Wisconsin engineer. Volume 124, Number 3 Fall 2020

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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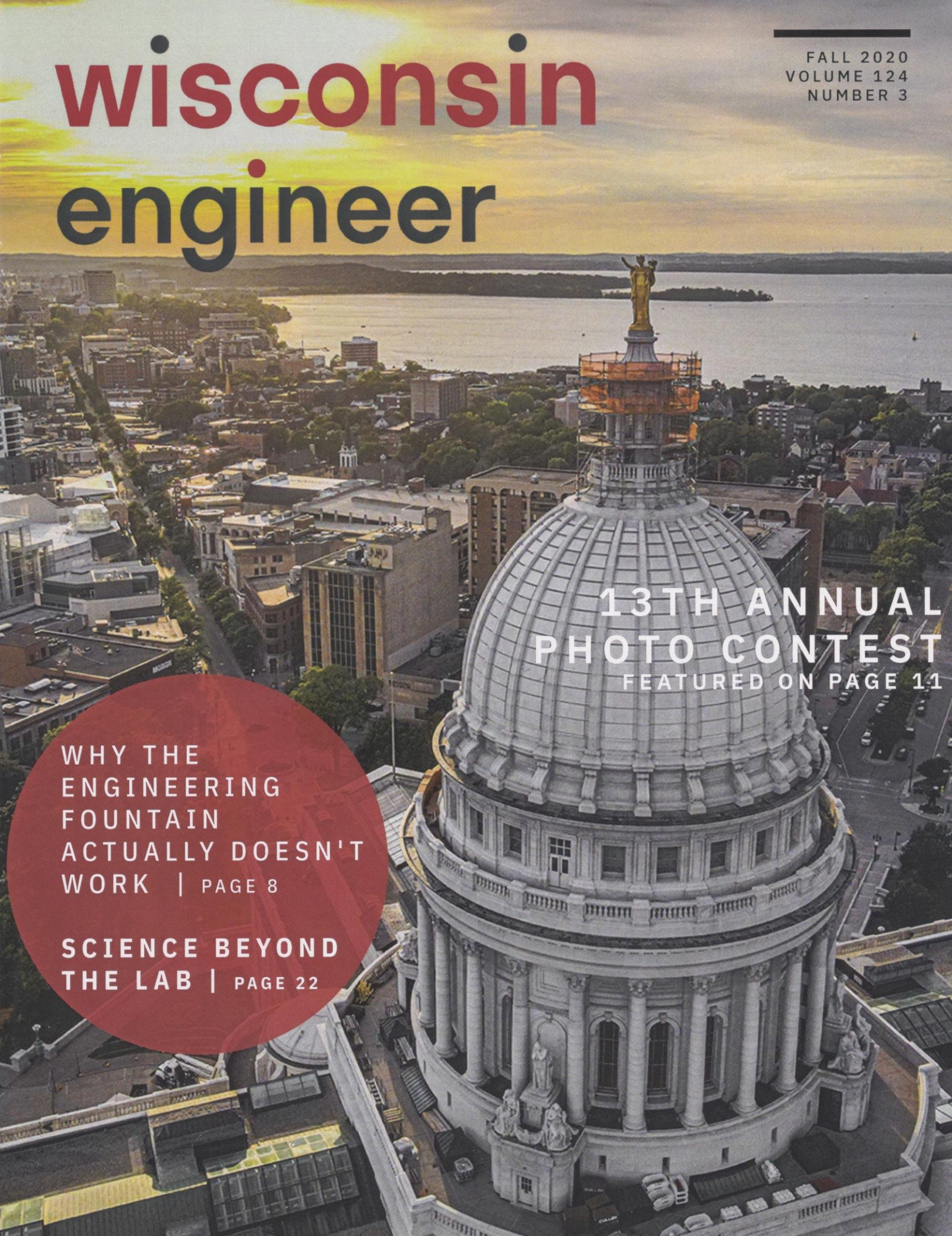
wisconsin engineer

FALL 2020
VOLUME 124
NUMBER 3



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The WISCONSIN ENGINEER MAGAZINE, a member of the Associated Collegiate Press, is published by students at UW-Madison. Philosophies and opinions expressed in this magazine do not necessarily reflect those of the College of Engineering and its management. All interested students have an equal opportunity to contribute to this publication.

PUBLISHER: Department of Information Technology, University of Wisconsin-Madison, Madison, WI

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The Wisconsin Engineer is published quarterly in Fall, Winter, Spring, and Summer by the Wisconsin Engineering Journal Association.

COVER PHOTO TAKEN BY: JOSH REDFEARN

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LETTER FROM THE EDITOR

This year has challenged all of us for reasons that seem to multiply every day. Between the Covid-19 pandemic and calls for social justice around the country, it seems that everyday life has been in a state of limbo since March. When rumors first spread that UW-Madison would transition to online after Spring Break, I personally didn't believe it would happen. Reflecting on this now in November, it's difficult to grasp how much has changed in the lives of us as individuals, students, and citizens.

With little notice of the cancelation of in-person class, we were left with no other option than to cancel the printing of our Summer 2020 issue. This is the first time we have not been able to print a scheduled issue since 1995. While this was a difficult decision, it was not feasible from a logistical or personal perspective to expect our staff to finish the issue remotely during (the early stages of) a pandemic. We are thrilled to be able to return to print with this Fall 2020 issue and hope you are too.

Even among the dozens of challenges we've faced while putting together this issue, I truly believe our publication is better for it. We've used this as an opportunity to expand more into social media (obligatory plug: check us out on Instagram, Twitter, and Facebook!). We've taken time to re-evaluate the content we bring to you, and hope you enjoy the greater variety of articles in this issue and the issues to follow. We've also welcomed our new faculty advisor, Mike Shapiro, to the magazine (truly a brave man to say "yes", even when we've never met in person!). Our staff have truly risen to the occasion, making time to write some stories, take some pictures, and put together this magazine, even when some days this semester have felt like the world is on fire.

Although this is not in any way how I expected my last semester of college and my last issue with the magazine to go, I am immensely proud to put my name on this publication. Being a part of the magazine for the last four years has been integral to my college experience. I am a much better writer, leader, and person than I would have been without the magazine or, more importantly, the wonderful group of people I have had the privilege to make it with. I hope that you learn something new, find some positivity, or are able to indulge in some STEM-related escapism with this issue of the Wisconsin Engineer Magazine and the issues to come, no matter what lies ahead.

-Katlyn

INTRODUCING THE EMERGING LEADERS IN ENGINEERING PROGRAM

WONDERING HOW TO BOOST YOUR LEADERSHIP SKILLS FOR YOUR RESUME? CHECK OUT THE NEW EMERGING LEADERS IN ENGINEERING PROGRAM

WRITTEN BY
SHIRENE SINGH

Our experiences outside the classroom can be just as vital as the professors' lectures inside. A number of cardinal life lessons and soft skills cannot be easily "taught" but are instead instilled through experiences. Participating in the Emerging Leaders in Engineering (ELE) program is one way for students at UW-Madison to develop these leadership skills through structured experiences.

ELE is a new cohort program facilitated by the College of Engineering that promotes a climate of student involvement through professional development opportunities, personal exploration, and civic engagement. By completing this program, students would gain the skill set to use their engineering mindsets while navigating everyday challenges, both in and out of the classroom.

Paige LaPoint, Director of Student Organizations and Leadership Programs in the College of Engineering, emphasizes on the significance of conceptualizing the ELE program. "The idea for the ELE program came from a group of ten undergraduate students and myself. We knew that the College of Engineering needed some type of formalized leadership education for our students, but we weren't sure what that looked like. The idea of the course, and having students navigate through the Center for Leadership and Involvement's program, came from many discussions, research, data review, conversations with students. Ultimately, we determined that we wanted our students in the College of Engineering to graduate from this program with formal recognition" LaPoint says.

Undergraduate students who participate in this leadership program and exhibit their understanding of (and engagement with) the leadership learning outcomes, get recognized with a Leadership Certificate, from the Center of Leadership and Involvement - UW Madison when they graduate. The ELE program runs from the fall to spring of one academic year. To earn the Leadership Certificate, students must be able to demonstrate at least 100 hours of experience focused on leadership development on and off-campus, among other requirements.

"The program really focuses on the full development of the engineer: both your technical abilities, as well as those you need to be a successful manager, employee, co-worker, teammate, or helper. We spend a great deal of the course talking about you, the student. What are your values, beliefs, strengths, areas for growth? How do we then take all of that knowledge and apply it to working on a team with other individuals who bring the same?" LaPoint says.

LaPoint also teaches the ELE program's required three-credit class INTEREGR303: Applied leadership competencies in Engineering. This class gives students the opportunity to foster relationships with fellow engineering students while working with a local non-profit organization on their chosen community project, using their engineering skills. This academic year, the ELE program is partnering with the Adams-Friendship School District, Adams County, WI for one of the community projects. This project's objective is to help improve career exploration opportunities for students. The second project involves the students working under the guidance of Brown County's Deputy County Executive, Jeff Flynt, to evaluate autonomous vehicle routes for consumer cars or shuttles in Brown County, WI.

In addition to being involved with a community project, ELE students also participate in a young alumni mentorship program. These mentors, who are recently graduated engineers, help guide students through their personal and professional development journey. They also provide professional insight on subjects that are often tricky for undergrads to navigate, such as finding research opportunities, resolving the industry vs graduate school dilemma, and conquering the start-up world.

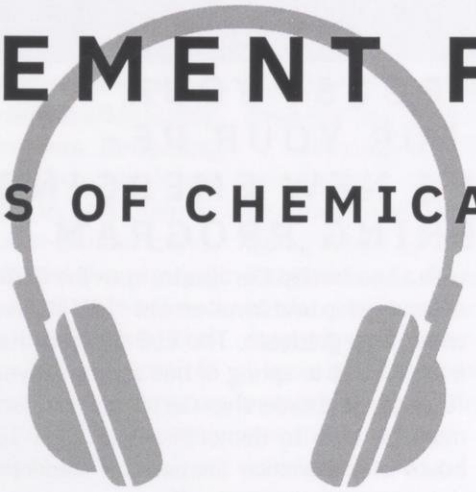
PAIGE LAPOINT, Director of Student Organizations and Leadership Programs

Leadership is an invaluable virtue that employers value deeply. It can often be difficult to demonstrate leadership experience on paper, as it is a quality that is typically developed and exemplified through experience. However, the ELE program is a great way to enhance this important skill and to convey these experiences to future employers.

The ELE program has been received positively by the students with nearly 200 interested students this academic year. "We were able to narrow down the pool to 22. Our hope is to provide the ability for all students who wish to participate to do so through more sections of the course," says Paige LaPoint. She plans to continue this program next academic year with the continued aim of making a positive impact on a young student leader's professional and personal development and equipping them with leadership skills to succeed in their future endeavors.

CHEMISTRY IN ITS ELEMENT PODCAST

CURIOUS TALES OF CHEMICAL COMPOUNDS



WRITTEN BY
TEJA BALASUBRAMANIAN

QUARANTINE IS A GREAT TIME TO LEARN ABOUT SOMETHING NEW, OR START LISTENING TO A PODCAST! THE "CHEMISTRY IN ITS ELEMENT" PODCAST EXPLORES SCIENCE AROUND US, THROUGH SEVERAL LENSES, INCLUDING ART, HISTORY, ANTHROPOLOGY, AND EPIDEMIOLOGY.

We are surrounded by chemical molecules and compounds – it is in our food, our bodies, as well as the plastics and products we use. Want to learn about how sunblock came to be, along with how its chemical components have historically been known to bleach coral reefs? How about oleic acid, which serves as the common denominator between olive oil, dandruff, and stained-glass windows? The Royal Society of Chemistry's "Chemistry in its Element" podcast series is remarkable in its witty, funny, entrancing analyses of chemical compounds. A wide range of chemicals are explored: from molecules that may potentially be a cure for Covid-19 to a hypothetical sci-fi exploration of alternatives for our ubiquitous life-building blocks carbon and hydrogen. This podcast is truly an amalgam of insightful knowledge-building and masterful storytelling.

This podcast caters not only to people invested in the field of chemistry, but to anyone who is interested in history, medicine, or culture. Each episode is quite short, only around five to eight minutes long, but packs in an abundance of quirky history facts and thought-provoking science questions.

One episode is about hydroquinone, a compound that plays a controversial role in skin depigmentation, as well as occasionally being released from a beetle's rear-end. Hydroquinones are made up of hydrogen, oxygen, and carbon. Throughout the episode, we learn that bombardier beetles, a species that thrives in the woodlands and grasslands of North and South America, raise their bums and release a chemical spray made up of hydroquinone and hydrogen peroxide. After discovering this, humans decided to incorporate hydroquinone in perfume, which is known to take on a leathery scent after several years.

Additionally, the same compounds come together to make vanilla essence, although this certainly is not the primary means of production. Furthermore, hydroquinone is found in castoreum, which is a yellowish fluid, secreted by beavers. Beavers utilize castoreum, in conjunction with their urine to mark their territory. Castoreum can also be found in a famous Swedish drink called Bäverhojt! The podcast goes on to explore the innovative ways that hydroquinone unites with other compounds to participate in skin depigmentation and photography.

The "Chemistry in its Element" podcast is available for free on the Royal Society of Chemistry's website, Spotify, Google Podcasts, as well as several other platforms. The producers of the podcast love to hear from their listeners and their suggestions of which element to explore next. By listening to this podcast, one will certainly develop an appreciation for the not-so-subtle means by which chemistry influences life around us.

GRAPHIC DESIGN BY KATLYN NOHR

QSI LAB - IMPROVING PATIENT CARE AT UW HEALTH

THE QUALITY SAFETY AND IMPROVEMENT (QSI) LAB IS A STUDENT-DRIVEN RESEARCH GROUP THAT PARTNERS WITH UW-HEALTH ON PROJECTS THAT IMPROVE PATIENT CARE.

WRITTEN BY
GABRIELA SETYAWAN

Jack Grahek started off his undergraduate career studying Biomedical Engineering (BME), when he realized that he was interested more in the process of healthcare than the actual practice. As a result, he switched gears to Industrial and Systems Engineering (ISyE) and developed a passion for Health Systems Engineering, which is a growing field that combines engineering analysis with human factors related to healthcare. When Grahek was a Sophomore, he saw the Quality Safety and Improvement (QSI) Lab as an opportunity to apply theory to practice, specifically in increasing efficiency in the delivery of healthcare. He decided to join the lab as a project support member.

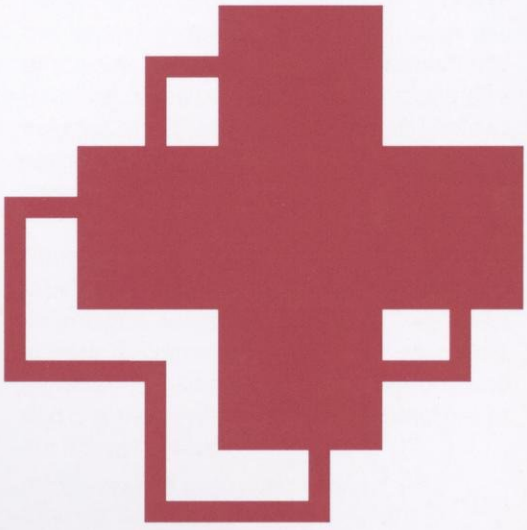
Today, Grahek is a graduate student studying Industrial Engineering. This past spring semester was Grahek's fifth semester in the lab where he led the lab with his co-project advisor, Allison Drees. As co-project advisors, they were responsible for overseeing several projects and reported directly to executives in the hospital. This past spring, the QSI Lab had five projects that were related to operations research and optimization, data analytics, patient safety, and process improvement.

Obtaining the right qualitative and quantitative data is critical in identifying inefficiencies and improving processes so that hospitals can deliver more productive and efficient services to their patients. For instance, during Spring 2020, the QSI Lab conducted a large data analysis project to investigate how operating rooms are used in the American Family Children's Hospital (AFCH). One of the critical findings was the underutilized surgical time blocks. Mitigating this inefficiency relates to another QSI project to improve operating room turnover process, enabling the Department of Surgery to serve more patients.

As part of the project management and communication, the lab conducts weekly meetings with different stakeholders in the hospital ranging from the head of the emergency department to surgical technicians. "The lab is focused on enhancing stakeholder engagement and building relationships with key staff members throughout the UW Health system" Grahek says. Effective communication with stakeholder is critical to the success of the projects because stakeholders in the hospital enable the lab to access information and gain feedback that strengthens the lab's recommendations.

In the spirit of having a strong stakeholder engagement, Grahek is particularly fond of building relationships with clinicians and patients through the QSI Lab. One of his past projects looked at how to improve a patient's experience in the emergency room. "Being in the emergency room is not the most favorable situation for a lot of people," Grahek admits. But, by finding the roots of dissatisfaction, he was very happy to see that a patient can have a better experience in the emergency room by redesigning staff communication patterns.

GRAPHIC DESIGN BY LUCAS BARTEL



SUSTAINABILITY, STARS, AND "SAVING THE WORLD"

THE RECENTLY ESTABLISHED OFFICE OF SUSTAINABILITY TAKES A SYSTEMS APPROACH TO STUDYING SUSTAINABILITY IN A HOLISTIC AND TRANSDISCIPLINARY WAY.

WRITTEN BY
MARY LAUDON

When students return to campus each year, their main priorities often include attending sporting events, catching up with friends, and preparing for another semester of classes. Meanwhile, the Office of Sustainability is working behind the scenes to leverage the effect that these 45,000 incoming students will have on the campus and community. The Office of Sustainability at UW-Madison, formally established in 2012, works to organize campus operations related to sustainability and to reduce the carbon footprint of our students.

The idea of sustainability is often equated with recycling or climate change. However, sustainability encompasses much more. Specifically, sustainability also studies social justice and economic vitality and how these concepts interact and intersect.

At UW-Madison, sustainability is the transdisciplinary research into solving critical problems in our community, which are usually related to the environment in some way. This research also focuses on how these problems affect marginalized communities. As Missy Nergard, the first full-time director of the Office of Sustainability put it, "Sustainability works across multiple divisions to bring everyone together for mutual benefits".

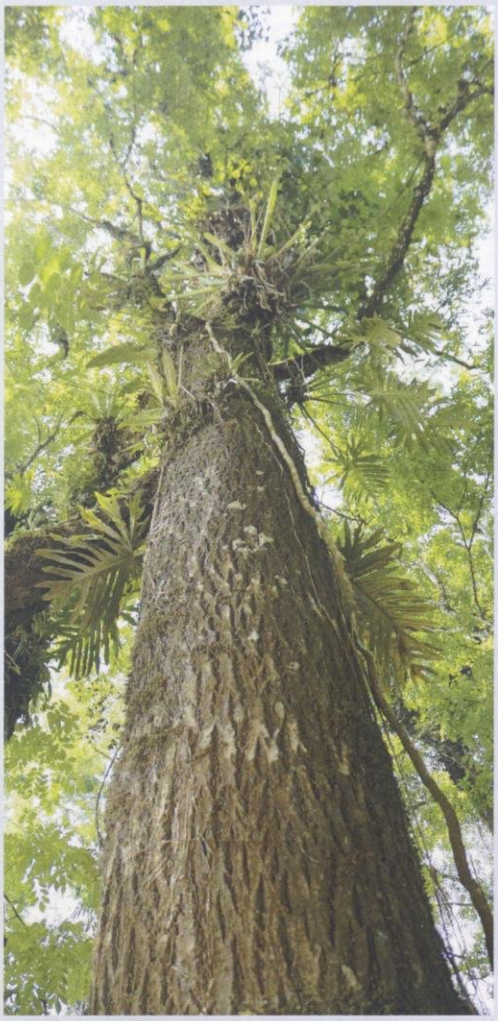
While the culture of sustainability and the respect for our environment is deeply embedded in campus culture, UW-Madison is behind other schools in measuring our sustainability efforts.

In 2006, AASHE (the Association for the Advancement of Sustainability in Higher Education) began developing a campus sustainability rating system, resulting in STARS, the Sustainability Tracking, Assessment, and Rating System. While some campuses have completed this assessment multiple times, UW-Madison completed this process for the first time in 2019.

The Office of Sustainability at UW-Madison measured sustainability on our campus in an extremely methodical and precise way. The metric is a point system with four different areas: planning and administration, engagement, academics, and operations. The Office of Sustainability met with over 150 data stewards on campus to gather information for the rating. One of their methods required a

thorough search of research publications and course catalogs to find specific key words indicating UW-Madison's commitment to sustainability.

UW-Madison received a Silver rating in their first STARS assessment, which falls in the middle of the award spectrum. The highest rating is platinum, followed by gold, silver, bronze, and reporter. Realistically, our campus likely practices sustainability on a



level higher than the rating shows, and it is not uncommon for universities to receive this level rating for their first STARS report. Since it was the first time completing the rating, the Office of Sustainability counted conservatively and ensured the counting process was done correctly. They were extremely transparent with the methodology that was used to complete the process, and they are continuously refining and evaluating this methodology to improve their data collection.

Our campus looks to other campuses and their ratings for comparison, but "we are competing with ourselves" Nergard says. While the rating is good for three years, the University plans to reassess in two years to demonstrate the progress we've made in measuring sustainability and to keep the idea in the forefront of people's minds.

> "EVERYTHING THAT IS NEEDED TO SAVE THE WORLD IS DONE IN THIS ONE-MILE CORRIDOR [OF CAMPUS]" -MISSY NERGARD

While UW-Madison may not have the highest rating (yet), the campus is making strides and setting precedents with regard to sustainability in higher education in other ways. For example, UW-Madison is the top producer of peer reviewed articles regarding climate change and one of the top researchers of climate change in the Midwest. Additionally, the Office of Sustainability is on their way to becoming one of the most professionally well-staffed sustainability departments in the country. UW-Madison is also one of the top poverty research institutes in the nation, which has direct ties to sustainability.

Sustainability is a holistic approach to the way we affect the environment and vice versa; therefore, research on poverty is central to sustainability. In this way, solving environmental justice issues are key to solving climate change. "Everything that is needed to save the world is done in this one-mile corridor [of campus]", Negrard says.

As for the future of sustainability at UW-Madison, Nergard and her colleagues have sizable goals beyond the STARS rating we receive every few years. Ideally, our campus would become a closed loop system, which reuses the same materials over and over again to create new products. When done correctly, this practice eliminates waste and conserves natural resources.

For example, our own scientists study microplastics in waterways that come off of our clothes. In a closed loop system, "Even our football team will be wearing some kind of amazing textile product that doesn't contribute to the pollution that we are studying and trying to alleviate", Nergard says. Looking forward, the Office of Sustainability would like to see our campus identify the problem and be the actors that create the solution.

If you are looking to get involved with the Office of Sustainability and contribute to their unique approach, they have held an intern program since 2012. For ten weeks each summer, 15 interns are paid to learn about the campus, community, and concepts of economic vitality and social justice. The interns act as liaisons and representatives throughout the academic year and interact with student orgs to further sustainability on campus.

As engineering students, we have more to contribute to sustainability than one may think. Look no further than our own campus, to the new Chemistry building that is currently under construction. Since concrete is one of the largest contributors to greenhouse gas emissions, a technique called 'BubbleDeck' is being used. Hollow plastic balls are inserted into the structural slab and held in place by steel, eliminating 35% of structural concrete.

In order to commit to a sustainable future, climate scientists and engineers must work together to translate science in meaningful ways. As students, we must actively recognize the ways in which we contribute to sustainability on campus and find creative ways to apply these practices to our future careers.

PHOTOGRAPHY BY JACOBO TORNELL
GRAPHIC DESIGN BY LUJAIN AL JUMAH

WHY THE ENGINEERING FOUNTAIN ACTUALLY DOESN'T WORK

A SHOT OF THE DESCENDANT'S FOUNTAIN DURING WINTER.

FAULTY JETS? LEAKY PIPES? NOT ENOUGH WATER IN MADISON?FIND OUT THE REAL REASON WHY THE DESCEN-DANT'S FOUNTAIN DOESN'T WORK.

WRITTEN BY
SYDNEY HEIMER

Why, on a campus full of engineers, is there a fountain that does not spray water? I sat down (virtually) with Dean Ian Robertson to find out.

The Descendant's Fountain, or Máquina (Spanish for machine) is the "showpiece" of the College of Engineering campus, according to Robertson. "It's one of those things that brings together art and engineering," Robertson says.

The fountain was designed by William Conrad Severson in 1994. Besides being a centerpiece for the engineering campus, the structure was initially a learning tool for students. When it was first built, students were tasked with programming the water feature using a logic controller. Students were also responsible for routine mechanical maintenance in the underground control room nicknamed "the dungeon." When the fountain was built, viewers could wave their hands over sensors in the walkway and

trigger the fountain to spray. The controller could also sense temperature and wind patterns to ensure that the spray would not create an icy danger zone on the sidewalk below. But this fountain has been shut off for over six years.

There are rumors that the fountain was not properly constructed, that the water jets were misplaced and would spew water everywhere, or even that the city of Madison does not have enough water to support it. "They're all wrong," Robertson says. He explained that the complex piping system is likely blocked, the pump system needs to be replaced, and the control system is corroded and outdated. Even if the faculty did want students to try to fix it, the "dungeon" control room no longer complies with safety regulations. Student access would require significant safety training and gear.

"The idea of letting students work on it would be a challenge these days," Robertson says. "We are not going to be working on the fountain any time soon." The College of Engineering campus may be seeing some bigger changes instead. The University of Wisconsin Schools System has requested state funds for a new building. In phase one of the project, they will replace 1410 Engineering Drive with a new seven-story building. In phase two, the building will be expanded into the green space east of the Engineering Research Building. An active two-story bridge will connect these two structures.

"WE ARE NOT GOING TO BE WORKING ON THE FOUNTAIN ANY TIME SOON."
-DEAN IAN ROBERTSON

This new building will house undergraduate classrooms and teaching labs. It will also have space for student organizations to work on design projects. "We really want to bring more students together from different departments to work on design projects, but we need new facilities to make that happen," Robertson says. "I think it is really exciting."

For fans of the fountain, its repairs may be addressed in the future. But the College of Engineering's current priority is the new building to improve student's learning experience.

"If we can get the new labs and the new classrooms built, and we start working on what the new landscaping would look like, then we can figure out what we're going to do with the fountain," Robertson says.

PHOTOGRAPHY BY AUSTIN NELLIS
GRAPHIC DESIGN BY JEMIMAH MAWANDE

RESEARCHERS GO "NUCLEAR" FOR SAFETY

RESEARCHERS AT UW-MADISON LOOK TO FIND A SAFER WAY TO USE NUCLEAR ENERGY.

WRITTEN BY
CAMEY ZUSSMAN

When the word "nuclear" comes into the conversation, bad connotations are immediately attached to the word. For Kaya Mondry, however, nuclear power is the gateway for many promising research opportunities. Her research group is fighting this stigma by improving how nuclear plants operate.

Research Intern Mondry, whose advisors are Michael Corradini and Hwasung Yeom in the Department of Engineering Physics at UW- Madison, takes part in researching materials that could be used to increase safety margins and decrease the likelihood of nuclear-related accidents.

"It's all safety research," Mondry says. "The Department of Energy decided to put funds into researching nuclear fuel to find what materials are best for preventing severe accident conditions."

The research being done in the Department of Engineering Physics was inspired by the Fukushima Daiichi accident in March 2011 where an earthquake of magnitude 9.0 followed by a tsunami disabled the emergency power generator for reactor cores and led to the loss of coolant to the nuclear fuel system. Under the loss of active cooling, overheating of fuel/cladding system due to decay heat accelerated the exothermic reaction between Zr-alloy cladding and high temperature steam, leading to core damage and high levels of hydrogen production. Researchers like Mondry chose this work because they understand the importance of nuclear power in our lives and want to make the process safer for the environment.

The research that Mondry has worked on is focused on evaluation of heat transfer performance for fuel cladding materials, encasing nuclear fuel pellets, within Light Water Reactors (LWRs). More specifically, Mondry is studying the critical heat flux (CHF) using these materials, which determines the operational limit of the reactors. CHF represents boiling transition point from high heat transfer nucleate boiling regime to low heat transfer film boiling regime.

"You want a high critical heat flux to improve safety margin. If the CHF is low, that can induce nuclear fuel damage at accident conditions and make radioactive fuel materials released into water coolant in the reactors" Mondry says. The materials being studied include zirconium-alloys, silicon carbide, and chromium coated in zirconium-alloys.

"We tested Zr-alloy, brass, stainless steel to investigate material effects on CHF. I mostly work with SiC [Silicon Carbide] and Zr-alloy." Mondry says. "I prepare samples which I then polish, and occasionally cut. Then I put the samples into an epoxy mount and place them in a box of water for a pool boiling experiment; to understand fundamental boiling phenomena in a nuclear reactor core."

From these tests, Mondry and her team drew the conclusion that surface characteristics of heater materials including roughness and wettability are key factors in affecting the CHF point.

From this piece of information, the researchers at UW Madison are studying new materials with these properties in mind to further increase the CHF point.

Kaya Mondry understands the impacts nuclear engineering has on people's lives as she continues her work on safety at UW Madison. "A lot of people are afraid of nuclear energy. It can be safe and can be done right," she says.

Her research with nuclear engineering goes outside of the safety realm as well, and ventures into environmental safety and human health. Mondry has become a huge advocate for nuclear energy as it is a zero-emission form of energy and does not release greenhouse gases.

People are not often aware of this aspect because the issue of safety overshadows this important step for improving our environment.

"When I first started, I had a general idea about nuclear engineering," Mondry admits.

"Knowing what I know now, I see the applications and how useful nuclear engineering can actually be." With the continuous research being done at UW Madison, safer methods using nuclear power nuclear power are being tested, and from there, nuclear energy can be used in a positive way to produce clean energy. The research done in the UW Madison Department of Engineering Physics allows for a step in the right direction for protecting our environment while protecting people's lives.

"A LOT OF PEOPLE ARE AFRAID OF NUCLEAR ENERGY. IT CAN BE SAFE AND CAN BE DONE RIGHT."

GRAPHIC DESIGN BY LUCAS BARTEL

OVERALL WINNER

CAPITOL UNDER CONSTRUCTION
JOSH REDFEARN

READERS' CHOICE

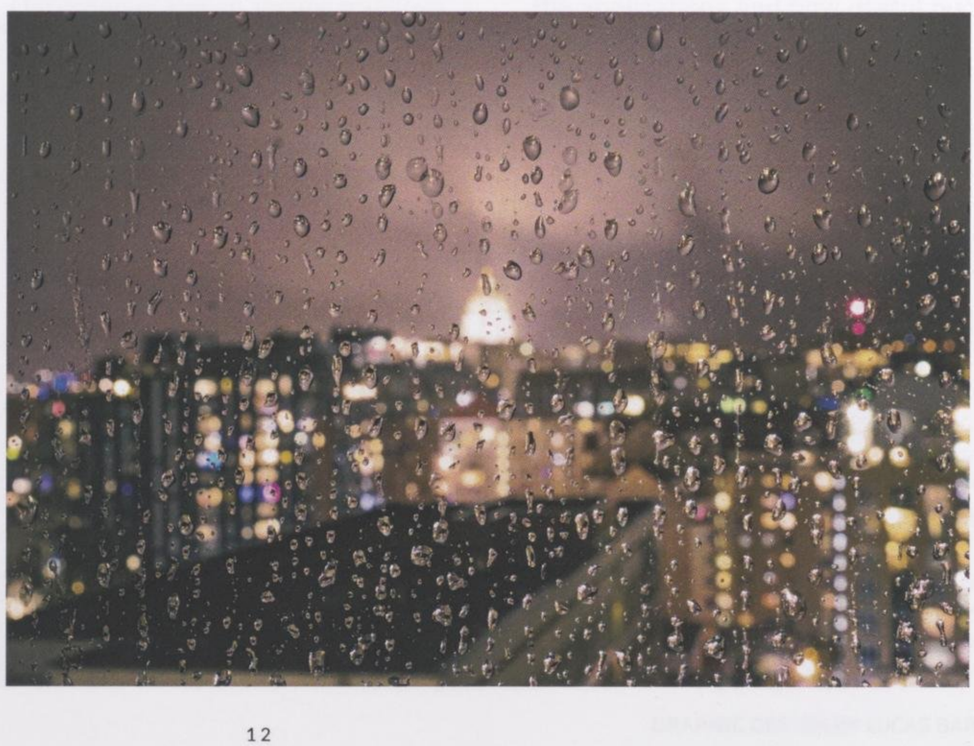
NORTHERN LIGHTS
ISAAC SCHLUESCHE

2020 PHOTO CONTEST WINNERS

LANDSCAPE

NORTHERN CABIN
GUNNAR EDLUND

CITYSCAPE

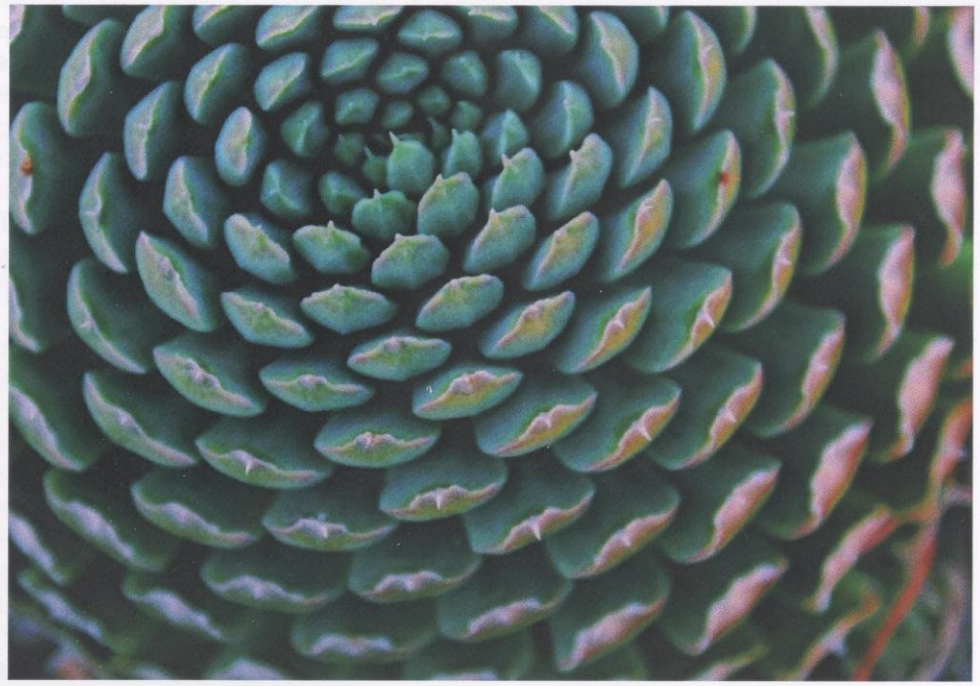


RAIN DAY IN MADTOWN
TIM SCHAAB

LEISURE & TRAVEL

NIGHT UNDER THE STARS
ISAAC SCHLUESCHE

MISCELLANEOUS



SUCCULENT
ALLISON SNIFF

CLEAN: STUDENT ORG SPOTLIGHT

WRITTEN BY
PAIGE DOLLEVOET

CARA NASTALI, SENIOR IN CIVIL ENGINEERING AND EXECUTIVE MEMBER OF CLEAN

If you saw signs on Bascom Hill on December 6th last semester, you saw the work of a newly formed student organization, CLEAN. CLEAN used to be a coalition of many different groups from around campus, such as the Sierra Club and 350 Madison, with the common goal of renewable energy. Recently, however, they have made the transition from coalition to student organization. They appeared at the organization fair for the first time in spring 2020. Though new and small, this organization is mighty and has very high hopes for their future.

CLEAN's primary goal is to have UW Madison using 100% renewable energy by 2050, and all electricity provided by renewable energy by 2030. CLEAN has already accomplished a lot for being such a new organization. On December 6th, they held a strike and marched to deliver a petition from Memorial Library Mall to Bascom with around 2500 signatures and to stick signs in the hill promoting renewable energy. Recently they held an event called Our Time to Shine, where Cara Nastali, a senior in civil engineering and executive member of CLEAN, gave a speech. CLEAN also petitions to the chancellor, meets with advisors, and holds events and weekly meetings. Cara said that she believes the best method for accomplishing the renewable energy goal is "getting students on board and making sure our voices are heard."

"Pretty much every university I know has a similar club with a similar initiative," said Cara, though she commented that they do have different goals. This is especially evident since other universities have already taken steps towards renewable energy, whereas Madison has not. When asked about her personal goals for CLEAN, Cara said, "I'd like the university to make a public statement about transitioning to renewables." Most other Big 10 schools have made some goal regarding the transition to renewable energy, however, UW Madison has not, despite its low STARS report (a measure of sustainability). For Energy, UW Madison comes in at a 3.46/10, a very low score.

There are a lot of problems related to pollution that CLEAN is trying to combat. For example, emissions from coal plants cause respiratory illness. At the Our Time to Shine event, a man from Oak Creek shared his personal story about how coal emissions affected him and his family. After moving to Oak Creek, close to a coal plant, the family developed respiratory illnesses, to the point where the children had to use respirators. When they asked the plant to check their house for dangerous contaminants, they found nothing out of the ordinary; however, when a third party checked the house, they found an abundance of dangerous chemicals. Over 40% of the energy currently used by UW Madison comes from coal. It is significant to note that though UW Madison does not have any coal plants within a close vicinity, there are still several remaining in Wisconsin.

CLEAN'S PRIMARY GOAL IS TO HAVE UW MADISON USING 100% RENEWABLE ENERGY BY 2050, AND ALL ELECTRICITY PROVIDED BY RENEWABLE ENERGY BY 2030.

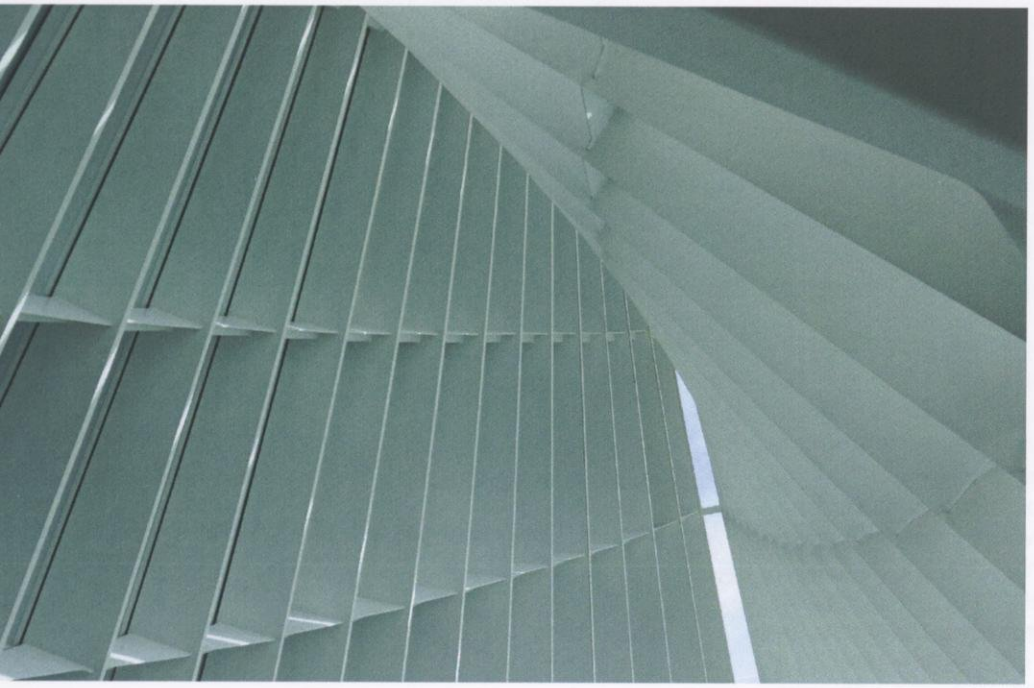
When asked about why she believes in renewable energy, Cara said, "I think it's the future...fossil fuels are pollutant, they hurt the community, human health, and they hurt the environmental health of people in the state." She also commented on some barriers to getting renewable energy quickly. These barriers include the "red tape" for being a public university, which means proposals must go through the state, and the high upfront cost. However, this high upfront cost could be curbed with the energy savings in the future that could make UW Madison money in the long run.

Does CLEAN sound interesting to you? You can get involved! The organization is seeking new members and has a variety of ways to get involved. The first step would be to go to meetings, signing petitions, voting for renewable energy, and attending CLEAN events. The "Doc of Voices," a document where students can write a short personal statement about why renewable energy is important to them, is another cool way to get involved. Cara believes the administration prefers CLEAN because it adds more of a personal touch. Though small, CLEAN is quickly growing into an organization to create a better tomorrow for all of us at UW Madison.

PHOTOGRAPHY BY ANNIE KRILLENBERGER
GRAPHIC DESIGN BY JEMIMAH MAWANDE

ASSESSING & ENSURING CONSTRUCTION READINESS

USING THE CONSTRUCTION READINESS ASSESSMENT, CONTRACTORS CAN BE READY FOR PROJECTS AND IMPROVE PERFORMANCE



INNOVATIVE CONSTRUCTION TECHNIQUES
at Engineering Centers Building

WRITTEN BY
SARAH GERARDEN

The construction industry is a competitive field with constant pressure to complete projects on schedule and within budget. Due to this, projects are often launched without adequate assessment of the readiness of the project. This leads to low productivity, delays, and even projects coming to a halt while decisions and changes are made.

UW Madison's Construction Engineering & Management (CEM) program, part of the department of civil and environmental engineering, is highly renowned and conducts research related to Integrated Project Delivery, Augmented/Virtual Reality/Disruptive Technology, and Construction Automation and Sensing, among other topics that improve and advance the construction industry.

Recently, the CEM program at UW Madison entered a research competition with the Construction Industry Institute (CII), the most prestigious research organization relating to construction. The competition encouraged research regarding the topic of construction readiness and was headed by Professor Awad S. Hanna. Readiness refers to a project's overall ability to maintain productive momentum without having to stop or slow down work. The research team derived 228 construction readiness factors that encompass 15 categories. After collecting data from 80 different projects, each readiness factor was given a weight, with

higher weights indicating a larger impact on the construction readiness.

The group of experts in alliance with the CII created a Construction Readiness Assessment (CRA) tool using Microsoft Excel and Visual Basic for Applications. This tool uses the weighted readiness factors to determine a Construction Readiness Score (CRS) that is represented as a percentage to assess the readiness level of a project. The tool then compares the computed CRS to three identified benchmarks: Construction-Not-Ready (0% - 75%), Borderline (75% - 85%), and Construction-Ready (85%-100%). The tool also recognizes construction readiness factor categories that can help increase or better maintain the project readiness. When the CRA tool is used repeatedly through the duration of the planning and construction phases of a project, readiness can be tracked and recorded to ensure improvement in the project readiness.

THE CRA TOOL INDICATED THAT CONSTRUCTION-READY PROJECTS SAW 20% COST SAVINGS AND 29% PRODUCTIVITY IMPROVEMENT COMPARED TO NOT-CONSTRUCTION-PROJECTS

The CRA tool was used on 80 projects and statistical analysis indicated that Construction-Ready projects outperformed Not-Construction-Ready projects in several ways. Most notably, a 20% cost savings occurred on Construction-Ready projects, along with a 22% schedule time reduction, 29% productivity improvement, 7% decrease in rework, and 21% decrease in contract changes.

This tool is now available to CII members and is being leveraged by construction contractors to improve their productivity. Although this tool was created for the construction industry, its applications are not limited to just construction projects. The CRA tool could be applied to any technical project with specifically designed readiness factors. For example, the tool could be used to show that a new product is ready to be manufactured, a new process is ready to be implemented, or even for personal use such as travel preparation. By incorporating this technology into the standard project preparation, projects can save money and time while improving productivity and overall performance.

PHOTOGRAPHY BY JACOBO TORNELL
GRAPHIC DESIGN BY KATLYN NOHR

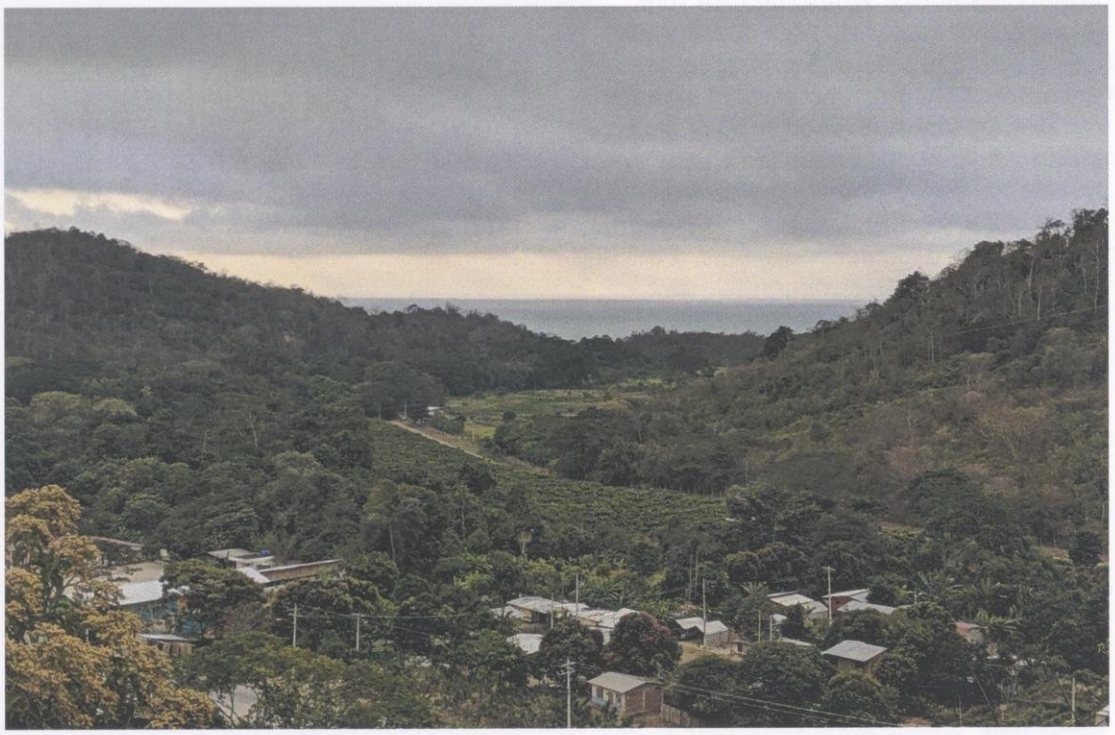
ENGINEERS WITHOUT BORDERS: THE WISCONSIN IDEA IN ACTION

ENGINEERS WITHOUT BORDERS COMBINES ENGINEERING SKILLS, COMMUNITY SERVICE, AND TRAVELING ABROAD WITH VALUABLE IMPACT.

WRITTEN BY
LUJAIN AL JUMAH

For over a century, the Wisconsin Idea has been the guiding philosophy of faculty, students, and alumni of UW-Madison. One of the earliest university presidents once said, "I shall never be content until the beneficent influence of the university reaches every family in the state." Today, that sentiment still holds true, reaching communities worldwide through the campus community's outreach initiatives.

One group on campus that has been particularly active in upholding the Wisconsin Idea is the Engineers Without Borders USA – UW-Madison Chapter (EWB-UW), established in 2003. According to their website, the team aims to "build a better world by educating internationally-responsible engineers and students." This starts with creating connections with under-served communities around the world, and maintaining those connections for a minimum of five years while working on projects ranging from building bridges to water systems. Currently, the chapter is working with Guatemala, Uganda, Puerto Rico, and Ecuador.



TABUGA, ECUADOR

I sat down with Meghan Maglente, a senior in Chemical Engineering and current Ecuador project manager, to talk more about the organization's work. Maglente has been an active member of EWB-UW since her freshman year. As a freshman myself, I had considered joining EWB-UW but put it off because I did not think I could contribute to major design projects. Maglente assured me that the organization has plenty of opportunities for everyone, regardless of school year, such as background research and logistical organization. In fact, she encourages students to join as early as possible since there is a lot to learn. As long as students are fully

committed, and willing to spend the time and effort required, their contribution will have an impact. "The actual motivation to do that for a student organization...is understanding that what we're doing will literally change people's lives and improve their quality of living and improve community health. And we're doing it for actual people. There's really no other student organization where you can do something this big with your engineering skills," Maglente explains.

Maglente recalled her first experience joining EWB-UW and the friends she made. When asked what inspired her to stick with the organization, she replied "I saw [the members'] passion and saw that they were actually using their engineering skills outside the classroom...not just in the Wisconsin community, but abroad in a country where people need us. And that was super cool. I fell in love with the way that they were in love with it. And then once I finally got to travel, it was super amazing getting to meet the crew members."

Each project starts with a community contacting EWB-UW with a specific problem. The team then visits the community on an "assessment trip" during which they collect the data needed to start designing a project. The process centers the community's needs, utilizes its resources and focuses on cultural and economic responsibility. After finalizing a design, the team revisits the community on an "implementation trip" to build the project with the help of contractors from the community. The experience of seeing the tangible impact on the communities creates a stronger sense of motivation and perseverance to the students. Maglente emphasizes this, saying, "it's not just a picture of our community that we put up on our slides every week for our meetings. They're real people. People who need water and need access to get to school."

When working on such impactful projects, there are bound to be some challenges. Maglente mentioned that funding can be an issue. Currently, the team receives most funds from grants and donations,for which they are immensely grateful. However, sometimes when funding is inadequate, the pace of major projects inevitably slows down. While fundraising is an option, Maglente stated that the organization focuses more on providing students with the unique experience of applying their engineering skills to real world problems. "We are engineering students. We are here to do engineering work. So, if you take ten people out of our engineering team to do fundraising, they are losing the engineering experience," Maglente stated.

"WHAT WE'RE DOING WILL LITERALLY CHANGE PEOPLE'S LIVES AND IMPROVE THEIR QUALITY OF LIVING AND IMPROVE COMMUNITY HEALTH. AND WE'RE DOING IT FOR ACTUAL PEOPLE." -MEGHAN MAGLENTE

For final remarks, Maglente reiterated the impact of working with EWB-UW saying that "it's bigger than a lot of things. It's changing people's lives, and it's super cool to be able to say that as a student when I leave here. Not only did I become an engineer, I got to contribute to this amazing project and also enhanced my engineering skills tenfold." Engineers Without Borders provides students the opportunity to practice their passion for helping people while applying the various skills they learn to real societal challenges. And their doors are always open to new members!

PHOTOS PROVIDED BY
ENGINEERS WITHOUT BORDERS
GRAPHIC DESIGN BY SOFIA NOEJOVICH

MEGHAN MAGLENTE AND OTHER MEMBERS OF ENGINEERS WITHOUT BORDERS IN ECUADOR

SUPPORTING PATIENTS WITH COMPLEX HEALTH NEEDS USING HUMAN FACTORS ENGINEERING

AN INVESTIGATION INTO HUMAN FACTORS ENGINEERING AS APPLIED BY THE WERNER LAB IN THEIR WORK TO DESIGN SYSTEMS TO SUPPORT SPECIALIZED HEALTHCARE USERS.

WRITTEN BY
SOFIA NOEJOVICH

A teenager suffered from brain damage and died two weeks after she received an organ transplant because the organs from her donor were incompatible with her blood type. An investigation into the incident determined that a lack of redundancy for checking blood type compatibility was a key factor in the error (Patient Safety: The Role of Human Factors and Systems Engineering, 2010). Unfortunately, mistakes in healthcare caused by system failures are common. One study identified 178 medication errors over a 7 month period in a hospital due to failures to follow procedures, written miscommunication, transcription errors, prescriptions misfiling, and calculation errors (Patient Safety: The Role of Human Factors and Systems Engineering, 2010). The success of products, processes, and systems depends on their ability to meet users needs, as opposed to requiring the user to meet the needs of the product or system.

HARVEY D. SPANGLER ASSISTANT PROFESSOR NICOLE WERNER

One field of study that is primarily concerned with designing systems to address the needs of the user is Human Factors (HF) engineering. According to the Human Factors and Ergonomics Society, HF engineering is defined as, " the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." HF is concerned with supporting people in their work, which occurs within complex systems comprised of people, tools, technology, and dynamic environments. With target outcomes such as safety, ease of use, and satisfaction, HF engineers investigate how people actually behave in a system (i.e. work as done) rather than how people are expected to behave (i.e. work as imagined). A deep understanding of work as done provides a critically important basis from which to design and develop technologies, processes, and systems that support and facilitate safe and joyful experiences for those involved.

The Werner Lab, directed by Harvey D. Spangler Assistant Professor Nicole Werner, is a multidisciplinary healthcare systems and HF research group based in the Department of Industrial and Systems Engineering (ISyE) at the University of Wisconsin-Madison. Their mission is to use HF engineering to design human-centered, smart and connected patient journeys. Werner Lab uses HF

approaches to identify and design for the needs of vulnerable patient populations, such as older adults with dementia and children with medical complexity. Both of these populations are at increased risk for experiencing poor health outcomes because technologies, processes, and systems are not designed to support their needs. By recruiting human-centered HF approaches to understand the context in which patients and their family caregivers complete tasks, also known as the work system, the lab uncovers issues within work systems that may otherwise go unidentified. This allows for the development of personalized tools and technologies that address the underlying challenges patients and caregivers experience and comprehensively meet their needs.

Currently, one of the Werner Lab's main projects, in collaboration with the UW-Madison Department of Pediatrics, aims to understand in-home caregiving for children with medical complexity (CMC) and design applications to support family caregivers. While this population only represents 6% of the Medicaid population, these patients account for 80% of the total hospital days at pediatric academic medical centers (Children's Hospital Association)–meaning that members of this population frequently require highly skilled care. When CMC are not hospitalized, the home environment in which a CMC receives care is challenging as it requires the family caregiver, who often has received no formal healthcare training, to provide continuous hospital-level care.

To support family caregivers, team members from Werner Lab and the Department of Pediatrics engaged an interdisciplinary team of clinicians, engineers, and families of CMC to develop a mobile health application to connect and support families caring for CMC with enteral tubes (e.g., tubes into the stomach or intestines to safely give medications, nutrition and hydration). The design process for this app involved engaging caregivers of CMC for co-design sessions, developing paper prototypes and transferring them to Adobe XD, a wire-framing software, and developing a minimum viable product. Next, the team conducted usability testing by having the families use the minimum viable product to complete example tasks on the app. Usability testing ensured that the caregivers' needs and expectations were met before finalizing the design and development of the app (Cheng CF, Werner NE, Barton H, Doutcheva N, Coller RJ., Hospital Pediatrics, 2020). PhD student Hanna Barton is a researcher on the project who says, "I think one misconception about HF is that it is just making sure that something is usable. This can be a pitfall of design...HF must be integrated within and throughout the design to yield success."

"I THINK ONE MISCONCEPTION ABOUT HF IS THAT IT IS JUST MAKING SURE THAT SOMETHING IS USABLE. THIS CAN BE A PITFALL OF DESIGN...HF MUST BE INTEGRATED WITHIN AND THROUGHOUT THE DESIGN TO YIELD SUCCESS."
- PHD STUDENT HANNA BARTON

Some members of the lab such as David Wilkins, Hanna Barton, A.J. Lingg, and Priya Loganathar are working to support the mental health of entrepreneurs. In the US, startups create approximately 43% of new jobs annually and small businesses make 8.4 million new net jobs as opposed to the 4.4 million jobs created of small corporations. However, a global health crisis is on the rise as 50% of entrepreneurs suffer from at least one form of mental health condition during their lifetime (World Economic Forum, 2019). Researchers have identified a lack of resources as a key component of this increasing mental health crisis in entrepreneurs (National Council for Behavioral Health, 2018).

To combat this growing mental health crisis, the team met with local entrepreneurs and conducted a survey of their needs and experiences. Then, they designed an interactive prototype of an app called Fika using Adobe XD as a first step in helping entrepreneurs manage their stress levels. The app is designed to easily integrate with the volatile schedule of an entrepreneur by reminding the user to take breaks, prompting the user to meditate, and allowing the user to set goals and track their progress.

The app was developed according to mobile health application heuristics, with a focus on consistency across visual and interactive elements. The team paid special attention to app features that would facilitate behaviors that promote positive health, including customizable break notifications and a progress page to see if users are meeting their personal health goals. To verify their design, the team met with a local entrepreneur to obtain their feedback to ensure the design met their needs since, as one member of the team David Wilkins states, "Fika is intentionally designed to blend into the as-lived lives of entrepreneurs."

The app was entered into the Mobile Health Applications for Consumers Design Competition in conjunction with the 2019 International Symposium on the Human Factors and Ergonomics in Health Care. The team finished among the top three finalists in the international competition.

What these two projects share is a deep understanding of the users for whom products are designed and an integration of that understanding throughout the design and development process. By understanding the work system within which users operate, engineers can design tools and technologies to support users in their tasks, making their lives safer and more enjoyable. To keep up with the work of Werner Lab, follow them on Twitter at @WernerLabUW, on Facebook or check out their website (wernerlab.engr.wisc.edu).

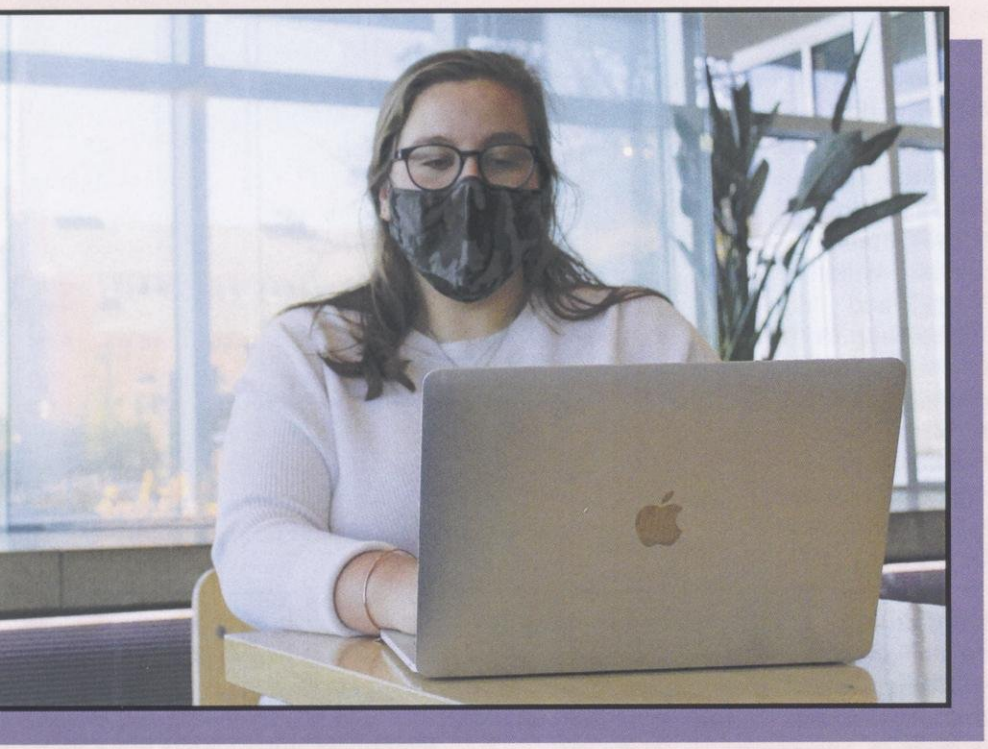
Special thanks to PhD student Rachel Rutkowski and Professor Werner for providing feedback!

GRAPHIC DESIGN BY SOFIA NOEJOVICH
PHOTOS PROVIDED BY WERNER LAB

SCIENCE BEYOND THE LAB: IGNITING SCIENCE COMMUNICATION

WITH SCIENCE MORE IMPORTANT NOW THAN EVER, A COLLEGE SENIOR OUTLINES HER JOURNEY OF BLENDING SCIENCE AND COMMUNICATION TOGETHER TO CREATE A WHOLE NEW CAREER OPTION, IN EFFORTS TO BEGIN TO HELP MITIGATE GAPS IN SCIENCE UNDERSTANDING.

WRITTEN BY
BROOKE VERFUERTH



BROOKE VERFUERTH, LIFE SCIENCE COMMUNICATION STUDENT

In the fast paced, ever changing world of science, effective communication could not be more important. Bridging the gap between the research in the lab and the diverse audience of the general public has its challenges, as has been highlighted in the past year with the COVID-19 pandemic. As we move forward, more work is needed to refine these communication channels to allow the public a greater understanding of the science and its effects on our everyday lives.

I am a senior at UW-Madison, and I am here to highlight how you can become a part of the solution. My major is Life Science Communication; a major that focuses on developing strong communication skills within the sciences, in order to effectively understand, develop, and reach all types of audience in response to science.

Before pursuing this major, I came to Madison to study Genetics and Genomics. To help enhance my learning in the classroom, I began to work in a Medical Microbiology research lab, specifically a fungi lab. I was an undergraduate research assistant and in love with the work I was doing. For a long time,

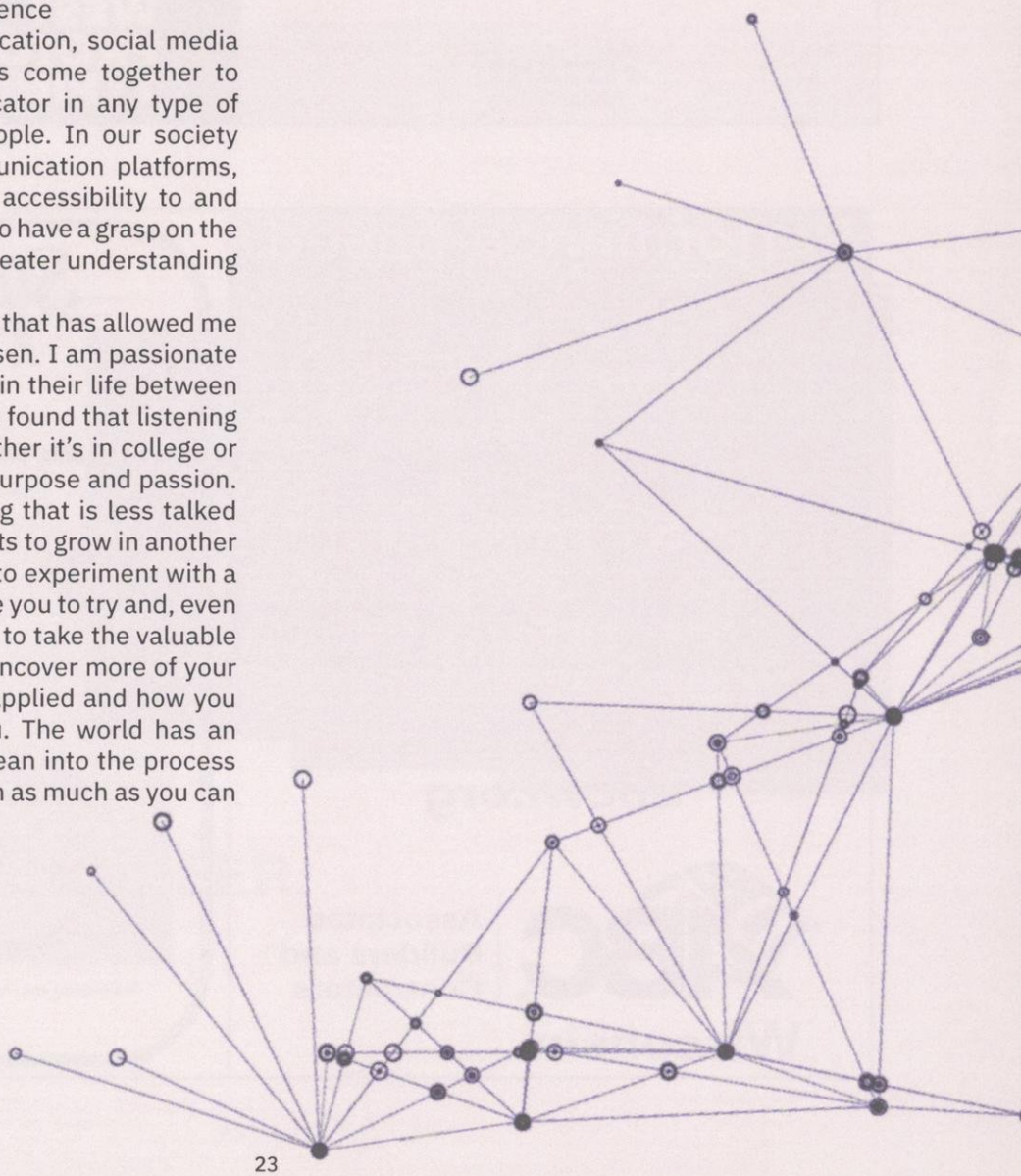
I found the work in the lab fascinating. I grew as a scientist, but, more importantly, I grew to understand how science could come alive in the lab and how the scientific process actually happens. I enjoyed talking to others about the complex biological systems that I was working on in a way that they were able to understand and connect to. The longer I worked in the lab, however, the more I came to realize that I loved talking about the research I was doing more than I loved doing the actual science. After coming to this conclusion, I was faced with an opportunity to pivot in a different direction that helped me continue to build and refine these communication skills within science.

This has led me to the major that I am currently pursuing. This major allows you to grow as a science writer and work to gain effective general communication skills. You work in classes to grow in a variety of science disciplines like marketing, mass communication, social media and community engagement. These parts come together to create a well-rounded science communicator in any type of platform that you are using to reach people. In our society where you have a broad range of communication platforms, and each person has a different level of accessibility to and understanding of these options, it's crucial to have a grasp on the many platforms to help contribute to the greater understanding of science.

"THE WORLD HAS AN INFINITE AMOUNT OF CAREER POSSIBILITIES, SO LEAN INTO THE PROCESS OF GETTING TO WHERE YOU WILL END UP AND LEARN AS MUCH AS YOU CAN ALONG THE WAY."

It has been through this pivot in my life that has allowed me to become reignited in the path I have chosen. I am passionate about helping more people bridge the gap in their life between science and how they understand it. I have found that listening to yourself to discover what you love, whether it's in college or the rest of your life, is key to finding your purpose and passion. Though, generally, I think this is something that is less talked about in college. It's so common for students to grow in another direction once they get to school and start to experiment with a diverse selection of classes. So, I encourage you to try and, even if you don't love it as much as you thought, to take the valuable experience you gained there and work to uncover more of your skills. Find out where those skills can be applied and how you can create a career path that excites you. The world has an infinite amount of career possibilities, so lean into the process of getting to where you will end up and learn as much as you can along the way.

PHOTOGRAPHY BY ANNIE KRILLENBERGER
GRAPHIC DESIGN BY LUJAIN AL JUMAH



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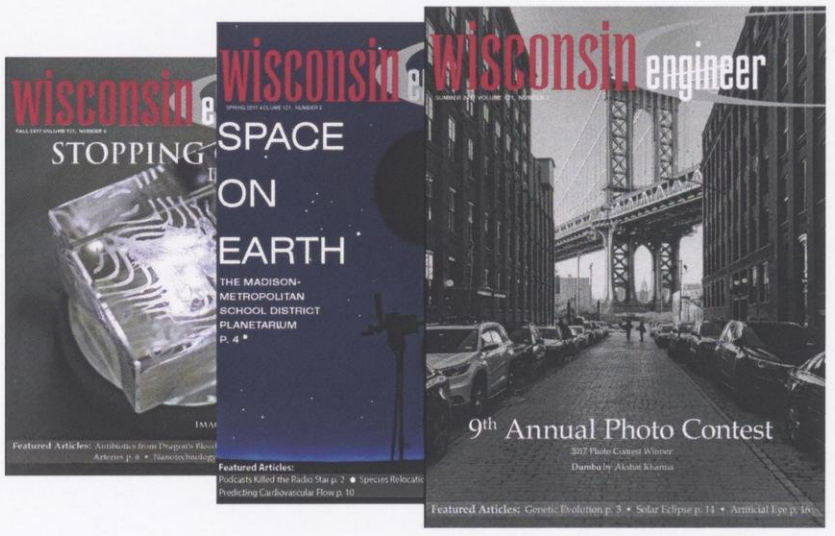

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