UNIVERSITY OF WISCONSIN-MADISON COLLEGE OF LETTERS & SCIENCE

FALL 2020

Letters&Science

WISCONSIN IN THE INFORMATION AGE

page 22

Cameron Batchelor and Ethan Parrish, graduate students in geoscience, captured the climate-describing bands of color in a slice of stalagmite, and their photo was one of 12 winners in UW's 10th annual Cool Science Image Contest. This slice — at 250,000 years old, the oldest dated stalagmite in the Midwest — is being used to study the climate of ancient mid-continental North America. The colored layers reflect changes in soil above the cave in which the stalagmite formed, with rich soil (and thicker vegetation) revealed in deeper orange bands and less organic matter (and fewer plants) in light green. A panel of nine experienced artists, scientists and science communicators judged the scientific content and the aesthetic and creative qualities of the 101 images and videos entered in the 2020 contest.

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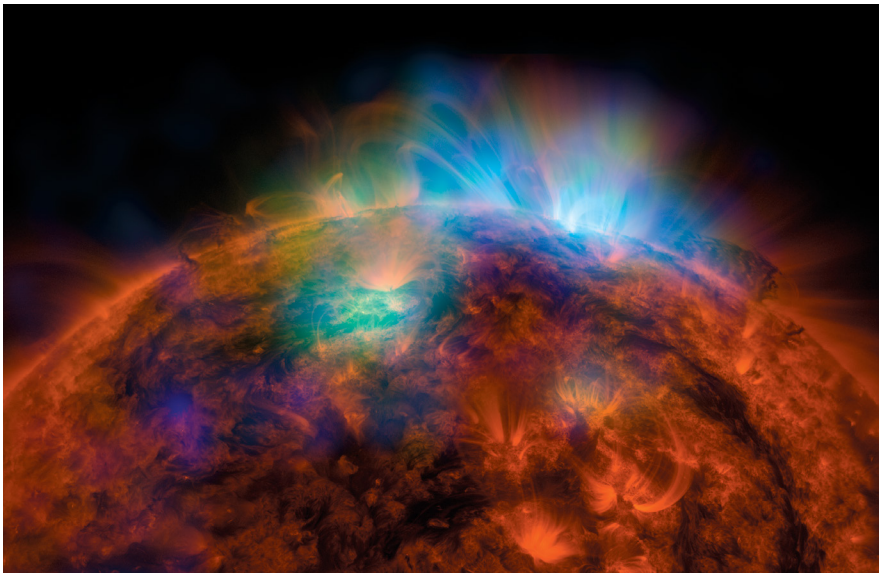

An image of high-energy emissions from the sun, courtesy of NASA.

PHOTO: NASA / JPL-CALTECH / GSFC

LETTERS FROM READERS

Hats off and cheers to you for the latest and greatest UW publication I have ever seen! The stories are intriguing, the graphics and colors completely amazing, and the entire issue "a keeper" in my already crowded library. Many thanks; your efforts are wholly appreciated and enjoyed.

A short Sami story [related to the "True North" article from Spring 2020]: My lady and I were in Northern Norway a year ago and visited a Sami village of temporary poled residences and chatted with a reindeer herder nearby. He [said that] his people felt fully integrated and included in the nation of Norway. How heartening to hear that a Western industrial democracy, with values similar to ours, has lessons for us, if only we could do it.

Best to you all, and On Wisconsin!

JEFFREY JAMES, PhD BS '64

The current stay-at-home rules have been difficult for everyone. But I suspect, with no data to support, that liberal arts students may be better able to deal with the confinement. L&S students tend to have a broad and diverse number of interests that find outlets in numerous ways. The idea that there need not be a choice between the active and the contemplative life — that both are possible — is deeply rooted in the liberal arts tradition.

My undergraduate degree is in English literature. I decided, given my interest in the outdoors, and my especial love for the wild rivers of northern Wisconsin, to enroll in the Water Resources Management program where I earned my MS degree. With that in hand, I joined the Wisconsin Department of Natural Resources. My career included special assignments to the U.S. Environmental Protection Agency, a stint at the Council of State Governments and a director role at the USEPA's Chicago office, running assistance programs in the newly free Baltic States as well as India, Chile and other countries. My final posting was to the U.S. Embassy in Copenhagen, Denmark, where I served as the first regional environmental attaché.

My background was quite different from the scientists and engineers with whom I worked. My L&S degree proved as valuable, if not more valuable, than my MS in water resources.

L&S, by its very nature, encourages integrative thinking that can resolve conflicts and define compromises.

JON GRAND (ENGLISH, '72)

The Spring 2020 issue of *Letters & Science* arrived in readers' mailboxes shortly after campus shut down in March.

Letters&Science

FALL 2020

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FROM THE DEAN

Digging In

I am honored to assume the role of dean for L&S, especially at this moment when we are facing such unprecedented challenges. The uncertainty we had in the spring about the global pandemic has carried on through the summer and points to an equally uncertain fall semester. Our faculty and staff have done a remarkable job of rethinking the academic year ahead to ensure maximum safety for all in the face of a global pandemic. At the same time we have been wrestling with how we can eliminate racism and injustice at UW–Madison and in our broader community. There is no more important time for the outstanding educational experience and world-leading research that guide the College of Letters & Science.

By the time you read this, if all goes as planned, UW–Madison will have welcomed students back to campus for the start of fall classes, and the semester will be well underway, with a mix of remote learning and in-person courses, as well as comprehensive protocols for keeping everyone safe.

But our rigorous planning can only take us so far. The virus, and human behavior, will determine the outcome of this highly unusual semester.

We have never faced a pandemic, social unrest and economic turmoil all at once — at least, not in my lifetime. But we have certainly weathered hard times. The 1918 influenza pandemic struck UW–Madison hard, but was overshadowed by World War I. The Vietnam War brought protests and violence to our campus and our city. Hard times — particularly times of protest — often bring about change. That's overdue here at UW–Madison, where many of our students of color have, for far too long, experienced a UW that feels less welcoming to them. One of my leadership priorities is creating an inclusive environment where all students can feel at home and thrive. There is a lot of work to be done.

As I look back on a turbulent spring and worrisome summer, I can't express enough gratitude for colleagues who have raised their voices in support for greater equity and inclusion for all, and who have transitioned their teaching to remote learning formats and reconfigured classroom spaces; for essential workers who kept campus operational and for students who adapted to new modalities of learning with resilience and strength.

This fall's magazine focuses on the good things: the outstanding students and the exciting research that continues to unfold here at UW–Madison, starting with our cover story highlighting our potential to transform the technology landscape, both on campus and around the state. Our new School of Computer, Data & Information Sciences, housed within Letters & Science, will expand computer and data literacy across campus, and spark some incredible collaborations and industry partnerships. A story about one of our top computer scientists, Miron Livny, chronicles how this pioneer in high throughput computing revolutionized the way researchers collect and analyze huge amounts of data. A third feature delves into the work of a leading physicist, Cary Forest, who is pushing the boundaries of plasma physics research with a Department of Energy grant to explore the creation of an efficient plasma fusion device, one that could advance the push for clean, safe nuclear energy. And do not miss our first-person student story, told with great honesty.

The year ahead will not be easy, but we will not give up. We will dig in — because that's what Badgers do. Thank you for all you do to support Letters & Science. It means the world to us.

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

PHOTO: KOLIN GOLDSCHMIDT

1

SPRING 2020

Confronting a Pandemic

2020 was the spring of uncertainty, change and resilience. For the first time in its 172-year history, UW-Madison shut down its campus in the face of a rapidly evolving threat: a new and highly contagious coronavirus, which was first documented in December, in Wuhan, China, and by March had spread to countries around the world, including the United States.

On March 11, Chancellor Rebecca Blank announced that UW-Madison would transition to remote learning and advised students who were leaving campus for spring break not to return. On March 12, all study-abroad programs were suspended, the NCAA canceled the men's and women's basketball tournaments and Wisconsin governor Tony Evers declared a statewide health emergency. On Friday, March 13, classroom doors closed, not to reopen to students until Fall 2020.

L&S moved decisively during this time. The rapidity with which instructors transitioned their classes to a remote format was extraordinary. Faculty and staff worked round the clock, and more than 90% of courses resumed online with little more than a week's notice. The Wisconsin Foundation and Alumni Association created the Emergency Student Support Fund to assist students and families.

2

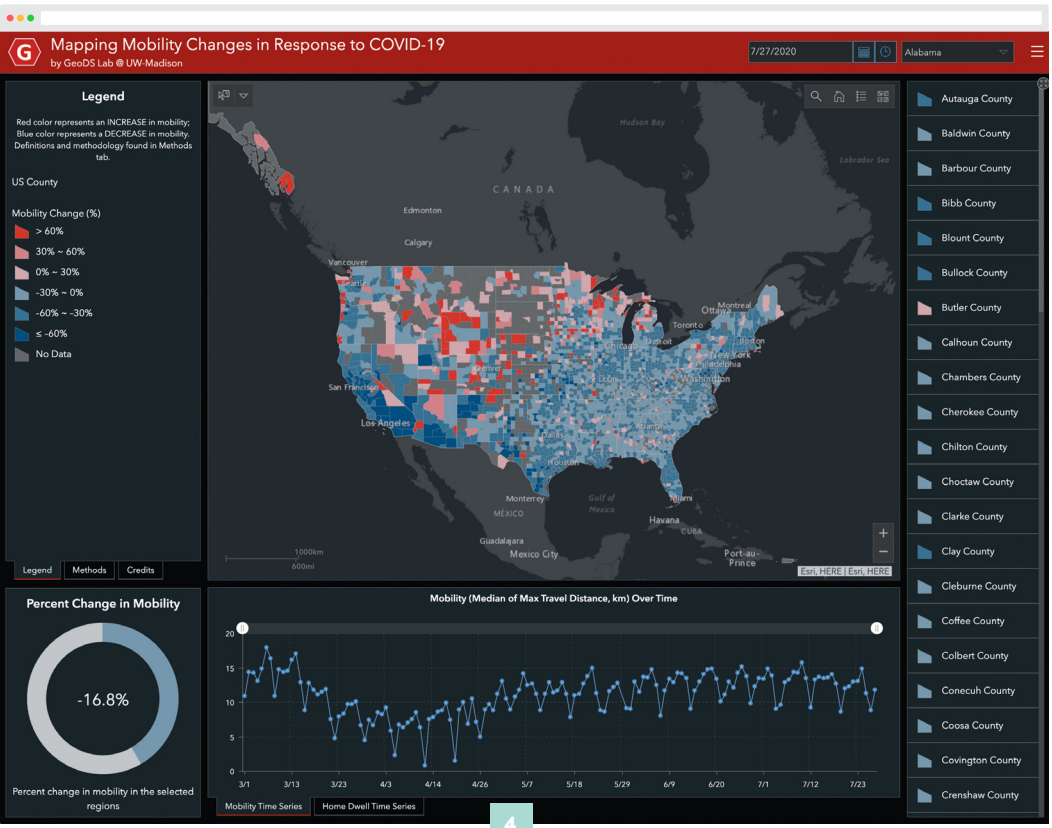
"Even if you think you're healthy, even if you think you're invincible, you can be like me and feel like you could almost die from it."

AMY SHIRCEL,
a 2020 graduate with a double major in Political Science and Environmental Studies, whose tweet about her ordeal with COVID-19 went viral in March. Now fully recovered, she has donated plasma in hopes that her antibodies can treat others.

3

Virtual Commencement

L&S released its first-ever online commencement celebration video (following UW-Madison's virtual celebration) on Saturday, May 9. Heartfelt messages from L&S faculty and staff, remarks by Dean Eric Wilcots and student leaders let the class of 2020 know that they will always have a special place in our hearts. (Visit @UWMadisonLS on YouTube.)



4

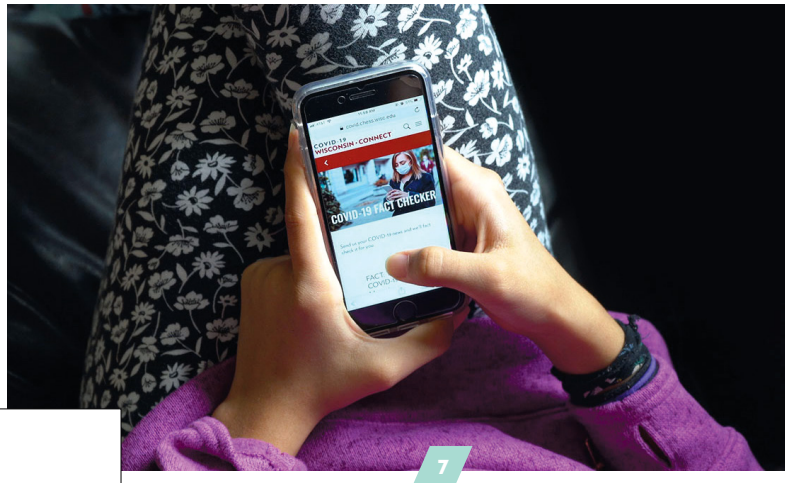
Mapping Our Movements

Assistant Professor of Geography Song Gao's Geospatial Data Science Lab turned new sources of information on the movement of Americans around their own neighborhoods and across the country into maps, models and messages that may help save lives. The mapping tool is funded by a new National Science Foundation Rapid Response Research Grant.

5

Experts in the News

L&S faculty were tapped by countless media outlets for their perspectives and insights on the coronavirus pandemic. Math professor Jordan Ellenberg penned an op-ed for the *New York Times* on a better way to approach testing, and Paula Niedenthal (psychology) discussed how videoconferencing taxes our brains. Kathy Cramer (political science) was interviewed by National Public Radio on how COVID-19 has become a "rural vs. urban issue." Other political scientists weighed in for the *Washington Post* on how the pandemic might affect voter turnout. Visit ls.wisc.edu/news for more on faculty sharing their knowledge with the world.



7

The Truth Is Out There

In response to the pandemic, a team of more than 30 faculty, staff and students from a range of departments and organizations, including the School of Journalism and Mass Communication, created the free @CovidWIConnect app, putting the Wisconsin Idea into action. Developed in partnership with the state of Wisconsin, the app allows users to both receive help from, and give help to, others in their communities while correcting state-specific misinformation trending on social media.

6

4,000+

Number of L&S courses moved to remote learning format in March

Peaceful protests in the wake of the killing of George Floyd, an African American man in Minneapolis, unfolded for several weeks in Madison.

8

SUMMER 2020

Calling for Change

Beginning on June 2, peaceful protesters filled the streets of downtown Madison in response to the killing of an African American man, George Floyd, by police officers in Minneapolis. Thousands drew together in support of the Black Lives Matter movement, but looters followed the peaceful protests and vandalized State Street businesses. Madison residents turned out to help clean the streets, and Madison artists created vibrant murals expressing both anguish and hope on the plywood boards that covered windows and doors.

On June 19, the Juneteenth flag was raised for the first time in history above the Wisconsin State Capitol building, commemorating the day in 1865 when General Gordon Granger officially proclaimed the freedom of 200,000 enslaved Texans — two years after the Emancipation Proclamation of 1863.

10

$10,000,000

The fundraising goal set by the university, in partnership with the Wisconsin Foundation and Alumni Association, to support recruitment of a more diverse group of students, faculty and staff and to build a campus culture that welcomes and retains all groups, particularly people of color.

9

Campus Response

Dean Eric Wilcots sent a message on June 3 to L&S students, encouraging all to "speak out and act against racism and injustice." In his Juneteenth message, Wilcots suggested that all read more about the history of a day that sees Black communities celebrating themselves as free and equal citizens, honoring military veterans and drawing connections between their struggles and those of their ancestors.

On July 8, Chancellor Blank pledged to increase efforts to make the changes needed at UW–Madison. She announced a fundraising initiative to support recruitment of diverse faculty and students, as well as a continuing commitment to the Target of Opportunity Program (TOP), which attracts talented faculty who enhance the quality and diversity of our academic departments. Campus will also require search committees to undergo training on implicit bias and recruiting for excellence and diversity.

"Black students, faculty and staff have consistently shared the discomfort they experience negotiating spaces on campus defined by White culture, and about the regular stream of microaggressions they experience — comments and behaviors that show misunderstanding (at best) and hostility and disrespect (at worst)," Blank wrote.

Mandatory this fall: the "Our Wisconsin" training program for all new entering undergraduate students, intended to promote understanding about culture, identity and difference, and build skills to create an inclusive community.

The Office of the Vice Chancellor for Research and Graduate Education will provide $1 million in research funding in the next academic year to support faculty and Principal Investigators whose research furthers understanding of race in America.

11

Equity in Libraries

Kevin Wamalwa, a doctoral student in anthropology and African cultural studies, is a 2020–21 Mellon Public Humanities Fellow and the Ripple Project Fellow at Dane County Library Services, where he'll focus on racial equity training and programs that encourage social diversity and inclusion. Assistant Director of Public Humanities Aaron Fai interviewed Wamalwa about the importance of this work. "Dealing with racial inequity starts with the ability to recognize the implicit and explicit forms of racial biases," says Wamalwa. "Equity training will create a platform for a meaningful conversation with communities of color, about race and racism." The Public Humanities Fellowship program is a multiyear project generously supported by the Andrew W. Mellon Foundation, creating professional opportunities outside of academia for UW graduate students in the humanities.

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Towering Progress

Launched in the fall of 2018, the two-phase chemistry building project is on track for completion in 2021. The project's centerpiece is a new, nine-story tower, designed to address critical space shortages for teaching and storage of chemicals. The tower will house lecture halls, an information commons, offices, teaching laboratories, and group write-up spaces for undergraduate teaching labs. The second phase of the project, set to begin once the tower is completed, involves renovation of the basement, first floor and second floor of the Daniels wing. These floors will house laboratories, classrooms and undergraduate student services spaces.

Weekly construction updates — and even more pictures — are available to view at chem.wisc.edu/chemistry-building-project-overview/

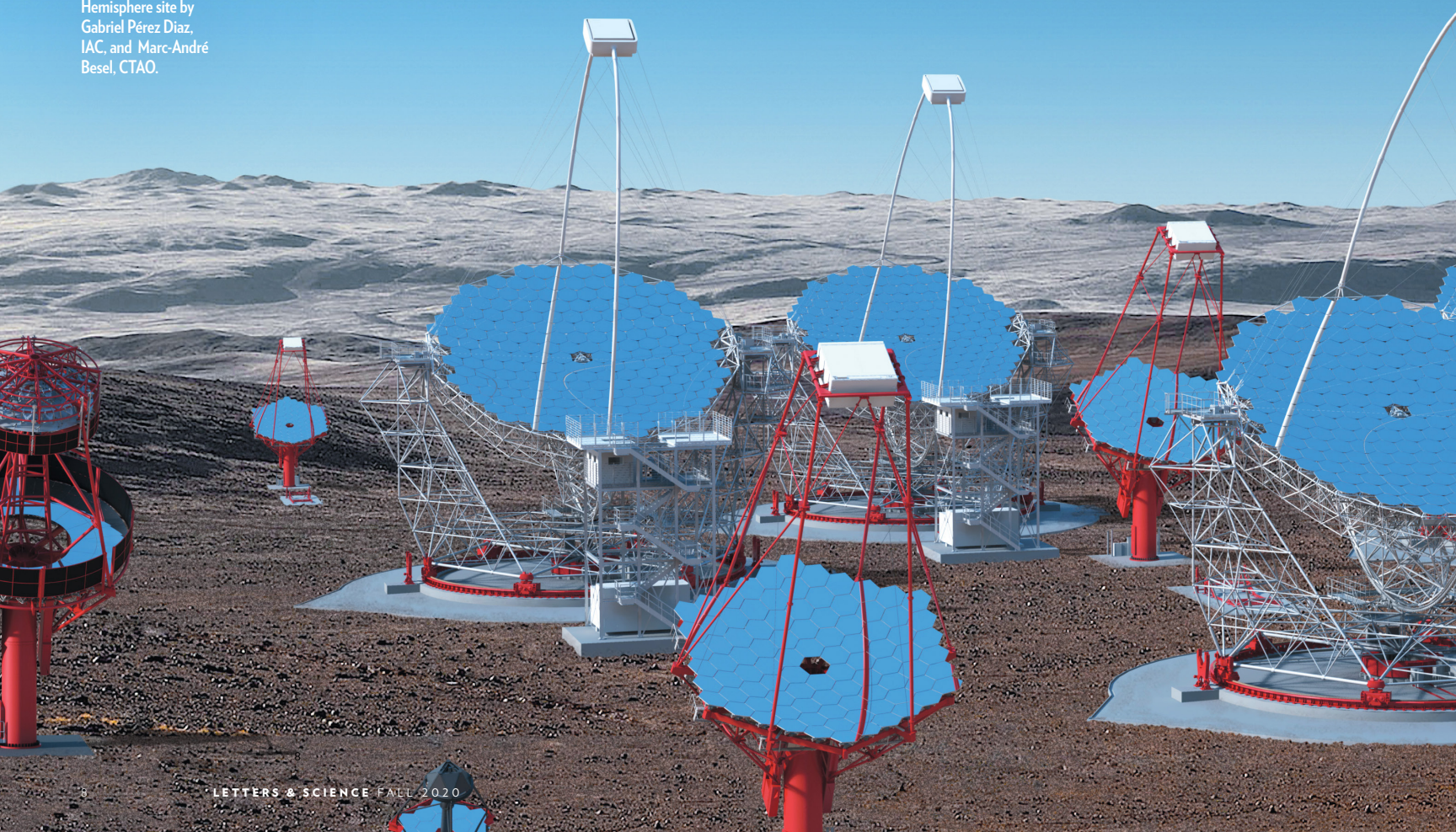
13

Student Journalist

In early June, journalism and mass communication major Tamia Fowlkes was selected (along with students from Princeton University and the University of Florida) to interview NAACP president Derrick Johnson on "Meet the Press: College Roundtable," about the protests playing out around the nation and world. Her question, about the NAACP's hashtag #WeAreDoneDying, received a thoughtful answer from Johnson, who reiterated the organization's commitment to supporting changes in policy that protect Black people. "It was super interesting," said the junior from Milwaukee, Wis. "They were really nice, treated us like professionals and gave us the reins to lead the questions. [Johnson] was awesome."

How do astronomers test-drive a telescope?

BY MARY ELLEN GABRIEL



An artist's conceptual design for the Cherenkov Telescope Array Southern Hemisphere site by Gabriel Pérez Diaz, IAC, and Marc-André Besel, CTAO.

It's not often that a graduate student has the opportunity to fine-tune the inner workings of a high-energy gamma-ray telescope, but that's exactly what physics graduate student Leslie Taylor was doing in the remote mountains of Arizona, at the Fred Lawrence Whipple Observatory some 35 miles south of Tucson.

Taylor is part of a research group within the Wisconsin IceCube Particle Astrophysics Center, led by physics professor Justin Vandenbroucke. The group plays a leading role in preparing the prototype Schwarzschild-Couder Telescope (pSCT) for the Cherenkov Telescope Array. The array, which will be made up of 118 small, medium and large telescopes across two sites (one near Paranal, Chile, and one on the island of La Palma in the Canary Islands), will eventually be known as the Cherenkov Telescope Array Observatory, the world's largest and most sensitive very-high-energy gamma-ray observatory.

"It's more common for graduate students to take data with the telescopes rather than work on hardware," says Taylor. "When I first started working in Justin's lab, the camera was located here in Wisconsin and I had the opportunity to work on it for several months. I like hands-on hardware stuff."

The camera — golf cart-sized, weighing 800 pounds, and capable of recording movies at a rate of a billion frames per second — was shipped to Arizona in order to be lifted and installed into the telescope. Taylor was asked to go along and help with a multi-stage process that required the camera modules, main structure, backend electronics, and auxiliary systems to be reconstructed onsite.

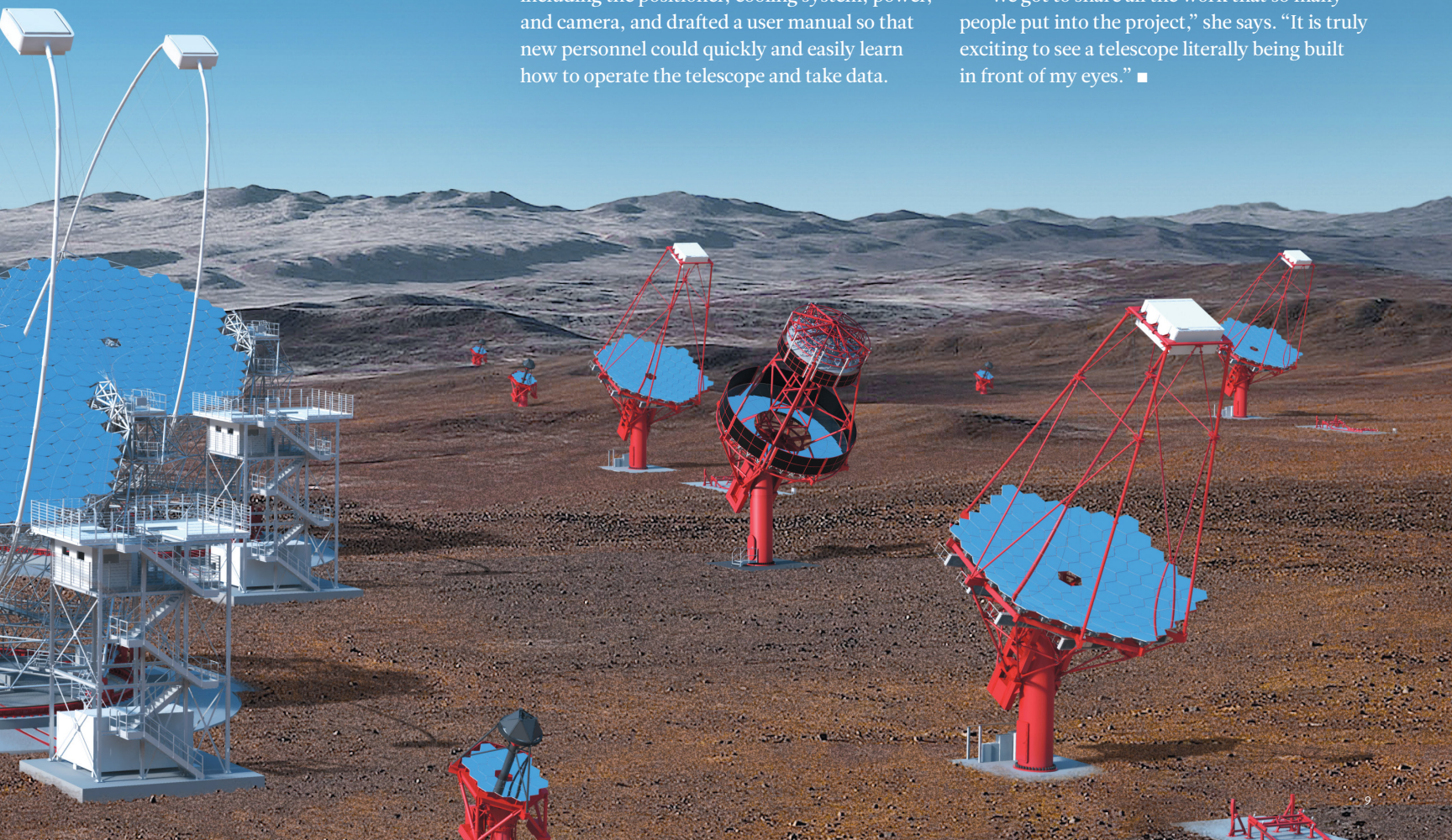
"There were many technical challenges," she says. After the summer monsoon in Arizona, "I discovered that water had made its way into the camera enclosure and damaged some of the camera sensors. In addition to removing and replacing them, I also completely waterproofed the camera enclosure to prevent it from happening in the future."

During her time in Arizona, Taylor learned how to operate all major telescope systems, including the positioner, cooling system, power, and camera, and drafted a user manual so that new personnel could quickly and easily learn how to operate the telescope and take data. (She also saw "a ton" of animals — skunks, javelina, coatimundi, mountain lions, owls — and some beautiful sunrises.)

"As I was working onsite in 2018, another team from UCLA was working on installing and aligning the mirrors," she says. "In January 2019, I took data for the first time with the mirrors uncovered. We achieved 'first light'" — meaning that the team detected particle showers for the first time. After commissioning the system and aligning the mirrors during 2019, in 2020 they detected the Crab Nebula, a remnant of cosmic gas and dust left over from an exploding star that is a bright source of gamma rays. The ability to detect it is the "gold standard" for calibration and verification of new gamma-ray instruments.

Vandenbroucke announced those results on behalf of the CTA Consortium at the 236th Meeting of the American Astronomical Society. Taylor and the entire pSCT team helped achieve the results and put together the materials for the announcement, an experience she describes as "extremely exciting."

"We got to share all the work that so many people put into the project," she says. "It is truly exciting to see a telescope literally being built in front of my eyes." ■



LEADERSHIP

New Leader Charts His Course

Dean Eric M. Wilcots rises to meet challenges and places diversity and inclusion at the top of his agenda.

BY AARON R. CONKLIN

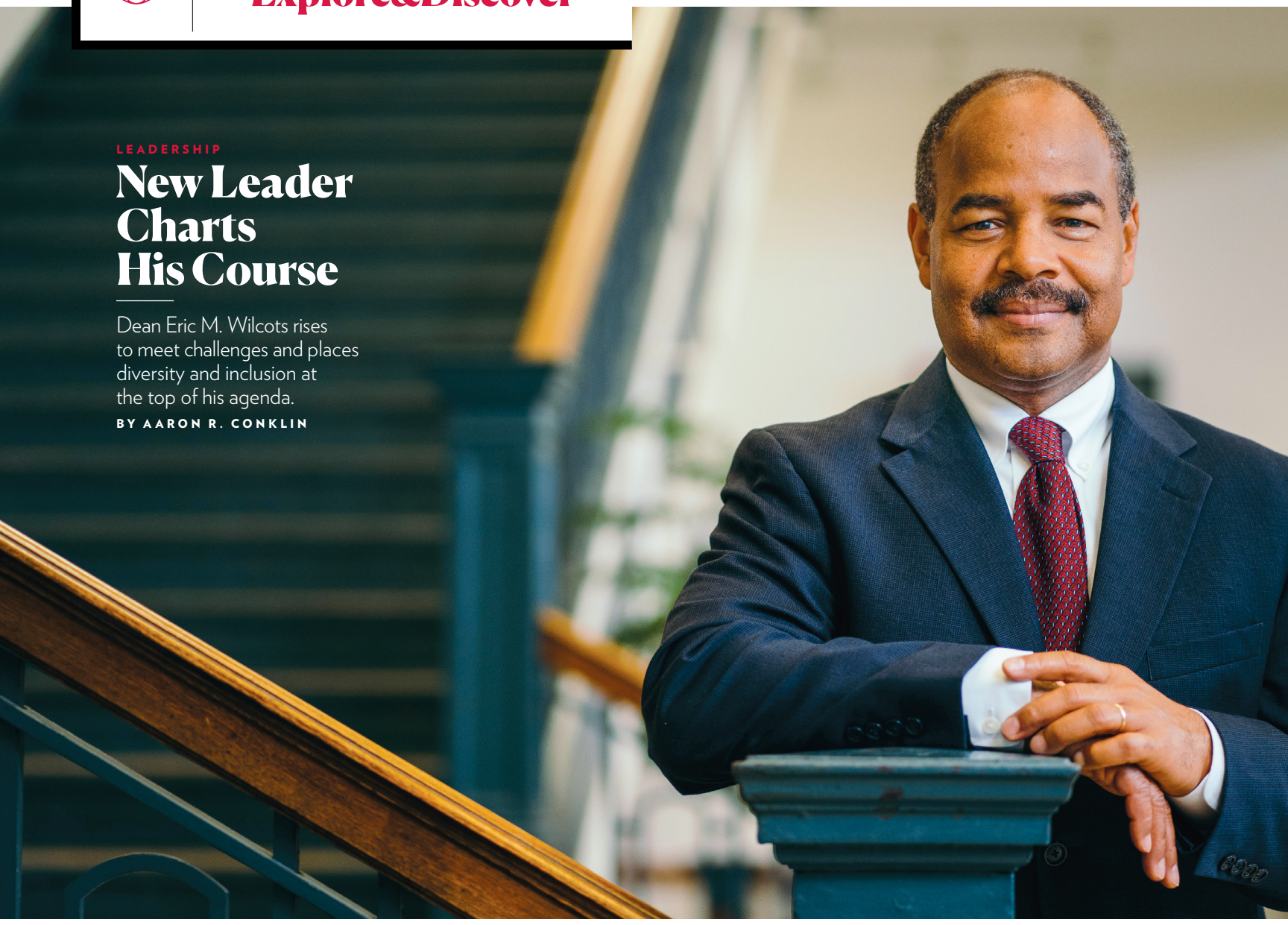


PHOTO: PAULIUS MUSTEIKUS

When he was growing up in Philadelphia, Eric Wilcots turned the telescope he'd received as a Christmas present toward the sky to view the rings of Saturn. It's one of the earliest moments that inspired his lifelong love of science and astronomy.

Several decades later, Wilcots has lost none of that sense of wonder and boundless enthusiasm. Today, he has his sights trained on a very different target: leading the UW–Madison College of Letters & Science confidently into the next decade. After nearly a year of serving as interim dean, Wilcots was officially named dean at the beginning of June, becoming the first African American to hold the position. A member of the UW–Madison faculty since 1995, he brings deep administrative experience, having served as the Mary C. Jacoby Professor of Astronomy, associate dean for the natural and mathematical sciences, deputy dean, and interim dean. Wilcots, who earned his undergraduate degree in astrophysical sciences at Princeton and completed his graduate work in astrophysics at the University of Washington, has made his priorities clear, and they begin with diversity and inclusion. At a time when issues of racial justice are energizing communities and campuses across the country, Wilcots is committed to making sure that all students can thrive and reach their full potential in L&S. In addition to relying on the College's Equity and Diversity Committee to identify and implement inclusive teaching strategies, he holds regular listening sessions to capture the concerns of faculty, staff and students.

"Part of what you're seeing out in the world — though I'm not a social scientist — is people weary of that reactive

In addition to diversity and inclusion, Wilcots intends to focus on promoting research and the student experience.

bit, where something happens, we have a reaction, and then it happens again," Wilcots says. "I think locally, we've missed the call, from incidents that have happened on our own campus over the last three or four years, to put in place some structural changes. We've got to do that now and not lose this momentum."

Wilcots' agenda also includes the promotion of research, as well as a vigorous defense of the value of the liberal arts. He's committed to defining Letters & Science's role in UW–Madison's standing as an "R1," or pre-eminent, research institution.

"We have some of the best researchers in the country on our faculty," he says. "We are addressing some of the biggest problems facing society, and I want to grow and celebrate that."

As an astronomer and researcher, Wilcots was fortunate enough to enjoy the experience of a lifetime: working on the Southern African Large Telescope (SALT), the largest optical telescope in the southern hemisphere. Wilcots was there for the groundbreaking in 2000 and spent years as a researcher collecting detailed data about black holes and the evolution of galaxies using its powerful instruments, which were also built at UW–Madison. Some of the magic of that project was captured in Origins, a stunning online project created by University Communications (origins.wisc.edu). Wilcots, a strong believer in the value of outreach and the Wisconsin Idea, loved being able to share that interactive, award-winning story, both in South Africa and here in the United States.

"Part of what SALT allowed me to do is be a tiny part of a renaissance of science in South Africa," he says. "And then being part of the community outreach there, to say, 'Hey, we're doing fun science and you could be part of it.' That's always been personally fulfilling."

As a teenager, Wilcots worked as a guide at the Franklin Institute Science Museum in Philadelphia, connecting visitors to the wonders and intrigue of science. The experience honed his natural ability to connect with people, one of his greatest strengths as dean.

"You're interacting with large numbers of people of a variety of backgrounds, and you've got a moment to capture their attention and get them excited about whatever the exhibit or the demonstration is," says Wilcots. "I don't know whether I did it naturally as a high school student, but it's something I developed."

Wilcots currently serves as the co-chair of the Wisconsin Science Festival and helped expand Universe in the Park, an outreach program through the Department of Astronomy that brings the wonder of stargazing to state parks across Wisconsin.

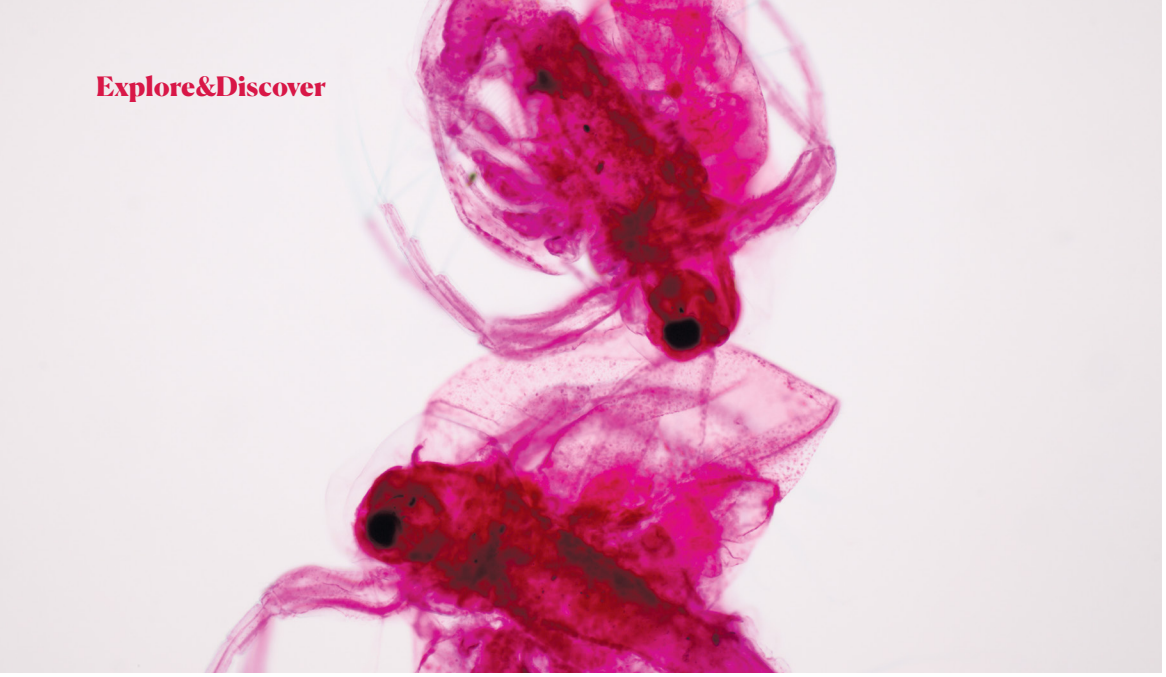
"We have this Wisconsin Idea that we hold near and dear as part of our DNA," he says. "Bringing the discoveries our faculty researchers are making to the public and reminding people of the value of the institution is critically important."

Wilcots knows he will face difficult challenges in the coming year, from finding ways to teach and operate through COVID-19, to budgeting and defending the value of a liberal arts education. But as he talks about his new role, you can almost hear that ebullient teenager who worked nights and weekends at the Franklin Institute.

"I've got a great job. I've always had a great job," he explains, with a laugh. "Why shouldn't I be enthusiastic about it?" ■

"We are addressing some of the biggest problems facing society, and I want to grow and celebrate that."

ERIC WILCOTS
Dean and Mary C. Jacoby Professor of Astronomy



Microscope photography of Daphnia.

RESEARCH

Evolutionary Edge

A discovery about plankton's ability to evolve offers hope for ocean life.

BY MARY ELLEN GABRIEL

Asked to imagine a world without plankton, Carol Lee shudders.

"Oh my God," says the professor of integrative biology, who studies the ability of plankton to evolve in the face of rapid human-induced environmental change. "There would be algae, but no fish. It would be like getting rid of insects on land. It would be really bad."

Plankton, which include the copepods and Daphnia that help keep toxic algae blooms at bay in Wisconsin lakes, are a diverse group of animals found in water bodies around the world. Their numbers are declining worldwide, with potentially devastating consequences for foodwebs and fisheries.

Last March, Lee was awarded a grant from the French government to study the capacity of plankton in the Baltic Sea (which is becoming warmer and fresher due to climate change) to evolve, in terms of the speed and extent of evolution. Hers was one of 12 projects worldwide to receive funding in a third phase of President Emmanuel Macron's "Make Our Planet Great Again" initiative.

The project's urgency is tied to the important role plankton play in food webs. Copepods are especially important because they form the largest biomass of all animals in the world's oceans.

"They are like the cows of the sea," says Lee. "They graze on algae, and they are a major food source for fish and whales."

Over the past year, Lee has established a collaborative project at France's Montpelier University and hired a graduate student, Theresa Popp, and a technician, Benjamin Kleinerman, to study the rapid evolutionary responses of plankton to salinity and temperature in the Baltic Sea.

"The Baltic Sea is a really important habitat for cod and herring," says Lee. "But it's like a semi-enclosed basin. It will become warmer and more like a freshwater lake. That will have devastating impacts on aquatic life."

Lee wanted to know whether the plankton, at least, could adapt to changing conditions. If the basic food source remains, then there's hope for sustaining fish populations — even if they differ from the ones that live in the Baltic Sea now.

Taking samples from the wild population, Lee's team launched laboratory selection experiments to determine the extent to which this copepod could evolve to low salinity. What they found was that as salinity in the laboratory lines went down over a few generations, the selection process kicked in, targeting many of the same genes across replicate lines. The variants of these genes (alleles) that allowed for freshwater survival became more common (i.e., natural selection). This result indicated that evolution could operate in a predictable manner in response to rapid environmental change. Notably, these same alleles are present in the wild populations across the Baltic Sea, indicating that the alleles could be favored by selection in the wild as conditions get more fresh, and that the population has the capacity to evolve.

This is good news, says Lee, as many high-latitude water bodies are becoming more fresh, with ice melt and changes in precipitation. Other, larger animals with longer life cycles may not have time to adapt. But these copepods, with their 20-day generational cycle, have the evolutionary advantage over fish.

"They can get a lot of evolution done in one year," says Lee, whose initial study from this project was published in the journal *Nature: Ecology & Evolution* this summer. ■

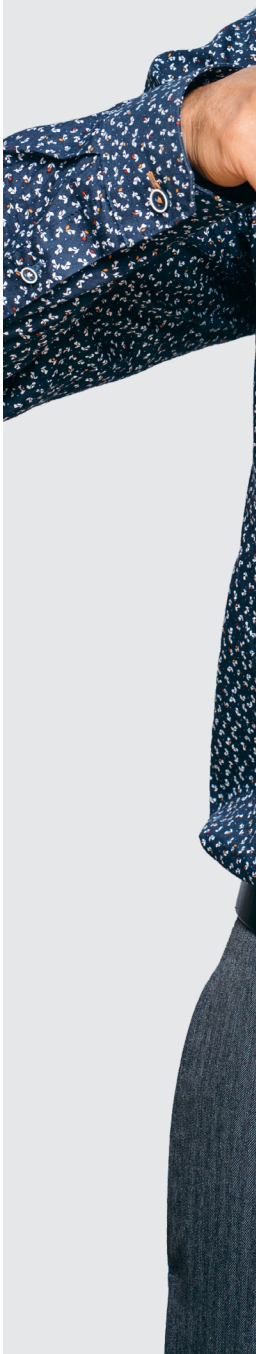


PHOTO: PAULIUS MUSTEIKIS

TEACHING

Rocking the Classroom

It's not at all unusual for Stephen R. Meyers to teach his Geoscience 100 course — a class that routinely attracts several hundred students — while standing on a chair. Or a desk. Or, during remote learning forced by COVID-19, on the roof of his house using a drone. This spring, Geoscience 100 went viral on Twitter, thanks to an exchange with Dwayne "The Rock" Johnson — a great example of how Meyers is always finding new ways to make learning about rocks a lot more fun.

BY AARON R. CONKLIN

Front and center in my mind is the opportunity I have to cultivate scientifically empowered individuals who base their decision-making on sound science, logic and empathy for one another. Climate change, the COVID-19 pandemic and especially the recent protests and Black Lives Matter movement make this more relevant than ever before.

I feel a professional, societal and personal responsibility to put creative energy into developing better approaches to communicate and teach science.

It is wonderful to see the students realize that this is not going to be the usual experience in a large lecture hall. Some of the more creative things we do, like lecturing from a roof or playing a drum kit on frozen Lake Mendota to demonstrate seismic waves, are meant to be playful and joyful, because that's how I experience science. The same energy, enthusiasm and playfulness that we, as scientists, put into our research is the approach I have chosen to also put into my teaching. More generally, all of this helps emphasize the emotion of science: the wonderment, the joy of discovery, the profoundness of the deep geologic history and connections that we all share, revealed through a shared past.

At the core of tadada Scientific Lab [an ongoing project cofounded with photojournalist Gigi Cohen], is collaboration and embracing possibilities. When I asked the students [at the beginning of the pandemic] to dream big about possibilities for how we could make the course meaningful even though we wouldn't be together in the classroom due to COVID-19, they responded with fantastic ideas, and reaching out to Dwayne "The Rock" Johnson on Twitter was one of them. We felt grateful that he responded with a personal story about his connection to geology.

My hope is to reach each student and to facilitate a journey of scientific wonderment and discovery that will inform their lives. I also want to equip them with tools that will help them thrive in college and beyond, whatever path they may take.

The title of the last lecture I give in Geoscience 100 is "Living in an Uncertain World." It became even more pertinent this year. It's about how science can empower us and allow us to see opportunity and possibilities immersed in uncertainty. ■

CAREER PREP

The Summer of the Pivot

Helping students navigate an uncertain job market where work, and interviews, are now done remotely.

BY AARON R. CONKLIN

For Badger students and recent graduates, the summer of 2020 not only brought physical distancing, social unrest and fears of catching a highly contagious virus, but also the need to pivot their approach to finding a job or internship. In the wake of the economic upheaval caused by the coronavirus pandemic, hundreds of graduating students and recent Badger alumni found their seemingly solid job and internship opportunities delayed and/or canceled altogether, necessitating a quick pivot to a viable Plan B.

The only problem was, many didn't have one.

Enter the team at SuccessWorks, the College of Letters & Science's professional development center. Shortly after campus closed in the spring, that team quickly saw they'd need to pivot as well, ramping up their online resources to serve a suddenly significant number of students in need of serious and immediate job- and internship-seeking assistance. Under the banner "Badgers on Track," SuccessWorks staged a series of well-attended virtual workshops and panels, helping hundreds of students hone their resumes, cover letters and interviewing skills to succeed in an online environment. Through industry partnerships, they also helped connect students with micro-internships, short-term project-based work that offered experience and hourly pay.

"In a strong economy, career services are something nice to have, a sort of icing on the cake," says Rebekah Paré, SuccessWorks' executive director. "In a disrupted economy like the one we've been in since March, career services are absolutely critical. Fortunately, we're poised to be able to help students navigate an online world. Amidst this great uncertainty, we're certain we have their backs and can make a positive difference in their situation."

Many students found their summer internships cancelled in March, on the heels of returning from spring break. Mahima Bhattar, a senior majoring in sociology and economics, lost her Chicago-based research internship in late April, well after applications for other possible options had closed.

Time for a pivot: Bhattar connected quickly with Maureen Muldoon, one of SuccessWorks' career and internship specialists, to find other potential options. Muldoon and her fellow specialists send out weekly emails with the latest information about professional opportunities.

"I knew that talking to a career advisor would help me strengthen my application for an internship that I really wanted," says Bhattar. "Maureen gave really good advice and also went above and beyond to point me to other opportunities or resources I would find helpful."

Bhattar ended up landing a great gig that fit her career goals: a remote position as a monitoring and evaluations intern at Health Access Connect, a Ugandan NGO that works to bring healthcare access to isolated communities in that country. She says the networking and the resource connections SuccessWorks provided were critical.

David Burnett, who graduated last spring with a major in Communication Arts and certificates in Chinese, Japanese and Entrepreneurship, was glad he'd interfaced

"In a strong economy, career services are something nice to have, a sort of icing on the cake. In a disrupted economy like the one we've been in since March, career services are absolutely critical."

REBEKAH PARÉ
SuccessWorks' Executive Director

PHOTO: COURTESY OF HEALTH ACCESS CONNECT

Mahima Bhattar (above) used her experience with SuccessWorks to land an internship with an NGO in Uganda.

early with SuccessWorks. Initially, he used their advising services to hone his resume, in hopes of landing a bilingual administrative position with FoxConn. When that didn't pan out, he had to recalibrate quickly, returning to work with an adviser on how best to utilize popular job-search tools.

"After SuccessWorks appointments went exclusively online because of the pandemic, everyone was still as helpful as ever and continued to give me feedback on my resume and cover letters," says Burnett. "They also conducted mock interviews with me and directed me to useful resources like Big Interview."

In mid-June, the weeks of post-graduation job hunting paid off: Burnett landed a job at Kosmek, a Japanese company specializing in industrial clamps, in Illinois.

"My advice to other students is to be flexible and realize that an opportunity you would not have otherwise considered can still be an incredible experience," he says.

SuccessWorks remains ready to assist current and recently graduated students. This fall, they have shifted focus to prioritize hiring and preparation for job searches in a remote recruitment situation. And just in time: Typically, peak hiring season for undergraduates looking for jobs and internships is from September through November.

Resilience remains the order of the day, says Paré.

"We've been working hard to remind students that even though internships and jobs are more difficult to locate, they're still out there, and the skills they've learned in L&S are still very much in demand." ■

FACULTY

A Community of Computers

Through the breakthrough concept of distributed computing, Miron Livny pioneered a way to harness massive amounts of computing and transformed the process of scientific discovery.

BY AARON R. CONKLIN

Miron Livny has always been a big believer in the power of sharing.

Livny, a professor of computer science and the director of UW–Madison's Center for High Throughput Computing as well as the chief technology officer for the Morgridge Institute for Research and the Wisconsin Institutes for Discovery (WID), laid it out in the conclusion of his doctoral defense, a document he wrote almost 40 years ago.

"In the early stages of mankind, individuals came together to create community, because they can do more and do better together," says Livny, who came to UW–Madison as a faculty member in 1983. "My dissertation was about building a community of computers."

What he built was more than just a simple community—it became a global phenomenon that transformed scientific research. Livny's ideas have been embodied in what came to be known as HTCondor, an open-source, high throughput computing software suite that allows thousands of computers to work together to manage complex computing tasks that may involve massive amounts of data. Where once a scientist might have taken weeks and months to accomplish a computational task, high throughput computing shortens that span significantly. In addition to supporting

Miron Livny's HTCondor has been integral to two Nobel Prize–winning discoveries.

hundreds of research projects around the world, from disease projections to nuclear physics to botanical studies of corn, Livny's creation was instrumental in two Nobel Prize–winning discoveries: the Higgs boson particle in 2012 and gravitational waves by the Laser Interferometer Gravitational-Wave Observatory (LIGO) lab in 2017.

"The power of sharing and coming together is why distributed computing is so powerful," explains Livny. "It's about putting smaller pieces together and working effectively on a shared mission."

In the early 1980s, Livny was finishing his PhD at the Weizmann Institute of Science in his native Israel when a fellow postdoc who'd studied at UW encouraged him to travel there. After making a few contacts in the computer sciences department, he quickly landed an assistant professorship—"back in those days, you said that you saw a computer and they gave you a job," Livny jokes—and the charm of the city, the systems-oriented culture of the computer sciences department and the collaborative nature of the campus have kept him here his entire career.

PHOTO: PAULIUS MUSTEIKUS

Livny arrived on campus at a time when computers serving campus researchers were hulking, room-sized objects kept behind glass walls, the kind of things students might view from a distance on a field trip. Livny, who had always been fascinated with questions around load balancing—the idea that distributing the work over a series of computers made the process more effective—saw an opportunity to do more.

The first HTCondor setup, back in the '80s, consisted of 20 workstations. Today, the Ice Cube Neutrino Observatory at the South Pole (WIPAC, the Wisconsin IceCube Particle Astrophysics Center, is located on the UW-Madison campus, encompassing faculty from the physics and astronomy departments) uses HTCondor to harness as many as 51,000 CPUs in 28 separate cloud regions to support their processing and analysis of astrophysical data.

The same idea behind HTCondor also powers Livny's other major contribution to the field of distributed research computing—the Open Science Grid, a project originally created to marshal resources to process data generated by the Large Hadron Collider, the world's largest particle accelerator. Since 2005, Livny has been the technical director of this national computing infrastructure, which provides high throughput computational services to researchers around the world.

While the horizon appears limitless, Livny does see challenges coming for his chosen field. As the ability to harness distributed computing has expanded and multiplied, so has the ability of researchers to collect signals from nature, like the radio signals astronomers collect from space. These signals need to be processed by a computer to become data. And the number of available signals to collect is truly mind-boggling.

"We are struggling with this," he says. "Our science is limited by our capacity to process signals. There may have to be tradeoffs in what we can and cannot do. The question becomes, how much money and energy do we want to invest in something that's increasing so dramatically?"

Other transformative breakthroughs, like quantum computing, may eventually address some of the shortfalls, says Livny, but it's too soon to tell. The bigger issue, he says, may not be technological but sociological: In other words, while it's now possible to share computing resources with anyone around the world, the first step is to help your potential collaborators see the benefits of sharing. Recognizing that issue, he says, is half the battle.

"When you bring resources to be shared, you have control over where and with whom it can be shared," he says. "It's not always easy to keep that in mind." ■

"The power of sharing and coming together is why distributed computing is so powerful. It's about putting smaller pieces together and working effectively on a shared mission."

MIRON LIVNY
Professor of Computer Science, Chief Technology Officer for the Wisconsin Institutes for Discovery and Director of the UW Center for High Throughput Computing

I'm majoring in Classics (Ancient Greek and Classical Humanities) and English (Creative Writing). Coming here, I had a pretty strong idea of my interests. I had been writing and performing all throughout my adolescence, so Creative Writing just felt like a given to me. It was studying classics that felt like more of an interest, less of a muscle already attached to my skeleton.

As a queer, low-income student on campus, I knew that every space I entered wouldn't be full of people I could relate to, so I prepared for that. I came to UW-Madison as a member of the 11th cohort of First Wave Scholars. First Wave is a full-tuition, four-year scholarship program that gives first-year students a head start through classes offered the summer before freshman year. That summer, I developed so much trust with total strangers in my scholarship program.

I am grateful for the moments I've been eating a meal, crying, laughing, or traveling and realized how full the people I've met in Madison make me feel. The people I've met and worked with at UW have urged and enabled me to grow, excel, and share that with others in ways I can't fully express.

As a First Wave scholar, you get to develop your craft as part of a high-level artistic community.

I typically balance somewhere between 17 and 19 credits a semester, my work as a writer and a position at the Division of Arts on campus. I learn from my peers, many of whom are also balancing careers as working artists.

I have a hard time imagining myself matching the image of what a typical "Badger" looks like. I've never been inside of Camp Randall. I don't own a single piece of red-and-white clothing. That said, I am proud of the Badgers I know who enter this university, which seems to contain more barriers than shortcuts for many of us — and then, to see us thrive here? That's beyond pride for me.

I've been an executive board and competing team member with the UpRise Poetry Collective since my first year on campus. We compete at the international level for spoken word and performance poetry, and at last year's competition we ended up taking home the "Best Writing as a Team" award. Most of my fellow teammates and I won individual prizes for solo poems and performances.

My long-term goal is to be the first in my family to go to graduate school. By the time I graduate, I hope to witness the ascension of every Madison restaurant food-truck worker to celebrity status (I will never be able to express my gratitude to those legends for keeping me fed). I'd also like to give a special shout-out to the creative writing department — thank you for your excellence in teaching and caring for your students. ■

STUDENTS

Poetic Synergy

Duncan Slagle, a senior from Minneapolis, Minn., arrived at UW-Madison prepared for a period of adjustment. "I knew that every space I entered wouldn't be full of people I could relate to," they say. But they wound up finding community through poetry as a First Wave scholar.

BY DUNCAN SLAGLE

PHOTO: FOCAL FLAME

A $10 million gift transforms the La Follette School of Public Affairs.

Kohl Initiative Fuels Growth in Public Affairs

Thanks to a $10 million gift from the Kohl Initiative, the foundation created by former U.S. Senator Herb Kohl, the La Follette School of Public Affairs is experiencing the most extensive growth in its 37-year history. New faculty hires, a new undergraduate certificate and expanded programming and research support have all been made possible by the May 2019 gift.

In March, the School convened nearly 350 policymakers, practitioners, community leaders, and researchers for its inaugural La Follette Forum, focusing on critical health policy topics and innovative solutions for improving the health of Wisconsin residents. The 2021 La Follette Forum will focus on climate policy.

Undergraduates benefit from the gift, thanks to wide-ranging resources made available for a new undergraduate certificate in public policy. The certificate program — a cornerstone of Sen. Kohl's donation — has tripled from an initial cohort of 50 students to more than 150 for Fall 2020.

The Herb Kohl Public Service Research Competition, now in its fifth year, funds faculty research, and the Kohl Competition Award went to Professor of Public Affairs Greg Nemet to expand his research on climate change analysis and policy.

Quantum Leap Forward

The University of Wisconsin–Madison, the University of Illinois at Urbana-Champaign and the University of Chicago have been named partners in a National Science Foundation Quantum Leap Challenge Institute.

The five-year, $25 million National Science Foundation (NSF) Quantum Leap Challenge Institute for Hybrid Quantum Architectures and Networks (HQAN) helps establish the region as a major hub of quantum science.

Quantum computing uses the principles of quantum physics to develop computing power that even the most powerful conventional

HONOR ROLL

Claire Evensen, a biochemistry and mathematics major from Verona, Wis., who graduated in May, was a finalist for the Rhodes Scholarship, and won the prestigious Marshall Scholarship, which will fund her master's degree work this fall at the University of Oxford in England. While at UW, Evensen also won a Goldwater and an Astronaut scholarship, a pair of national awards given to promising students in science.

Nandini Pandey, an associate professor of classics, and Laila Amine, an assistant professor of English, received the 2020-21 Berlin Prize from the American Academy in Berlin. Each will spend four months conversing with and learning from other scholars at the Hans Arnhold Center in Berlin.

AA A&S

Five L&S faculty members were inducted into the American Academy of Arts and Sciences: Professor of Psychology Seth Pollak, Professor of Philosophy Steven Nadler, Professor of History Louise Young, Professor of Geography Lisa Naughton and Professor of Chemistry Martin Zanni are among the 276 new members for 2020.

Jairo Villalona (left) and Olga Riusech are two of the first four American Chemical Society Bridge program graduate students.

supercomputers cannot match. Quantum computers could, for example, solve complex logistics deployment problems or help to discover new life-saving medicines.

"At the HQAN institutions, there are several people developing different ways of processing and storing quantum information," says UW-Madison Professor of Physics Mark Saffman, a co-principal investigator. "We're asking, can we hook together these different types of hardware to synthesize a stronger system with a hybrid approach?"

Another focus of HQAN is on quantum science outreach, education and corporate partnerships, which will be headed by Shimon Kolkowitz, an assistant professor of physics at UW-Madison.

HQAN's corporate partners include Fermilab, MIT Lincoln Labs and Air Force Research labs, as well as American Family Insurance and ColdQuanta, which have offices in Madison.

Halfway Across the (ACS) Bridge

The first cohort of graduate students in the Department of Chemistry's new American Chemistry Society (ACS) Bridge program wrapped up the first leg of their 21-month experience this spring. Designed to increase the number of students from marginalized groups in chemistry doctoral programs, ACS Bridge gave four students the opportunity for extensive lab work, research training and mentorship. Each will graduate with a research master's degree and be prepared to apply for a doctoral program.

Olga Riusech was inspired by a trip to the Inclusive Graduate Education Network's national meeting in Florida last fall, where she heard famed African American theoretical physicist James Sylvester Gates describe how his heritage inspired his sizable career achievements.

"I'm a little more aware than I was about all the systems at play when we're talking about academic and socioeconomic inequity," says Riusech. "I'm

learning how many compromises we're expected to make, to fit in with other people's idea of a scientist, and what it means to defy those preconceived notions."

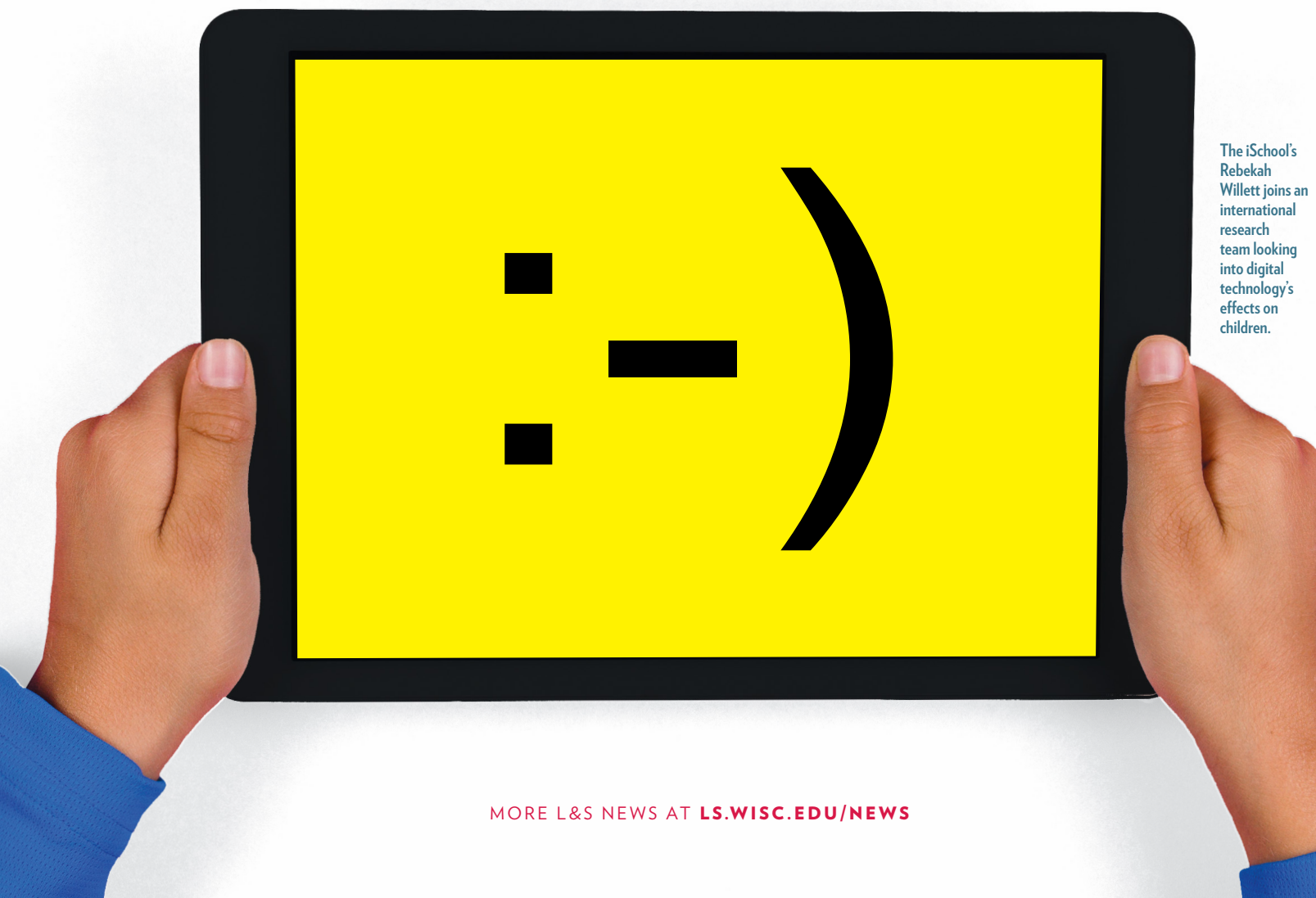
Jairo Villalona joined the research lab of Andrew Buller, an assistant professor of chemistry whose group studies new ways to create enzyme-based chemical reactions. The experience honed his communication and critical thinking skills — and inspired him to partner with other graduate students to launch *The Benzine*, a micro-art publication that features chemistry students.

"I believe this is an avenue that can be utilized to promote inclusivity by providing an outlet for student creativity," he says.

A second set of four students joins the ACS Bridge program in Fall 2020. Funding for the program will support a total of three cohorts.

Technology: Good for Children?

The effects of digital technology on children is an issue that's puzzled both parents and researchers for decades. Rebekah Willett, an associate professor in the Information School, is part of an international team researching the topic as part of a $23.4 million, seven-year project housed at the Australian Centre of Excellence for the Digital Child at Queensland University. Researchers plan to focus on children from birth to age 8, including a longitudinal family cohort study with 3,000 Australian families. The research will center around topics such as the impact of digital technology on children's mental and physical health, the educational possibilities offered by technology, and the balance between online connectedness, surveillance and privacy.



The iSchool's Rebekah Willett joins an international research team looking into digital technology's effects on children.

WISCONSIN IN THE INFORMATION AGE

In L&S, a new school focused on human-centered computing expands opportunities for students and aims to nourish the state's entrepreneurial ecosystem.

BY MARY ELLEN GABRIEL

COMPUTING AND DATA PERMEATE EVERY ASPECT OF SOCIETY, from banking to health care, from retail to communications, from agriculture and manufacturing to education and tourism. We vote, drive, visit the doctor, buy a house and make our phone calls with the assumption that somebody, somewhere is collecting information, feeding it into a database, processing and using it (we hope ethically) to make decisions. Computing algorithms power services from Netflix to Google to Facebook and are at the heart of artificial intelligence (AI). Using statistics to detect patterns in massive amounts of data, AI algorithms not only predict which song you want Alexa to play next, but also help scientists monitor climate change, disease spread, population fluctuations and other global trends.

The need for tech-savvy graduates has been skyrocketing for years. Here at UW-Madison, computer science is the most popular undergraduate major, and last year, more than 3,000 students were pursuing degrees in majors offered by computer sciences, statistics and the Information School (iSchool).

High demand, along with the tantalizing prospect of fueling research and fostering growth and innovation in the state's technology sector, prompted Chancellor Rebecca Blank to convene a working group in 2018 to determine a bold leadership strategy to meet Wisconsin's needs and those of students and faculty.

The result was the creation, last fall, of the new School of Computer, Data & Information Sciences (CDIS) in the College of Letters & Science — the first new school in more than two decades on the UW-Madison campus.

"The new school unites the powerhouse departments of computer sciences, statistics and the iSchool under one umbrella — the College of Letters & Science — combining existing strengths to enable innovative new courses and curricula, as well as research that integrates the full breadth of L&S and UW-Madison," says Eric Wilcots, dean of the College of Letters & Science.

The school aims to produce more graduates who have been exposed to, and trained in, computational thinking, big data, AI and related fields. It also recognizes that all students, no matter their major, need some training in these disciplines to be able to excel in the workplace and engage with computing capabilities that pose new challenges to privacy, security and the flow of information across diverse segments of society.

"The importance of our youth having opportunities in the area of tech has never been greater," says Tom Erickson (BS, Electrical and Computer Engineering, '80), the founding director of CDIS. "And the state of Wisconsin is positioned for innovation and entrepreneurship, especially with the university here. There's always this conversation: How do we create jobs and get people working? The answer is staring us in the face: We educate a wider pool of students, and we help create an ecosystem that nurtures the creation of new companies."

TAPPING LEADERS TO GROW TALENT

Erickson was tapped by Blank to co-lead the working group and eventually was selected to lead the new school. He grew up in Mondovi, Wis. (a third-generation Badger), and has been part of at least ten software companies around the world in the last four decades. He helped found Acquia (which commercialized Drupal as a platform) in 2008 and retired from the international firm in 2017 as its CEO.

"I have always been interested in how we take talent and grow it," he says. "I want to encourage programs that allow people from any kind of competency and interest level to graduate from this university with enough tech literacy that they can find meaningful employment and leverage that knowledge for success."

Associate Director of CDIS Kristin Eschenfelder agrees. The professor of information sciences and former director of UW-Madison's iSchool was recruited to handle all aspects of academic programming, as well as faculty hiring and recruiting for the new school. An explicit goal, she says, is to create programs and opportunities that attract a more diverse range of students to the computing/data/information field.

"There's a huge pool of very, very smart students who may not feel comfortable diving into computer science as a major, but are very interested in technology," she says.

We've spent the last 50 years of the Information Age making faster computers and more storage, creating environments for machine learning and harnessing big data. The challenge we face in the next 50 years is, are we doing all of this right?

TOM ERICKSON, Founding Director of CDIS

If we want to achieve higher adoption of contact tracing technologies, we need to ensure that our approach to the design of technology is intersectional, encompassing the voices and needs of people from all races, socioeconomic classes and gender identities.

COREY JACKSON, Postdoctoral Researcher, iSchool

"As a society, we need all the brains we can get in this area. We have to attract new people from new audiences. And once we do that, we have to keep them."

There is a great "value proposition," as Erickson describes it, in the decision to locate the new school within the College of Letters & Science, home to the humanities, the social sciences, and the natural and physical sciences.

"We've spent the last 50 years of the Information Age making faster computers and more storage, creating environments for machine learning and harnessing big data," he says. "The challenge we face in the next 50 years is, are we doing all of this right? What does the Information Age mean for society? That's not just a discussion between statisticians and computer scientists. Sociologists, psychologists, philosophers, and historians should be part of it, too."

PLACING HUMANS AT THE CENTER

Everyone has experience with frustrating information systems that should be easy and turn out to be daunting. When technology works well, it's freeing and empowering. When it doesn't, it can be annoying. Even a well-designed system can be ethically questionable and even potentially harmful.

"We need people with the skills and knowledge to design systems that work better for people, that help them accomplish their tasks in the world," says Eschenfelder. "But we also need to ask: What are the negative sides to all this technology? If students aren't sensitized to these things, they come out the door so solutions-oriented that they just build the system without thinking through the negative repercussions of the designs they make."

Corey Jackson, a current postdoctoral scholar who will join the iSchool faculty as an assistant professor in Fall 2021, specializes in the area of human-centered computing. He came to UW-Madison from the University of California-Berkeley, where he taught data science. Jackson says that an idea has floated around the data and computing fields for a long time: If you build it, they will come.

But that's not always true, he says.

"I'm collaborating with colleagues from IDEO [a global design and innovation company], Microsoft and Duke Health on COVID-19 research, where we're trying to understand the challenges to adoption and use of contact tracing technologies," says Jackson. "We're finding that the populations most impacted by COVID-19 have the lowest adoption of those technologies."

The resistance comes from a deeper suspicion of how their data will be used, he says. Historical cases of racism and unethical medical practices (such as the infamous Tuskegee study of untreated syphilis in African American men, which ran from 1932 to 1972) have created skepticism and mistrust within communities of color.

"The Tuskegee Study, a major violation of morals and ethical standards, was just one instance of how vulnerable communities are taken advantage of, and so it makes sense that communities of color may not be as eager to adopt new technologies," Jackson says. "If we want to achieve higher adoption of contact tracing technologies, we need to ensure that our approach to the design of technology is intersectional, encompassing the voices and needs of people from all races, socioeconomic classes, and gender identities. This approach should permeate all facets of our thinking about designing future computing systems."

Tech is everywhere in society. Those with a base level of literacy can be effective citizens, informed consumers, better advocates for their own health, privacy and safety.

KRISTIN ESCHENFELDER, CDIS Associate Director

CREATING FLEXIBLE PATHWAYS FOR STUDENTS

Eschenfelder intends to expand the percentage of UW–Madison undergraduates who think hard and critically about the human aspects of computing and data sciences, building "flexible curricular pathways" for students who want basic literacy.

"Right now, we have excellent options for students who want a full computer science or data science experience, but we need to increase the range of options for those who want a more hybrid experience," Eschenfelder says. "Tech is everywhere in society. Those with a base level of literacy can be effective citizens, informed consumers, better advocates for their own health, privacy and safety."

Remzi Arpaci-Dusseau, chair of the computer sciences department, agrees.

"Many professions will require computational and data literacy, much like many professions have required a certain level of mathematical proficiency," he says. "Our goal is to help students learn these core fundamentals, so they have the necessary foundations in place to succeed."

For some students, he says, it will mean going deep into the material, perhaps adding computer science or data science as a second major. For others, it may be a certificate or smaller subset of courses that give grounding in core concepts. For yet others, it may be just a class or two, so as to have a slightly deeper appreciation of technologies that are shaping our world.

"We believe this approach is essential as students move into our highly digital and data-driven world," says Arpaci-Dusseau.

ADDING AN INTERDISCIPLINARY MAJOR

The data science major is an example of extending literacy across campus, while also making a data-oriented major more inclusive and broad-based. Students in this new interdisciplinary major (administered by the Department of Statistics within CDIS) will be able to apply computational, mathematical and statistical thinking to data-rich problems in a wide variety of fields. In addition to the L&S "breadth and depth" requirements in languages, literature, social sciences and natural sciences, the data science major will have electives in geography, economics, sociology, Biocore labs and other courses not typically required for a quantitative major.

"The Data Science Program Committee, led by Bret Larget [a professor of botany and statistics], did a lot of reaching out and creating partnerships across campus," says Eschenfelder.

Eventually, Eschenfelder envisions adding requirements to the CDIS majors and certificates that pull from departments like psychology and sociology as well as departments in the humanities where data mining of texts has yielded fascinating insights for more than a decade.

"We are putting the building blocks in place for leadership in human-centered high tech," Erickson says.

BUILDING A STRONG FACULTY

Top-tier faculty are attracted to collaborative environments. The School of Computer, Data & Information Sciences hired a total of 15 new faculty this past spring, in the areas of human/computer interaction (UX), machine learning and artificial intelligence. All are research faculty from top-ranked institutions.

All will help meet the demand for more courses in a broad range of areas that will attract a wider pool of students.

These faculty will be interacting with others from across campus regularly.

"All three of these CDIS departments [computer sciences, statistics and iSchool] are ranked in the top 14 in the country," says Erickson. "We'll be leading on the research side. And those same people doing the research? They'll be doing cutting-edge teaching, too."

It follows, says Erickson, that students coming out of CDIS programs will be on the cutting edge of their disciplines.

DIVERSIFYING AT EVERY LEVEL

Accelerating recruiting and outreach strategies for underrepresented groups is a priority for CDIS, Erickson says.

"Historically, 35% of computer sciences graduates were women. Five years ago, that number went down to 18%," he says. "Something happened, and we need to solve this both for the benefit of society and for the benefit of the industry."

Arpaci-Dusseau acknowledges that computer sciences has work to do. Computing affects everyone; thus, it should include everyone, he says.

"To make progress on these issues, we believe doubling down on recruiting is a first step," he says. "But beyond recruiting, we want to build and maintain a strong, positive, inclusive culture. We cannot rest until all people have access to the education and research opportunities available within our department."

Meeting goals of inclusivity in the student body can't happen without faculty to lead the way. When female students see a woman teaching a 500-level computing class, they believe they can excel in a field inexplicably dominated, lately, by men. The same is true for students of color, whose experience with data, information and computing may not align with that of their white peers.

Each of the departments in CDIS has a diversity and inclusion committee, and all of them meet regularly to improve best practices and set ambitious goals.

"We are committed to achieving better outcomes," says Eschenfelder.

COLLABORATING ON RESEARCH

Many CDIS faculty are working on teams connected with UW-Madison's American Family Insurance Data Science Institute (DSI), which was created in 2019 as a campus-level center to encourage cutting-edge research and advance scientific discovery in collaboration with researchers across campus and beyond.

For example, there is a DSI COVID-19 Research Group that includes more than 100 people, including many CDIS faculty and staff, working together to interpret data and create models that help inform public health responses to the pandemic. Brian Yandell, professor of statistics, is the David R. Anderson Interim Director of the Data Science Institute.

"Data science research is all about collaboration," says Yandell. "CDIS and DSI together increase campus-wide visibility and focus on computing and data science, drawing on the diverse strengths of UW-Madison to attract industry and foundation partnerships to address wicked problems such as transforming human society in the face of pandemic threats, depleted environments and social inequities."

PARTNERING WITH INDUSTRY

At the heart of Erickson's vision for the School of Computer, Data & Information Sciences is the goal of positioning the new school as a critical resource for sparking entrepreneurship and innovation in Wisconsin.

"One of the key factors that has benefited the coasts has been the creation of new companies," says Erickson. "Ironically, Wisconsin is one of the great centers for scientific innovation. But we need to do a better job reaping the economic benefits of that."

He cites a December 2019 report from the Brookings Institution, "The Case for Growth Centers: How to Spread Tech Innovation Across America," that places Madison at the top of a list of 35 "potentially transformative growth centers" with promising innovation capacity, led largely by the research powerhouse that is UW-Madison.

The computer sciences department has always had strong ties to industry. Chair Arpaci-Dusseau says he and colleagues are excited to do even more to spark new companies and ventures.

"Where will new digital innovations be needed?" he asks. "How can we connect students to problems in agriculture, insurance, and other parts of our state economy, so that their innovations can help transform those fields? What elements need to be put in place so that innovators can be connected to relevant funding opportunities and professional networks, which are often critical to success?"

Erickson acknowledges that a strong foundation has been laid, but stresses that he'll be encouraging conversations with tech entrepreneurs, venture capitalists and industry leaders around the state.

"I feel that the state of Wisconsin can be a leader in value creation," he says. "And I believe the university has a responsibility for making that a reality." ■

HERE COMES THE SUN

Cary Forest has pushed the boundaries of plasma physics research at UW-Madison, investigating solar wind and, now, plasma fusion—with results that could benefit medicine and the planet.

BY SARAH PERDUE

Unlike the solids, liquids and gasses that predominate physical life on earth, the majority of our universe exists in a fourth phase: plasma. Plasmas are ionized gasses — a mix of charged atoms and free electrons — that have intriguing electrical and magnetic properties. The field of plasma astrophysics asks questions about plasmas throughout the universe, helping researchers to understand the formation and destruction of stars, star systems and galaxies.

Closer to home, our sun is also predominantly made up of plasma, and investigating its properties helps researchers to study the energy-producing nuclear fusion reactions that power the sun, as well as phenomena like solar winds that cause auroras and can affect satellite communications on earth.

This intersection of fusion research and astrophysics is where Professor of Physics Cary Forest has spent his entire career. Since joining the faculty in 1997, Forest has pushed the boundaries of plasma physics research at UW–Madison, continuing a tradition that started here in the early 1960s. As director of the Wisconsin Plasma Physics Laboratory, Forest helped to design and build the Big Red Ball, a three-meter-wide hollow sphere that allows scientists to study phenomena associated with magnetized plasmas, including aspects of the solar wind. The Big Red Ball and the Madison Symmetric Torus (MST), another plasma device, are now a U.S. Department of Energy (DOE) National User Facility, housed in Sterling Hall on the UW–Madison campus but available to researchers from across the country (thanks in part to a $12.5 million DOE grant to develop an integrated facility that would expand the frontier of astrophysical plasma research).

In April 2020, the DOE's Advanced Research Projects Agency-Energy (ARPA-E) announced that Forest and colleagues had been awarded a $5 million fusion energy grant to explore the creation of an efficient plasma fusion device. Their work could advance the push for clean nuclear energy, without the radioactive byproducts, and it holds significant promise for creating efficient medical isotopes.

FUSION: THE SUN'S SUSTAINABLE ENERGY SOURCE

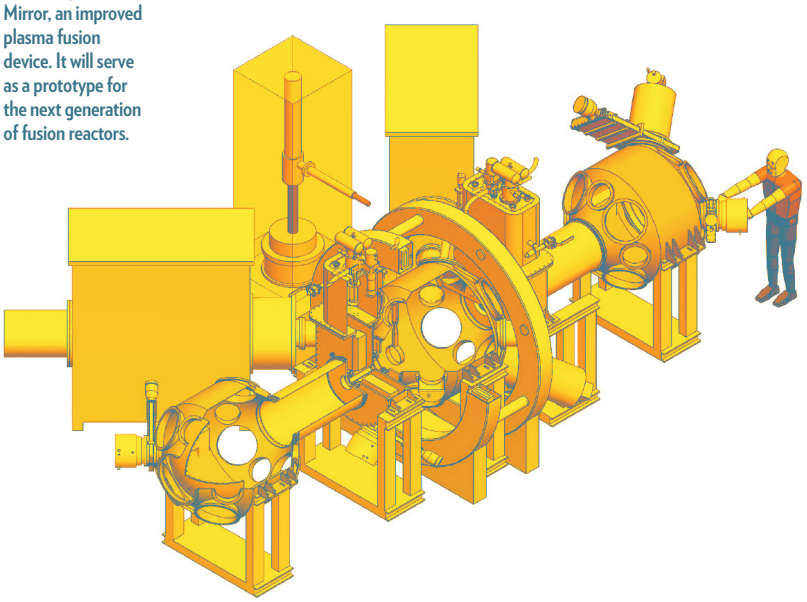
In solar fusion reactions, a molten plasma made up of hydrogen ions and electrons spins at rapid speeds, allowing the ions to collide and fuse their nuclei. The result is helium atoms and high-energy neutrons. The sun is a continuous fusion reactor; the energy it produces from fusion sustains the high temperatures needed for fusion to happen, and gravity helps keep the ions in close proximity so that they can bombard each other.

Essentially the same process happens in laboratory and other fusion reactors, just with slightly different isotopes of hydrogen — and much, much less efficiently. A large amount of energy is needed to heat the plasma to temperatures high enough for it to undergo fusion and, once those temperatures are achieved, it is difficult to contain the plasma long-term to generate a sustained fusion reaction.

If researchers like Forest can efficiently harness the fusion process of our sun, it could yield enormous benefits. For example, those high-energy neutron products from fusion are already being used to produce medical isotopes, which are used in procedures such as PET scans or some cancer treatments, and improving the efficiency with which neutrons are produced would significantly lower treatment costs. The neutrons could also be used to produce steam, which could be converted into electricity — electricity that is produced without the release of greenhouse gasses and with fewer radioactive products than the fission reactions used by current nuclear power plants.

"Our idea initially — funded by a UW2020 grant — was to build a neutron source which could go several orders of magnitude beyond current medical isotope production efficiencies but also provide a key first step in the direction of advancing fusion energy, which could potentially be a clean power source in the future," says Forest.

The DOE grant will help Forest and colleagues take that step: determining whether they can harness the power of high-temperature superconducting magnets to create a more efficient plasma fusion device. With the funding, Forest and his team will design and build the Wisconsin HTS Axisymmetric Mirror, or WHAM — which will serve as a prototype for the next generation of fusion reactors.



An illustration of the planned Wisconsin HTS Axisymmetric Mirror, an improved plasma fusion device. It will serve as a prototype for the next generation of fusion reactors.

BACK TO MIRROR MACHINES, BUT WITH UPGRADE

Fusion research began in earnest in the 1960s, when scientists developed mirror machines. These cylindrical devices have strong magnetic fields on either end that act like mirrors, reflecting the charged plasma particles inward and retaining them and their heat in the machine. American researchers, including a UW team operating the Phaedrus Tandem mirror, halted mirror research three decades ago, mainly due to an inability to contain the plasma.

Instead, U.S. research focused on donut-shaped devices called tokamaks and variants such as MST, which confined plasma much better than mirrors. Other countries, however, such as Russia and Japan, continued mirror research and made great advances.

"We're producing fusion reactions all the time at MST, but it is a pulsed machine, as opposed to a continuous one like the mirror machines were. Pulsed operation adds complications to power plants: Just like for solar, if the heat

PHOTO: JEFF MILLER

Cary Forest works at the intersection of fusion research and astrophysics.

comes and goes from a [theoretical] pulsed fusion plant, you need to store energy for when the reactor is off,” Forest explains. “Another advantage of the mirror machines is that their linear systems are much easier to build, take apart, and put back together than the toroidal machine.”

WHAM will essentially restart U.S. research on mirrors, but with significant technological upgrades and lessons learned from Japanese and Russian colleagues.

“We hope to go well beyond what was done in the mirror program because we have access to very-high-field superconducting magnets like those being built by our partners for toroidal plasmas. These magnets and heating systems simply weren’t available 20 years ago,” Forest says. “It’s a new look at an older concept using new technology.”

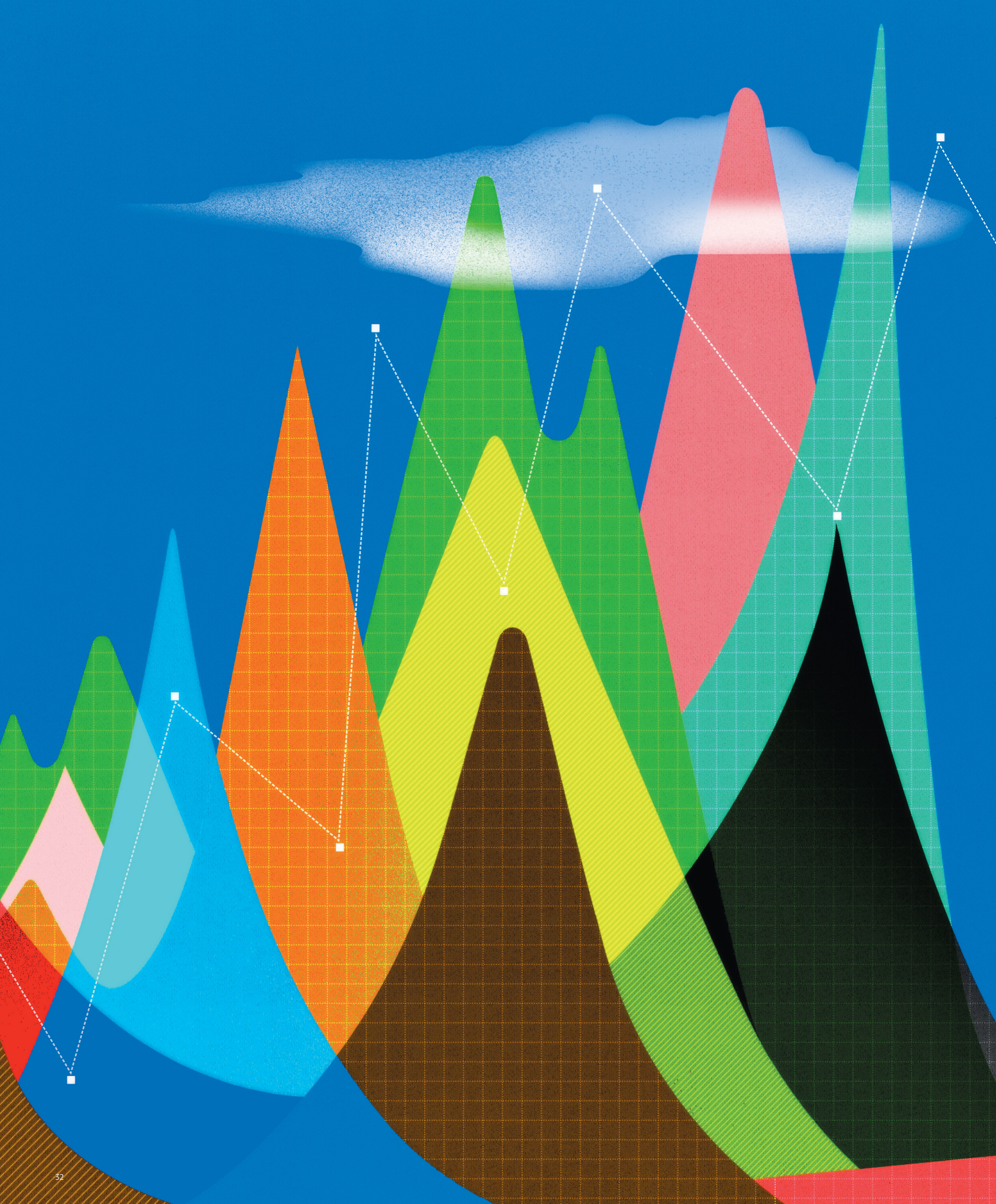
With the DOE funding, the UW–Madison team will build the device at the Physical Sciences Laboratory (near Stoughton) and begin operating it, which involves burning plasma to more than 100 million degrees Celsius, confining it magnetically with superconducting magnets and, eventually, using it for neutron production.

A key difference between WHAM and a power plant that relies on fusion (rather than fission, like current nuclear plants do) is the types of hydrogen isotopes they will be using in the reactor. Natural isotopes of hydrogen contain a single proton in their nucleus, but anywhere from zero to two neutrons. Protium (zero neutrons) and deuterium (one neutron) are stable isotopes, but tritium, or hydrogen with two neutrons, is radioactive.

“We’ll be making neutrons using the deuterium–deuterium reaction, not the deuterium–tritium reaction that you’d have in an actual fusion power plant,” Forest says. “We’re able to study things without being full-on nuclear.”

Still, Forest expects this prototype device will provide invaluable input into scaled-up devices. And, it should produce neutrons much more efficiently than current methods, helping to reduce the cost of medical isotope production, and offer the promise of energy production that is safer for the planet. ■

The DOE-funded work is part of a collaboration led by UW-Madison scientists that includes researchers at the Massachusetts Institute of Technology, who are developing a blanket to wrap the device for improved performance, and Commonwealth Fusion Systems, a company spun out of MIT that will produce and supply the magnets.



SOARING STATISTICS

Growing department raises Wisconsin's profile in the data and information sector.

BY AARON R. CONKLIN

Statistically speaking, it's a great time to be a statistics major at UW–Madison.

The major, which hosted less than 50 students as recently as a decade ago, ballooned to a whopping 468 students in fall of 2019, including an increase of more than 200 students in the past two years. And the department is included under the auspices of the College of Letters & Science's new School of Computer, Data & Information Sciences (CDIS), where it houses a new (and already popular) data sciences major beginning this fall. More than 175 current students and more than 130 incoming students have expressed an interest in it.

What's driving the sudden increase?

"Businesses are increasingly relying on data for their decision-making," says Cecile Ane, a professor of statistics and botany. "The increase in data availability drives an explosion of jobs that need data skills in every sector."

Statistics, the science of learning from data, is like a Swiss Army knife in that it pairs easily with other academic disciplines. Students majoring in math and computer sciences often double-major in statistics, but the department is also seeing students in economics, business, psychology, biology, linguistics, global health, engineering, sports/entertainment, sociology, astronomy, and even fashion design expressing interest in statistics. The career paths can be equally diverse. A recent department alumni event featured graduates with statistics degrees who were working at places like the Mayo Clinic, CUNA Mutual Group and the Wisconsin Alzheimer's Association.

"My biology colleagues often ask me what species I work on," Ane says. "As a statistician, the methods I use and develop are applicable to all of them, from large animals and plants to small bacteria and viruses." Ane points out that statistical methods are the reason scientists know that the virus that causes COVID-19 was introduced many separate times into Wisconsin from elsewhere in the United States and from other countries. Professor of Statistics Brian Yandell was recently awarded one of nine University of Wisconsin Area Research Foundation COVID-19 Accelerator Grants to develop a method for visualizing and tracking the virus's spread in Wisconsin counties with small populations.

Juliana Brandt, a rising junior from Orange County, Calif., who is double-majoring in mathematics and statistics, chose UW–Madison because of the statistics department's breadth and depth of offerings.

"I'd like to work for a tech company or one that shepherds new discoveries," says Brandt, who aced an AP statistics class in high school. "The statistics department really lets me find my own path." ■

ILLUSTRATION: BRIAN STAUFFER

A Gift of Love

Joel Berman's generosity creates the Sandra Rosenbaum School of Social Work.

BY AARON R. CONKLIN

Joel Berman's love for his wife, Sandra Rosenbaum, has transformed the School of Social Work at UW–Madison.

Three years ago, Berman, a member of the Letters & Science Board of Visitors, approached the school's leadership to fulfill a promise he'd made to his wife of 27 years. Sandra, who received her graduate degree in social work from UW–Madison in 1976, wanted him to donate to the school to put dedicated, well-trained social workers into the field quickly while reducing the financial barriers to earning the degree. When Sandra passed away that summer, Berman created a scholarship in her name and that of her mother, Harriet, a New York social worker who had inspired Sandra's love of the field. Harriet also graduated from UW–Madison.

He wasn't done. In June, Berman fulfilled his promise to his wife and then some, donating $25 million to rename the school the Sandra Rosenbaum School of Social Work. It's the largest gift in the school's history and makes it one of the only named schools of social work in the country.

"This generous gift will support us in continuing our reputation for excellence by allowing us to further enhance our research, teaching and service missions," says Stephanie Robert, professor of social work and the former director of the Sandra Rosenbaum School of Social Work.

Berman's gift will support doctoral programs, help create named professorships and scholarships, and provide funds that will allow the school to further diversify its student body, support an inclusive environment and expand impactful work around issues of racial and social justice.

"I felt I wanted to do more," says Berman. "It makes me feel good to say to the world, 'I love my wife, and I wanted her name to have a home in a place she loved.'"

Berman, a gregarious and humble storyteller, grew up outside Philadelphia. After graduating from the University of New Hampshire with degrees in physics and earth science and completing a master's degree in earth and planetary science at the Massachusetts Institute of Technology, he founded Iatric Systems, a healthcare technology systems company he sold in 2018, a year after Sandra's death. The company had around 300 employees, nearly all of whom worked remotely, long before the global pandemic made this commonplace.

"It gave me the ability to hire good people and not care where they lived," says Berman. "People always tell me I accomplished a lot. I just hired good people and got out of the way."

Berman first met Sandra Rosenbaum while at MIT. Berman and Rosenbaum's then-husband were both part of the same graduate student study group. Joel and Sandra married in 1989 in a park following a Milwaukee Brewers game.

Though she only spent a few years as a social worker, Rosenbaum never lost her love for the profession — or for Madison, a place she and Berman visited frequently, in addition to the couple's international travels. Rosenbaum nursed a penchant for Babcock Hall's orange custard with chocolate chips and sunsets on the Terrace at Memorial Union.

"Every time we came to Madison, she'd have us drive around campus, and she'd say, 'Can we make just one more loop in the car?' It was literally like sacred ground to her."

Berman's attachment to the school, which began with his wife, remains strong. He makes a point of reading every student essay submitted in application to the Harriet & Sandra Rosenbaum Scholarship he created and meets the winners each year at a celebratory event for awardees. Now that the school bears his wife's name, he relishes the opportunity to be part of making a difference for future generations of social workers.

"Sandy and I were both alarmed by the current environment of 'What's in it for me?' That sort of me-first thinking ignores the guy who's sleeping in the street," Berman says. "The values of helping people will be forwarded by this money." ■

Sandra Rosenbaum, left, had a deep affinity for both social work and UW-Madison. "It was literally like sacred ground to her," says Joel Berman.

Finding Common Ground

BY ARMANDO IBARRA

For me, the Wisconsin Idea means producing knowledge about the issues of migration and settlement in collaboration with community stakeholders. I see this work as a way to help all of us learn to live together as we face economic, demographic, and environmental change.

Armando Ibarra is an associate professor in the Department of Labor Education and director of the L&S Chican@ and Latin@ Studies Program. Trained as a political scientist, he studies and teaches on migration and settlement and the social and cultural transformations that these processes create.

And make no mistake: The United States is changing. Over the last thirty years, trade and foreign policy initiatives have made us increasingly interdependent with our neighbors to the south. The old era of "gunboat diplomacy" with Latin America has more or less ended, but our new relationships are fraught and asymmetrical. Life in countries like Mexico, Guatemala, El Salvador and Honduras has become untenable for large numbers of people. Some labor moves north, even as some formerly secure U.S.-based jobs move south and further afield. This new interdependence is reshaping the population of the United States even as it concentrates more and more wealth in fewer and fewer hands both here and abroad.

Most demographers agree that in the future the United States will be more racially and ethnically diverse than it is now, and economic trends point to continued change that will make tomorrow's labor market different from today's. In this context, change and inequality generate anxiety and conflict. Policies and political positions emerge from incomplete information, strengthening myths and feeding rhetoric that polarizes our country. Some of my academic friends who study social movements say the United States is as divided politically and culturally now as it has ever been. I think I agree. So, what to do?

I engage in community-based research that seeks to identify root causes and consequences of these dynamics and consequently offers practical evidence-based conclusions and recommendations.

In addition to preparing academic publications and reports that could allow policymakers to strengthen our communities by receiving newcomers from Latin America effectively, I have documented the lives, dreams, and struggles of ordinary workers, mostly people of Mexican descent, in our state. This work has added a Wisconsin voice to national social science debates on labor, migration, politics, and integration. These debates and these realities also inform my work with students. In partnership with community organizations in Madison, Milwaukee, and beyond, I have trained students to collaborate with marginalized communities in the production of knowledge that can help them address their most pressing concerns. In all of this work, I seek to find ways for all Wisconsinites to build common ground and work for a shared, more just and equitable future. ■

ILLUSTRATION:FRANCESCO CICCOLELLA

WFAA 2020 DISTINGUISHED ALUMNI AWARD

ADA DEER '57 (BA, SOCIAL WORK) is the first Menominee to earn a UW–Madison undergraduate degree and the first American Indian to earn a master's degree from the School of Social Work at Columbia University. A social justice activist for the past half-century, Deer is committed to human rights for all, and especially American Indians. Deer worked relentlessly on behalf of the Menominee in their struggle to restore their land and sovereignty. Through her leadership, she worked with many in her community to create the Menominee Restoration Act of 1973, a historic reversal of national policy. She became the tribe's first woman chair. During the Clinton administration, Deer became the first woman to serve as assistant secretary of Indian Affairs for the U.S. Department of the Interior. Some of her most important and meaningful work in this role was applying her powers to federally recognize 226 native villages in Alaska.

Deer was the inaugural participant in 2018 of the Culture Keepers/Elders-in-Residence Program, a new UW–Madison initiative to improve the experience of American Indian and Alaskan Native students by hosting Native elders on campus for extended visits and educational exchanges.

In 2019, she was inducted into the National Native American Hall of Fame.

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Last Word

The Badger state is #1 in a recent study (by Tufts University) ranking top states and districts where young voters have the highest potential to sway the outcome of the 2020 elections. Students voted in-person absentee in the August primary, at various stations around campus.

PHOTO: KOLIN GOLDSCHMIDT