all across Wisconsin, from Lake Mendota in Madison to Trout Lake in Vilas County.

PHOTO: CARLIN SOOD

When Emily Stanley says she's knee-deep in her research, she means it literally. The professor of aquatic biology and ecology spends many of her days taking samples in Wisconsin's rivers, streams and lakes around Madison and at the Center for Limnology's Trout Lake Station in Vilas County. And when she's not in the water, she's diving into the data and analyzing what is going on in some of our most precious freshwater resources.

"I love Wisconsin, because everyone here seems to have a connection to and an appreciation for water — because some part of their life is linked to all of these lakes and rivers that we have," Stanley says. "My hope for a brighter future is that people recognize the value in that and really prioritize making sure that things don't get worse and, perhaps, even get better."

The things that Stanley is looking for as a scientist when evaluating the health of a water resource aren't all that different from what passersby look for when they're deciding if they should take a dip. She's looking at water quality and whether there are algal blooms, zebra mussels or dead fish. But she and her research team in the Stanley Lab aren't just passing by. In some cases — such as the North Temperate Lakes Long-Term Ecological Research (NTL-LTER) program — they've been studying these lakes for 44 years. This effort is part of the larger LTER Network funded by the U.S. National Science Foundation (NSF) since 1981.

"LTER allows us to be in the right place all the time," Stanley says. "We have this remarkable long-term data set that is unique in the world."

For example, there's been a lot of attention on winter salting in cold states like Wisconsin. The salt used to prevent slipping on sidewalks and roads ends up in our lakes, and this study has allowed researchers to understand the consequences of that salt buildup. What they found is that not only has salt content in lakes increased over the past 40 years but that the salt is interrupting the stratification of lakes in the spring, which is what's responsible for the temperature layers in lakes like the cold bottom and warm top.

In true Wisconsin Idea fashion, scientists on campus have worked with city leaders in Madison to help reduce excess salting in the city to support beloved water resources such as Lake Mendota. But for Stanley, efforts like this are just the beginning. As she researches more climate struggles such as how human activity is increasing the amount of greenhouse gases coming out of surface waters or adding more phosphorus to lakes that fuel algal blooms, she wants to remind people that problems develop over a long time and take a long time to solve.

"We know from our science that if you could magically wave a wand and stop all the phosphorus from going into Lake Mendota today, it would be many years before we would see the phosphorus concentrations going down in the lake," Stanley says. "We humans are impatient, and the lesson is to not give up just because it didn't happen really fast."

For Monica Turner, being in the right place at the right time meant being at Yellowstone in the summer of 1988 when lightning sparked 18 massive fires that scarred 800,000 acres (or about 36%) of the national park.

"We never did the project we thought we were there to do," says Turner, the Eugene P. Odum Professor of Ecology and Vilas Research Professor in the Department of Integrative Biology. "But we were able to start studying the effects of those fires in what I call a natural experiment."

Pointing at photos of the aftermath of the flames, Turner describes a "mosaic" etched across the landscape. There are blackened areas where the trees were all killed, but also brown edges where the pine needles and cones hadn't fully combusted, as well as green space where the forest still lived. In the 37 years following those fires, she's carefully studied that mosaic as it changes and recovers to answer one critical question: What happens when a forest burns?

Her pursuit of understanding has led to massive studies on everything from plant communities to elk populations to aspen trees. Early on, the findings were surprisingly optimistic. She learned that forest systems were incredibly resilient. Wildlife, native species of plants and trees all came back. This was by design, since these forests had burned once every one to three centuries for the past 10,000 years. But this positivity was challenged by climate warnings that predicted that the hot, dry conditions that caused the fires of 1988 would eventually become the new normal.

"That completely challenged my understanding of the system and what the future might be," says Turner, who wrote the textbook on landscape ecology. "From that point I shifted a lot of our effort to understanding what would happen and whether forests could persist if fire became more frequent."

Turner's passion for the Greater Yellowstone Ecosystem is unwavering, and she's trained a generation of new fire ecologists who match her enthusiasm for this beloved ecosystem through the Turner Lab Group. Together they study how and why the forests will change and preview what tomorrow's Yellowstone will look like. In 2016, the opportunity to test theories about frequent-interval fires came in the form of another wildfire across much of the same landscape as 1988. As she predicted, the forest wasn't ready to respond so quickly, and very few trees came back. What once was a lush young forest is now an airy meadow.

"My research journey has been a long and winding road, which is very characteristic of the way science works," Turner says. "But it's important to understand how natural ecosystems are adapting and responding to a change in climate. Without that, we'll be pretty clueless about how these ecosystems will respond."

Monica Turner returns to burn sites decades after wildfires to research new plant growth.

PHOTO: ALTHEA DOTZOUR

> **"What we're doing with satellite data now — 10 or 15 years ago, that would've seemed like science fiction."**
>
> TRACEY HOLLOWAY

Tracey Holloway has worked on air quality solutions through government service and academic research.

PHOTO: HILLARY SCHAVE

Analyzing the last 50 years of American air quality, Tracey Holloway sees a success story.

"The work we've done on clean air in the United States has been amazing," says Holloway, the Jeff Rudd and Jeanne Bissell Professor of Energy Analysis and Policy jointly appointed in the Department of Atmospheric and Oceanic Sciences and the Nelson Institute for Environmental Studies. "We're driving more, using more energy, and our population and economy have grown, but our air — aside from wildfires — has gotten cleaner and cleaner."

In the 1970s, air quality was suffering due to industrial pollution, but thanks to intentional policymaking and industry investments in cleaner cars and greener electricity sources, Americans have benefited from cleaner air year over year. Holloway's been a part of this effort firsthand. She served twice as the leader of the NASA Health and Air Quality Applied Sciences Team (HAQAST), where she used NASA data to work with stakeholders and create beneficial policies.

Today, she continues to make a difference by training the next generation of air quality scientists and conducting critical research through her lab, the Holloway Group. Together, scientists, graduate students and undergraduates work to advance air quality research that informs science and policy. They regularly partner with organizations on the local and national levels to make sure their work serves real-world needs. Having worked in air quality for more than 20 years, Holloway's amazed at how far the field has come and the progress that has been made.

"What we're doing with satellite data now by tracking what people are breathing on the ground and using that to make policy decisions — 10 or 15 years ago, that would've seemed like science fiction," she says.

When tackling air quality challenges, scientists are looking at particulate matter and nitrogen oxide levels. Both these chemicals are reactive, which is why applying pollution control devices at power plants and on automobiles has been so effective. However, carbon dioxide isn't reactive, which makes addressing the climate carbon challenge more difficult. Still, Holloway is hopeful that there are ways to take the research done on air quality and apply it to lowering carbon dioxide rates. But she knows it will take collaboration between researchers, policymakers and industry to make that dream a reality.

"I really believe that science is a team sport," Holloway says. "And I think there are a lot of win-win opportunities to take what we've learned about air pollution control and apply it to carbon control so that we can get cleaner, healthier air and tackle climate change and carbon emissions." ■

PHOTO: FRAZER HARRISON / GETTY

Bad Bunny worked with the history department's Jorell Meléndez-Badillo for the visualizers of his newest album.

A Historic Collaboration

Jorell Meléndez-Badillo didn't bring his computer on vacation last year. But he did bring his cellphone, and that's what allowed the assistant professor of history to see the Instagram message from representatives of Puerto Rican trap-rapping superstar Bad Bunny. The musician was gearing up for the release of his sixth studio album, *DeBÍ TiRAR MáS FOToS*. He wanted to recruit Meléndez-Badillo, a Puerto Rican native and the author of two books about his home country's history, to create a series of YouTube visualizers for each of the album's 17 tracks. Meléndez-Badillo leapt at the opportunity, spending the next week writing a whopping 74 handwritten pages of historical highlights, all in Spanish, including one that discusses the origins of the Puerto Rican flag and another that details the initial encounter between Indigenous Puerto Ricans and an expedition led by Christopher Columbus.

"[Bad Bunny] was really interested in having that sort of historical component, so people were not only listening to the songs in YouTube but learning their history while they do so," Meléndez-Badillo told the *Los Angeles Times*.

The songs — and the visualizers — have since reached hundreds of millions of people, raising awareness of a history that is rarely studied and often misunderstood.

MAPPING THE WISCONSIN IDEA

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DOUGLAS COUNTY

For the past seven years, the Wisconsin Dugout Canoe Survey Project has been documenting and creating 3D virtual models of dugout canoes used by members of Wisconsin's Indigenous tribes, including a red pine dugout found in the Bois Brule River and now housed with the Douglas County Historical Society.

FOND DU LAC COUNTY

Researchers in the Department of Planning and Landscape Architecture created *Farm2Facts.org*, a set of online tools that enable managers of the Downtown Fond du Lac Farmers Market to collect, analyze and report helpful data on the market's reach and operation. The software now serves more than 100 markets and hundreds of farmers across the country.

LAFAYETTE COUNTY

Ever stood in Yellowstone Lake State Park in Blanchardville during the summer months and stared up at the stars? It's a lot more interesting when you do it with astronomy professors, who routinely hold Universe in the Park sessions there each year. Locals and park visitors get a chance to catch up on the latest astronomical news and, if the weather's clear, view constellations through powerful telescopes.

Gurindar Sohi—Vilas Research Professor, John P. Morgridge Professor and E. David Cronon Professor of Computer Sciences—is the first UW–Madison professor to receive the Computer Pioneer Award in Honor of the Women of ENIAC from the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. The award celebrates individuals whose enduring contributions have propelled the growth and sustained impact of the computer industry.

Professor of Mathematics **Mihaela Ifrim** received the Presidential Early Career Award for Scientists and Engineers, the highest honor bestowed by the U.S. government on outstanding scientists and engineers early in their careers. Ifrim's research involves nonlinear dispersive equations, fluid mechanics and harmonic analysis.

The Lucky Ones, a memoir penned by **Zara Chowdhary**, a Hindi instructor in the Department of Asian Languages and Cultures, was selected as one of the top 10 nonfiction books of 2024 by *Time Magazine*. The book details Chowdhary's experiences as a teenager with sectarian violence in India in the early 2000s.

At First Brush

Was a real Vincent van Gogh painting sold at a garage sale? That question is at the heart of one of the biggest art debates of our time. It started when an art dealer walked up to a garage in Minnesota and bought an oil painting for less than $50 and ended with the prominent art research firm LMI Group International declaring that it is a lost work by van Gogh worth $15 million.

Susan Brantly, a professor in the Department of German, Nordic, and Slavic+, was one of the experts featured in the 458-page report that came to this conclusion. The painting portrays a rosy-cheeked fisherman who shares his name with the work of art, "Elimar." That's where Brantly's expertise on Nordic art and literature came in handy, because she was able to answer a crucial question of the case: Who is Elimar? It turns out van Gogh was an avid reader, and Brantly believes the fisherman is a character from Hans Christian Andersen's *The Two Baronesses*.

Despite the time, investment and research efforts LMI put into verifying the painting and understanding its story, the authenticity of it remains unofficial. The Van Gogh Museum in Amsterdam has yet to recognize it as one of the late artist's works, so far standing by the initial judgment they made five years ago when the painting first crossed their path.

Real Reels

While Danny Kim ('08) came to UW–Madison with plans to become a doctor, the Department of Communication Arts inspired him to change course and follow his passion for film. Now, he is the founder and executive director of Docu+, a South Korea–based studio that's dedicated to producing documentaries with a focus on social issues.

He's currently working on his second feature-length documentary. Called *August, Again*, Kim and his crew are following a second-generation Korean atomic bomb survivor who is fighting for her son's medical treatment rights. "This documentary is especially timely, as this year marks the 80th anniversary of the Hiroshima and Nagasaki bombings, and we are still living in a world where nuclear threats are real," Kim says.

The film gets its name from the survivors' tradition of gathering in their communities each August to remind the world of the horrors they endured and advocate for change.

Down to a Science

This year, three College of Letters & Science faculty were elected to the ranks of the American Association for the Advancement of Science (AAAS), the world's largest general scientific society: Anne Pringle, the Mary Herman Rubinstein and Vilas Distinguished Achievement Professor of Botany; Ive Hermans, the John and Dorothy Vozza Professor of Chemistry; and Timothy Smeeding (MS'73, PhD'75), the Lee Rainwater Distinguished Professor Emeritus of Public Affairs and Economics.

Hermans was selected for his contributions to the development of catalytic materials and elucidating reaction mechanisms using kinetic and spectroscopic techniques. Pringle's contributions to mycology, especially fungal spore dispersal and the effects of invasive fungi on ecosystems worldwide, was honored. Smeeding was selected for his leadership in assembling and making available a worldwide database for the study of income dynamics and for distinguished contributions to the study of poverty and social welfare programs.

Fellows are selected for their achievements across disciplines, from research, teaching and technology to administration in academia, industry and government to excellence in communicating and interpreting science to the public.

Researchers are working to solve the mystery of "Elimar," a painting that turned up at a garage sale and could be a lost work by Vincent van Gogh.

MORE L&S NEWS AT
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In the Game

As a video game executive in a male-dominated industry, Meghan Morgan Juinio is paving the way for the next generation of women.

BY AARON R. CONKLIN

Last fall, Meghan Morgan Juinio ('94) came back to Madison to do something she's rarely done before: stand on a stage and tell her story in front of a packed room of videogame developers. More than 700 of them, in fact.

Morgan Juinio is the director of product development for Santa Monica Studio (SMS), the California-based game developer that produced, among other things, the uber-popular "God of War" series on Sony PlayStation. That made her an ideal keynote speaker at the 2024 Midwest Game Developers Conference (MDEV).

PHOTO: JOHN DAVIS

The gig gave her the opportunity to provide a perspective that isn't often showcased. The multi-billion-dollar videogame industry has experienced both unprecedented growth and difficult challenges, including battling long-standing issues with misogyny and sexism. A 2021 survey put the number of women in the industry at 30%, up 10% over the previous four-year period.

But as Morgan Juinio can attest, the number of female game development executives is significantly smaller. She didn't encounter a female studio head until she'd been in the industry for more than six years, when she worked on now-defunct publisher THQ's "WWE SmackDown! vs. Raw" franchise beginning in 2007. She found another female mentor when she joined SMS 11 years later.

"I've been on lots of projects and teams where I'm the only woman at the table or where I'm brought in because there's need for another perspective," she says. "And I've jumped at those opportunities, because I feel that diversity is what makes us better, but it's taken a lot of perseverance. I've had to learn how to function as a woman in the video games industry."

As part of the SMS leadership team, Morgan Juinio's job is realizing the game director's vision, making sure the internal development team has everything it needs to get the game out the door. Her responsibilities include team management, project management and maintaining studio culture.

The skills she has developed in these tasks are what’s moved her up the leadership ladder. But language is what opened the doors.

Morgan Juinio had always loved languages, starting with Spanish as a fifth grader in Milwaukee. But a disappointing experience with a teacher in eighth grade sent her in search of a different option in high school — Japanese. Morgan Juinio quickly leaned in, becoming the only girl in a group of students who won an essay contest held by Wisconsin-based Kikkoman Soy Sauce. Her prize? A 10-day tour of Japan.

“It was this brilliant life choice that ended up changing the entire trajectory of my life,” she says. “I realized, this language I’m learning is a tool. It’s a key that’s going to help unlock access to this whole other world that exists outside of Wisconsin.”

Morgan Juinio chose UW–Madison for her undergraduate experience, pairing a program in Japanese language and literature with a double major in political science and international relations, focusing on East Asia. Her language skills are what landed Morgan Juinio her first job in film-based computer graphics, working with Square USA on the 2001 CGI film *Final Fantasy: The Spirits Within*. It was also her entrée into the video game industry, working for Konami Digital Entertainment at a newly constructed studio in Hawaii. Half of her team were non-English speakers from the games industry in Japan, and the other half were from the computer graphics and film industry in Hollywood. Morgan Juinio’s challenge was to help bridge the cultural gap.

“Even though I didn’t have the development experience, I had the language skills, and I kind of had that cultural experience of living in Japan for a while before coming to Hawaii,” she recalls. “That was my opportunity. That was my foot in the door.”

Now, with multiple decades of experience in video-game development, Morgan Juinio is working to open that door for the next generation of girls. She has partnered with a Los Angeles-based group called Project Scientist, creating a week-long summer camp experience that introduces girls to video game design and walks them through the fundamentals of creating their own game. Female developers, including animators, engineers, artists, designers and writers from SMS, have given attendees a sense of the broad range of opportunities in the industry. Morgan Juinio also took advantage of the little-known fact that Brownies and Girl Scouts can earn a video game development patch. She helped members of LA-based troops earn one and has partnered with the group Girls Make Games as a judge of the demo games created through their summer camp program.

“What’s important to me is, how do we get more girls into the video game industry?” she asks. “How do we also get the women who are already in the industry seeing themselves in leadership and decision-making positions? The more that we can create pathways and opportunities for women to be in decision-making positions over the content, then the type of content that we’re going to get is just going to get broader and broader and hopefully more appealing to a larger swath of people.”

Before delivering her keynote at MDEV, Morgan Juinio workshopped it with a few female friends in the industry. One of them suggested she spike the word “relentless” because, for women, it can sometimes be seen as negative.

“I thought, I’m leaving it in. I can use the word as it applies to my own career growth and development,” she says. “That’s one of the reasons why I accepted the invitation to come back to Madison, to just stand up there and say, ‘I don’t have all the answers. I don’t have everything figured out, but this is my journey. This is my story, and here I am.’” ■

Casey Durandet was inspired by her former professor Albert Erwin. Now, she's mentoring students as a physics professor at Paradise Valley Community College.

PHOTO: BRANDON SULLIVAN

A Force for Good

Inspired by her mentor, a physics alumna continues a legacy of support, a quest for knowledge and the pursuit of discovery.

BY KATIE VAUGHN

It was the summer of 1984 when Casey Durandet ('89, MS'91, PhD'95) first stepped inside the Fermi National Accelerator Laboratory. That's where she saw a soaring four-story particle collider and when her future came into focus.

"I knew that's what I wanted to do," she says, referring to both the research being conducted at Fermilab — such as the Tevatron project, the world's most powerful particle accelerator at the time — and to physics more broadly.

And thanks to impactful experiences at UW–Madison, Durandet has become an integral link in a chain reaction of providing mentorship and support and encouraging bright futures in science.

Early Discoveries

The daughter of French emigrants, Durandet grew up in Madison eager to figure out how things worked. "I was a curious character, questioning everything, taking things apart, tinkering with everything," she says.

At UW–Madison, physics was a natural fit. As Durandet pursued a trio of degrees — her bachelor's and master's degrees in physics and a PhD in high energy particle physics — she augmented her studies with summer work at Fermilab in Chicago, where she got hands-on experience and put her critical thinking skills to use.

"At Fermilab, you have to think outside of the box. You have this problem, so you have to build this circuit board or debug this device," she says. "It showed me I didn't want to be a theorist; I wanted to be an experimentalist."

Another breakthrough on Durandet's path was meeting Albert Erwin, who taught her introductory physics course. When the professor was looking for a few students to help with work on a small collider experiment at Fermilab, she became part of his lab group and found her place on campus.

"Those years at UW were some of the best years of my life," she says. "I was doing things that I loved, working on experiments and working with like-minded people."

A Scientific Role Model

Erwin was an experimental high energy particle physicist who dedicated his career to teaching and researching at UW–Madison from 1959 to 2005, and as professor emeritus until his passing in 2011. He conducted experiments at laboratories around the world.

Erwin built much of the apparatus used in his research and was an early adopter of new technologies. He made important contributions to flavor physics — the study of different types of elementary particles and how they change during interactions — including work on Tevatron experiments at Fermilab.

In his own lab, Erwin oversaw PhD students as well as undergraduates, and he served as a mentor to many of them, including Durandet.

"He was a major influence in their lives," she co-wrote in Erwin's obituary. "Albert was a man of honesty, integrity and humility. He avoided the spotlight and always followed his curiosity and instincts."

After Erwin's estate created a significant endowment to support physics research projects, Durandet made her own gift in Erwin's name to endow a graduate fund to support female students in particle physics.

Catalyst for Change

Durandet is passionate about increasing diversity in the sciences. She was the sole female graduate student in Erwin's lab in the early '90s. Back then, about 12% of physics PhDs were awarded to women; today, it's around 21%.

Durandet works daily to try to change those numbers as a physics professor at Paradise Valley Community College, part of the Maricopa County College District in Phoenix, where she has taught since 1998.

Like Erwin before her, Durandet uses her teaching style and experiences in physics to inspire students, especially women interested in STEM careers.

"A lot of women want to take my classes," she says. "I find myself being a role model to them."

Durandet encourages her students to gain experience outside of the classroom, and some have participated in summer internships at Fermilab, where she spends most of her summers continuing to work in particle physics.

The combination of contributing to research, teaching and mentoring strikes a balance that Durandet finds fulfilling, just as Erwin did throughout his career. And she's excited to see where her support of physics students at her alma mater will take them.

"If it hadn't been for Albert, I wouldn't be where I am today," she says. "I want to pay it forward." ■

PHOTO: SABRINA WU

Potential Energy

As Anna Cooleybeck completes her fifth year as a physics PhD student, she's been contemplating the broader picture.

"One thing I've been thinking about a lot lately is big breakthroughs," she says. "You know a breakthrough is interesting, but you may not know what it will be used for. It may be an advancement, but you don't know the implications yet."

These are fitting thoughts for the most recent recipient of the Albert R. Erwin, Jr. & Casey M. Durandet Award, which supports graduate students working in high energy experimental physics. Durandet established the award in 2011, intending it to impact students, even if she couldn't predict exactly how.

Cooleybeck used the scholarship to support her time working at Fermilab in Chicago. Securing housing close to the lab allowed her to build connections with fellow students who would talk about their research and experiences after hours.

"It felt good to see that people were interested in the research I'm doing," she says of receiving the award. "It's also nice to recognize women in high energy physics."

Cooleybeck is currently analyzing two experiments that aim a beam of neutrinos from Fermilab to detectors hundreds of kilometers away, studying how the particles change. Analyzing the experiments together will create a more precise understanding of neutrinos.

"No one has simultaneously analyzed data from experiments that look at different parts of the same neutrino beam," she says. "The joint analysis allows us to explore techniques we can use for future experiments."

Beyond Highlight Reels

BY ASHLEY BROWN

From left to right: Althea Gibson, Johnny Unitas and Jackie Robinson

The notion that there are lessons to be learned through playing sports is as old as athletics themselves. Athletes, coaches and physical educators have long touted their chosen sports, whether individual or team-oriented, as holding wisdom. Citizenship, leadership, financial and business success, life happiness and manliness are just some of the most popular examples. As with any subject, though, the lessons learned through sports are influenced by each player's perspectives, their ambitions and, perhaps most important of all, their level of open-mindedness.

The lessons learned through sports history, it turns out, are no different. There is one crucial addition, though. Our understanding of sports history is immeasurably enriched by learning about the complexities of the lives and times of the individuals who played, organized, covered and watched these games.

Ashley Brown is an associate professor and the Allan H. Selig Chair in the History of Sport and Society in the Department of History. She is the author of *Serving Herself: The Life and Times of Althea Gibson*. Her newest seminar is *Sports, Health, and Presidents*.

As a historian and educator, I approach sports history as the ongoing story of how sports and American history — in all its intricacies — converge. People are drawn to history and sports in part because both are filled with stories, often powerful ones. Stories are driven by people. And the most compelling stories — which do not always have happy endings (in fact, they often do not) — consist of people who are multi-faceted. The sports figures that my students and I encounter are alternately embattled, persistent, ambitious, indecisive, unwise, defeated, triumphant, generous and self-involved, among other things. In other words, for all the successes and seemingly super-human abilities and feats of people in sports — the very reasons so many of us admire them — they are, like us, human. And like us, sports figures have interests beyond sports. They also struggle to make sense of an unceasingly complicated world and strive to find their place in it. The limelight as well as the spoils and pressures of fame perplex their efforts in ways most of us can only imagine.

Any serious study of sport must go beyond highlight reels. Conversations about landmark "firsts" must grapple with why trailblazers like Hank Greenberg, Jackie Robinson, Charlie Sifford and Althea Gibson, the subject of my book, emerged when they did. Doing so allows us to see that all athletes' lives and careers are impacted by events and histories beyond sports that shape not only their opportunities but also how they are perceived and what they symbolize. Discussions about Billie Jean King and the famed Battle of the Sexes are incomplete if Bobby Riggs is treated simply as a harmless, clowning blowhard, a relic of a distant past. We can talk about Johnny Unitas as the heroic star of the 1958 NFL Championship Game, which raised the popularity of football and inspired countless American boys to want to play the sport. That conversation, though, should also address the publicity that a physically ravaged Unitas received at the end of his life, as he confronted the league over disability matters and pensions for retired players. Seabiscuit was a valiant horse, winning races against better-regarded eastern thoroughbreds during the Great Depression. Yet we cannot forget that he was also an avatar for millions of Americans who felt overlooked because of their origins and class status as millions of people feel today.

"Show me a hero and I'll show you a tragedy," wrote F. Scott Fitzgerald. That observation applies to sports heroes, too. Sports history is more than trivia, and it is more than ever-smiling, one-dimensional icons hoisting trophies. Whether it is sports history or any other field of history, we gloss over and ignore the hard and inconvenient truths at our own — and our students' — peril. ■

ILLUSTRATION: MARIO ZUCCA

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Last Word

Just before sunset, the rain clouds cleared, and the last rays of light created this picturesque rainbow over Science Hall. Housing a handful of L&S units, including the Department of Geography, the red brick building at the bottom of Bascom Hill is one of the most beloved spots on campus. Over the years, it has served as a hub for the sciences, with the Departments of Geology, Zoology, Botany, Physics, Meteorology and more all calling it home at one point in their histories. The current Science Hall was constructed in 1887 to replace the original, which burned down in a tragic fire. The structure holds a notable superlative: It's the oldest still-standing building that uses structural steel, which was relatively new technology at the time it was built. The College of Letters & Science is working on restoration plans for this historic building.

PHOTO: ALTHEA DOTZOUR