Wisconsin engineer. Volume 124, Number 2 Spring 2020

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

https://digital.library.wisc.edu/1711.dl/7P3DBZ6M5SIJV8I

SPRING 2020
VOLUME 124
NUMBER 2

wisconsin engineer

THE NEW MESSENGER

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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.

Faculty Advisor: Steven Zwickel **Publisher:** Department of Information Technology, University of Wisconsin-Madison, Madison, WI **Web address:** http://www.wisconsinengineer.com

Correspondence: *Wisconsin Engineer* Magazine; 1550 Engineering Drive; Madison, WI 53706 **Phone:** (608) 262-3494 **email:** wiscengrmagazine@gmail.com

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

Subscription is $12 for one year.

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MS IN DESIGN + INNOVATION: A PROGRAM FOR SUCCESS

UNDERGRADUATE STUDENTS WORK ON A AQUAPONICS PROTOTYPE DURING DESIGN STUDIES 341: DESIGN STUDIES FOR TRANSFORMATION

THE M.S. IN DESIGN + INNOVATION WAS CAREFULLY CREATED TO REVITALIZE THE DESIGN PROCESS AND PREPARE STUDENTS FOR INTERACTIONS AND CHALLENGES THEY WILL EXPERIENCE IN THEIR PROSPECTIVE CAREERS.

WRITTEN BY
MARY LAUDON

This spring, UW-Madison will become one of a handful of universities to offer a unique graduate opportunity: A Master of Science in Design + Innovation. This program pulls from five fields of study at UW-Madison; the School of Human Ecology, the College of Engineering, the Business School, the Information School, and the art department.

Administratively, the degree lies in the College of Engineering, but it is open to many potential graduate students. The minimum requirement for the program is a bachelor's degree in a relevant field with a minimum GPA of 3.0. Additionally, a personal statement by an applicant carries significant weight in the admissions process. Due to the unique nature of the program, those interested must enjoy interdisciplinary interactions and be open to new ways of thinking about problems and the design process.

Lee DeBaillie, the program director, anticipates a heavy industry influence throughout the program. "We really want to connect industry to make it a realistic experience and to encourage student and employer relationships," says DeBaillie. Interested corporations will provide problems, advise students, and potentially offer opportunities beyond the program. The program spans 12 months and includes 30 credits: 18 required credits which span the five involved schools, and 12 elective credits.

FROM LEFT TO RIGHT, UNDERGRADUATE STUDENTS COURTNEY COTEY, QUINN BURZYNSKI, AND NADIA TAHIR WORK ON A HARVEST BASKET PROTOTYPE DURING DESIGN STUDIES 341: DESIGN STUDIES FOR TRANSFORMATION

Six credits of undergraduate coursework at UW-Madison can count towards the degree if the coursework is relevant and a part of the elective coursework options. Students are encouraged to utilize the elective credits to specialize in one of four areas: product design, UI/UX design (user interface/user experience), communication design, and design strategy. The cornerstone of the program is a yearlong collaborative capstone design class.

The program is interdisciplinary at the core; the courses and faculty come from a wide background. The faculty have carefully designed the program to foster relationships between students with differing skill sets. However, the integrative nature of the program may create a slight tension between creativity and structure while also uniting students who have differing ideas of the design process. "Creativity often likes constraint. Frustration from constraint drives new ideas," says DeBaillie. While it may be uncomfortable at first, ultimately the design process and the students will benefit.

A portion of the ground floor of Wendt Commons is currently being renovated to house the program, allowing the students the opportunity for ample time in the TeamLab and Makerspace. The degree emphasizes hands on learning and focuses on efficiency and creativity in the design process. "This program provides some structure that has been vetted over decades by what tends to work well. But it doesn't provide you 100 percent of the structure; there's still spontaneity... it's somewhat chaotic," says DeBaillie.

This degree is fundamentally different from the other accelerated master's degrees because it is considered a breadth program. While the program doesn't expand on specific undergraduate engineering majors, it is instead designed as a means of connection; it connects students laterally with non-engineering ideas. Some depth is available, however, as the Design + Innovation program encourages specialization in a specific area and allows students to tailor the 12 electives to their needs and interests.

The Master of Science in Design + Innovation arose from demand for increased innovation in the design process and well-rounded candidates for industry. Additionally, companies admire programs that develop new sets of skills within students. Companies in the STEM field are especially interested in working with students on problems they face in the industry, as students are valuable and provide the company with a new perspective. It is the hope that through this program, students will have the opportunity to connect with professionals and better prepare themselves for careers in a variety of fields.

The Master of Science in Design + Innovation program is accepting applicants for its first term, which will begin the summer of 2020. Applicants must apply between September 1st and February 1st to be considered for the following summer term.

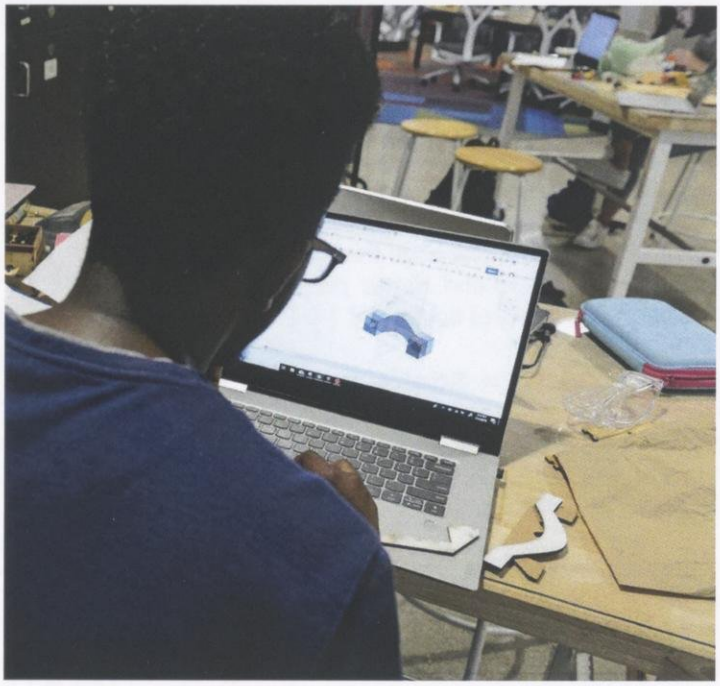
PHOTOGRAPHY BY
JEFF MILLER

GRAPHIC DESIGN BY
LAURA RODRICKS

UW STUDENTS' MAKERSPACE

A MAKERSPACE FOR THE STUDENTS, BY THE STUDENTS.

WRITTEN BY
DANIEL YAO

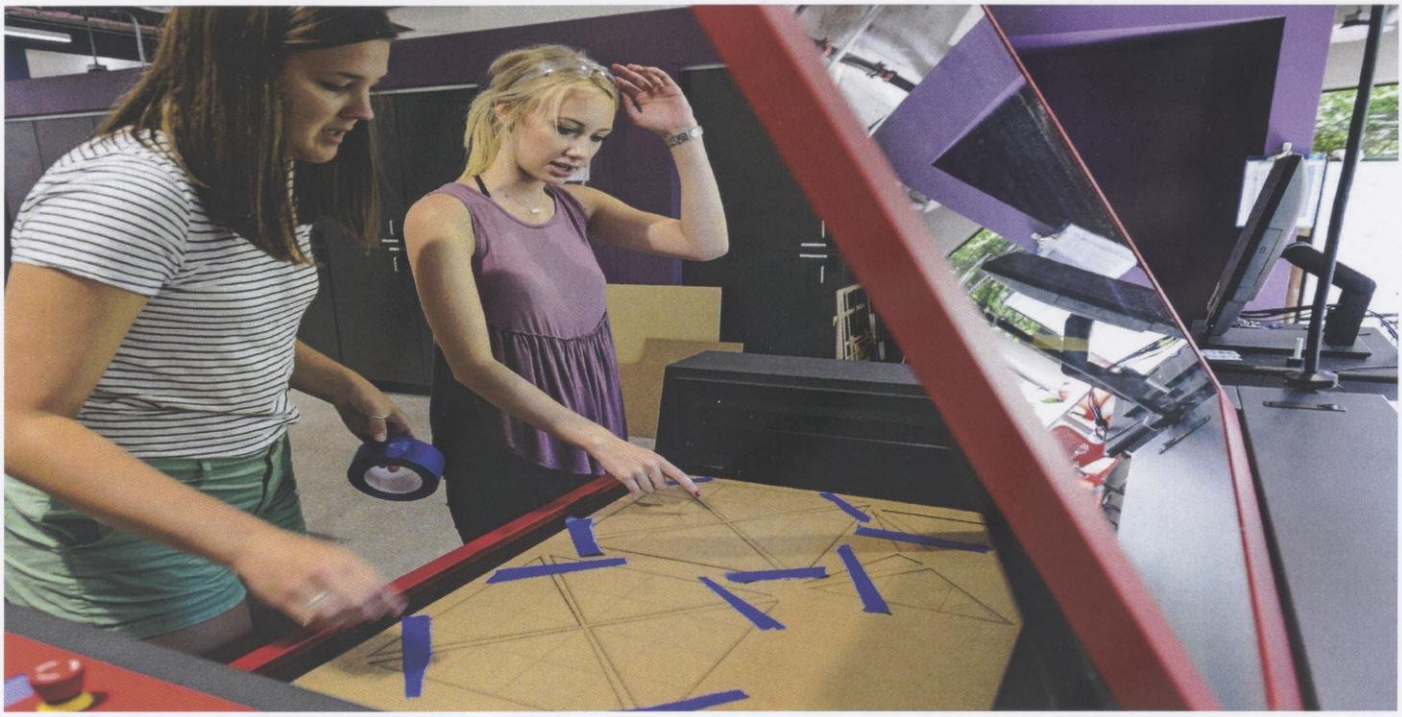


UNDERGRADUATE STUDENT FUAD AHMED WORKING ON COMPUTER-AIDED DESIGNS (CAD) FOR A PORTABLE GARDEN PROTOTYPE

One of the newest additions to UW-Madison is the Makerspace, a student-run facility where a flurry of activities ranging from 3-D printing to peer learning have been occurring since the fall of 2017. Founded through a generous donation by UW alumnus David Grainger, the Makerspace is aiming to help students realize and prototype their innovative designs.

According to Lennon Rodgers, the director of the Grainger Engineering Design Innovation Lab, which includes the Makerspace, "... our mission statement was created by the group of student staff we initially hired," and focuses on student empowerment, peer learning, and the production of advanced technologies from the minds of students. The equipment that the Makerspace first purchased was determined through feedback from across campus. Some particular equipment that the Makerspace has are 3D printers, 3D scanners, virtual reality headsets, and even drones. Rodgers adds that these machines are "state-of-the-art" and can satisfy most students' needs. There are many devices available to support multiple student users at once.

Many students have been fully utilizing the Makerspace since its opening. Besides supporting courses such as InterEgr 170: Design Practicum, a first-year engineering introductory course, as well as senior capstone projects, which can range from programming drones to building autonomous boats,



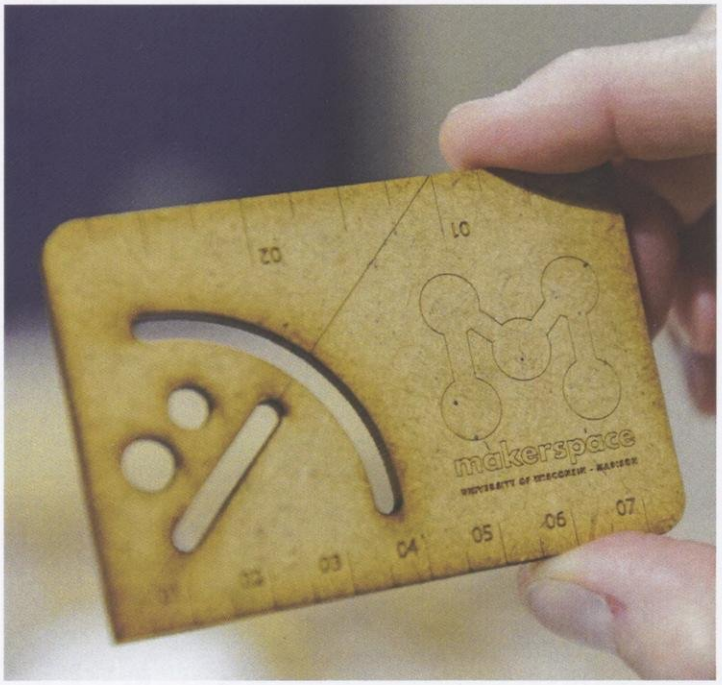
UNDERGRADUATE STUDENTS LAUREL PIERSKALLA, LEFT, AND RACHEL JOHNSON SET UP A COMPUTER NUMERICAL CONTROL (CNC) LASER AND FABRICATE PARTS FOR A PROTOTYPE PRODUCT

the Makerspace has enabled many creative independent projects. Rodgers points out that some alumni before "got their company off the ground" by using the Makerspace to create prototypes of a 3D metal printer. Students outside of the College of Engineering also benefit from this facility. "A surgeon from the veterinarian school 3D-printed out the devices that help him during surgery and regularly seeks 3D printing advice from our student staff," says Rodgers. Rodgers also encourages more students to take part in realizing their own designs, especially during summer when they have more free time and the Makespace is still open for use.

Students using this facility also benefit from the peer learning opportunities that the Makerspace offers. The student staff at the Makerspace maintain the equipment, teach student users how to use the machines, and provide design advice. Student staff also hold workshops on Makerspace-related topics such as programming using Arduino and 3D printing. These workshops are free for all UW-Madison students and occur daily during the fall and spring semesters. During the fall 2019 semester, there were over 85 workshops with around 600 different students attending. Discussion and consultation with the student staff foster cooperation and communication among students and help with learning. Through this process, "a welcoming atmosphere" is created.

The inviting atmosphere of the Makerspace is proven in user statistics. Rodgers and Karl Williamson, the shop manager, presented a paper at a Makerspace conference at Stanford in 2018 that explored the impact the Makerspace had on the amount and demographic of shop users. They found that a signification portion of female and minority students entered the engineering shops (including Makerspace and

Everyone is welcome in the Makerspace. To participate and realize a design idea or attend any of the workshops held by their friendly student staff, you can visit the Makerspace on the ground floor of the Wendt Commons. This is the space for you to make your future!



A MARKETING CARD WITH LASER-CUT GRAPHICS IS PICTURED AT THE UW MAKERSPACE

PHOTOGRAPHY BY
JEFF MILLER

GRAPHIC DESIGN BY
LAURA RODRICKS

THE NEW MESSENGER

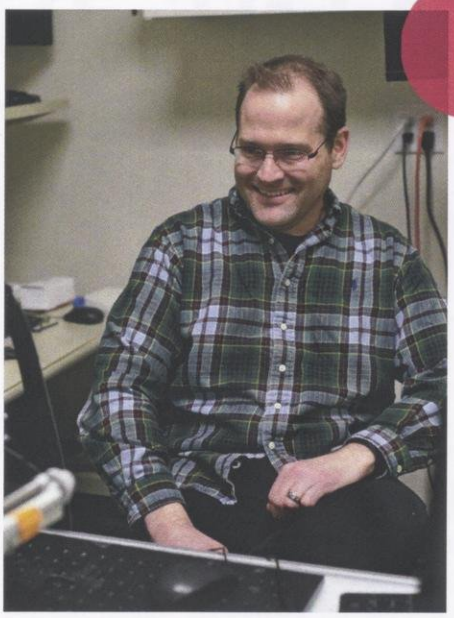
A NEW FLUID CALLED THE INJECTRODE, ALLOWING FOR HEIGHTENED COMMUNICATION BETWEEN MEDICINE AND THE BODY THROUGH NEVER CONNECTIONS.

WRITTEN BY
CAMEY ZUSSMAN

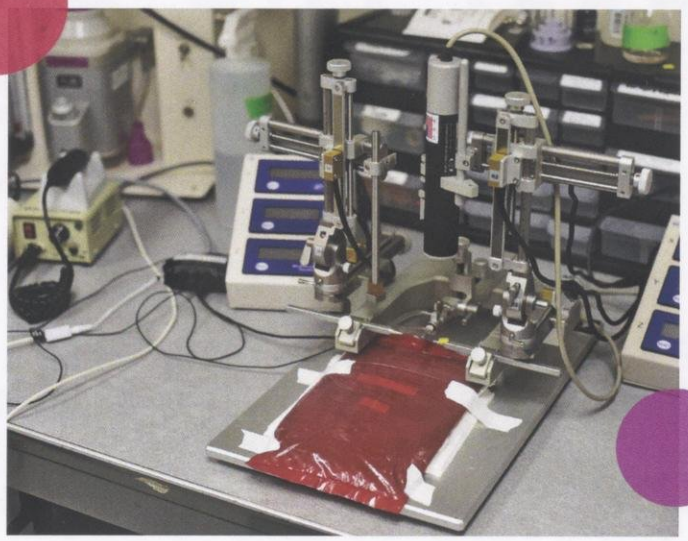
When most people go to the doctor, their biggest fear is pain. Last year, Kip Ludwig, a professor at UW-Madison, designed an electrode to "hack" nerves and stimulate biomolecules, telling the body where to release its produced drugs. The main goal of Ludwig's research was to create minimally invasive techniques that allow for communication between medicine and the patient's body, significantly reducing the potential for pain.

Previously, the electrode technology Ludwig researched used internal wires which can wear throughout many years. The insulation around the wires wears and eventually fails. This causes a problem for the user because replacing implants is expensive. Ludwig's previous research also focused on a minimally invasive procedure; however, implants were still placed inside the patient's body. He has now found a way to make the electrode act as a "flexible" liquid. An electrode is injected as a liquid, called an "injectrode," which then becomes a stretchable, conductive wire and creates a connection between the nerves. "We are injecting the electrode fluid and extruding the wire back to the surface of the skin and attaching it to a unit. This allows for stimulation of just the nerve while minimizing stimulation of anything other than the nerve," says Ludwig. By using this technology, there is no need

"THERE IS NO NEED FOR SURGICAL MANIPULATION, AND THE FLUID WILL FILL THE SPACE WITHOUT CHANGING ANYTHING WITHIN THE BODY."



DR. LUDWIG SITS IN A SMALL ANIMALS TESTING ROOM WHERE THEY TESTHOW THE INJECTRODE INTERACTS WITH NEURO SIGNALS.



A DEVICE IN A SMALL ANIMALS TESTING ROOM THAT IS USED TO HOLD ANESTHETIZED LAB MICE IN PLACE WHILE INJECTRODESOLUTIONS ARE APPLIED.

A COLLECTION OF INJECTRODES USED FOR TESTING. THESE TUBES CONTAIN A VISCOUS FORM OF THE INJECTRODE FLUID THATENABLES VOLTAGE TESTING IN A LIQUID BIO-SOLUTION. APPLIED.

creating a passive bypass for a path to the skin from the nerve," explains Ludwig, which can be done without invasive techniques.

The original methods of implanting a device are quite costly and require surgery. "People do not get devices they need to stimulate their nerves, even though they would benefit from them, because of how expensive and invasive the procedure is," says Ludwig. These implants are rigid devices, which do not match with our soft body tissue, or are attacked by our bodies when they detect a foreign object. Even normal movements will cause these implants to break over time. By using a fluid that cures to become a stretchable electrode, most of these problems are avoided. In addition, the cost of this procedure is much more affordable than the previous procedure.

Many medicines are a "one size fits all" approach, this ideology does not apply with this injectrode. Not only can researchers change the amount of fluid the patient needs, they also can use this minimally invasive procedure to connect the necessary nerves for the desired message in the individual. "There is no need for surgical manipulation, and the fluid will fill the space without changing anything within the body," says Ludwig. In the past, the medicine went through a longer path and risked losing the effect it needed to have due to lost signals. Now, by injecting fluid, the problem spot is an easy target.

This research has made vast progress, from the injection of a solid, pricey device to the injection of a more versatile and affordable fluid. However, Ludwig is not stopping there. He continues to work towards his goal of making the stimulation of nerves an even more approachable and efficient procedure.

A LAB STATION INSIDEWHERE DATA RELATING NEURO RESPONSES AND VOLTAGEAPPLICATIONS IS COLLECTED.

DR. TREVATHAN (RIGHT) ANALYZES RESULTS FROM A VOLTAGE TEST CONDUCTED ON A BIO-SOLUTION TO MIMIC HOW THEINJECTRODES WILL INTERACT WITH THE BODY.

PHOTOGRAPHY BY EZRA ECKERSON
DESIGN BY: JACOBO KIRSCH

UWELL: THE BRAINS OF MENTAL HEALTH AT UW MADISON

UWELL IS THE OVERARCHING ORGANIZATION THAT ALL OTHER HEALTH ORGANIZATIONS ON CAMPUS ARE ABLE TO MEET THROUGH WITH THE COMMON AGENDA OF STUDENT AND EMPLOYEE HEALTH AND WELLBEING.

WRITTEN BY
PAIGE DOLLEVOET

College can be very stressful at times, and it is important that students understand the resources that are there for them when they are struggling with mental health. An organization that plays a crucial role in mental health activism around campus here at UW-Madison is UWell. What exactly is UWell? "[It is made up of] a lot of people who provide wellness services," says Valerie Donovan, a Suicide Prevention & Mental Health Promotion Coordinator and a Community Health & Student Wellness Specialist for UHS. UWell includes members of organizations such as University Health Services (UHS), The Office of Human Resources, University Housing, academic groups, and student affairs organizations. "Folks who are doing work to support student well-being come together with folks who are supporting employee well-being," says Donovan. She describes UWell as "the name that is given to the strategy at UW-Madison to promote well-being for the entire campus community." It is important for these groups to come together to discuss what their respective organizations are doing, and what improvements can be made when problems arise.

UWell is a big picture organization that has one big goal in mind: to improve overall well-being and health across campus. To achieve this goal, UWell seeks to answer a few large-scale questions. What are the needs of the students and employees? Where are the gaps of programs currently in place? They look at real data to answer these questions. The purpose of UWell is to provide a place where people who work with employee health and/or with student health can share ideas and experiences and grow as a result.

"Some of the most critical [...] health issues that we see are related to mental health," says Donovan. There are many students that struggle with mental health issues. Fortunately, there are strategies being put into place to help the campus population as a whole. A lot of smaller and individualized problems can be tackled by smaller groups, but UWell focuses on broader issues. For example, the Mental Health Task Force was created by the Vice Chancellor for Student Affairs last year. Students evaluated the current support for mental health on campus and looked for existing problems. UHS is offering later hours this year due to an increased demand in mental health services over the last couple of years. A new online program for suicide prevention training is also now available on Canvas. "This is a really cool opportunity to have a universal education tool that teaches students how to recognize potential warning signs for suicide and how to respond to those [...] and how to make referrals and understanding what resources you have available to you" says Donovan. She believes it is an especially helpful tool because it can reach so many students. This is the first semester that this tool is available for use. It is not required, but provides an available optional resource for students interested in becoming more well-versed in this important topic.

"More and more students are using mental health services on campus. We are also continuing to hire more and more [health] providers [at UHS] to try to meet that need," says Donovan. This is due both to an increase in people struggling with mental health conditions and a decrease in the stigma that may have prevented them from getting help with such issues in the past. The mental health groups here on campus focus on a lot of prevention work and try to create a very supportive environment for students. "Often the first person a student will talk to when struggling with their mental health is maybe a peer," explains Donovan. This means it is very important for students to have a good understanding of mental health resources on campus, even if they personally do not have mental health issues.

"THIS IS A REALLY COOL OPPORTUNITY TO HAVE A UNIVERSAL EDUCATION TOOL THAT TEACHES STUDENTS HOW TO RECOGNIZE POTENTIAL WARNING SIGNS FOR SUICIDE AND HOW TO RESPOND TO THOSE [...] AND HOW TO MAKE REFERRALS AND UNDERSTANDING WHAT RESOURCES YOU HAVE AVAILABLE TO YOU" - VALERIE DONOVAN

So, what should a student do if they or someone they know are having mental health problems? "Be aware of what resources exist to them [...] there are a lot of different resources and services and support that range from clinical services at UHS to advocacy services in the Dean of Students Office or more informal group from peer organizations" advises Donovan. She believes a good first step would be to go to UHS. If a peer is struggling with mental health, a student could call UHS and they will advise the student on how to help their struggling peer. UHS also does a good job redirecting students to where they can receive help for their particular issue. The Dean of Students Office and many student organizations are also very good resources to look into. There is an incredibly wide variety of resources available on campus, and it is important to remember that there is always someone who is there to help. UWell and all of the organizations that meet through it always have the well-being of student and employee health in mind. Stay healthy, Badgers!

MENTAL HEALTH RESOURCES

UHS Mental Health: 608-265-5600
UHS 24-hour Crisis Line: 608-265-5600
Crisis Text Line: Text HOME to 741-741
Suicide Prevention Lifeline: 800-273-8255
Trevor Project Lifeline: 866-488-7386
Trans Lifeline: 877-565-8860
Veterans Crisis Line: 800-273-8255

DESIGN BY
SARAH WORTHINGTON

UW-MADISON GETS TAKEN OVER BY ROBOTS

UW-MADISON PROVIDES A NEW HOME FOR DELIVERY ROBOTS

WRITTEN BY
JARED VAHRENBERG

The robots are here! Starship Technologies has brought their lovable little robots to the UW-Madison campus. You can now order food from the dining halls and have it delivered to you on any part of the Lakeshore portion of campus. All you have to do is get the app, place an order, and the robots will use your location to deliver your meal right to your door.

"WE'RE HERE TO PROVIDE EVERY TYPE OF FOOD YOU COULD WANT, FROM FRIED CHICKEN TO YOUR MOST HEALTHY OPTIONS, TO COME IN AND GET IT DINE IN, TO GO, OR DELIVERED TO YOU." -PETER TESTORY

These little 'bots are friendly and do not get in the way of pedestrians or traffic. There is no need to fear of some gigantic robot getting in your way as you are off to class, because they are only a few feet tall. They also only go at a walking pace and are polite enough to avoid walkers, stop at crosswalks, and stay off the roads. They even will say "thank you!" if you help one that gets stuck in the snow, which is a very real possibility here on the UW-Madison campus. So, if you see one the little guys stuck, you might as well give them a hand.

Currently, the robots are limited to the portion of campus that lies north of University Avenue, but as the Director of Dining and Culinary Services, Peter Testory, explained, there are plans to extend the range of the robots to reach Gordon Dining Hall and the residents in the Southeast neighborhood of dorms. "We gained approval from the city a week or so before the launch date, so we did not have time to get [the Southeast] area mapped" says Testory. So do not worry and be patient, Southeast students!

It may even be possible in the future for these robots to have the capability to deliver items from places like Flamingo Run in the Dejope Residence Hall. The more pressing issue right now, however, is to get the Southeast residents' access to this service.

It is very exciting to see a company approaching UW-Madison and wanting to give us their product. UW-Madison is a perfect place to test and show off these new technologies. As Testory put it, he hesitates to call these new technologies "futuristic" because we are living in this today. It is suddenly not so absurd to share the sidewalk with a little knee-high robot who is just trying to do their job.

Testory is very excited about more similar opportunities, because improving the student's experience here at UW-Madison is always a focus, especially for the Dining Services.

PHOTOGRAPHY BY
JACOBO KIRCH TORNELL
GRAPHIC DESIGN BY
ALEX DEGRYSE

FIGHTING PARASITES

SCHISTOSOMIASIS IS A DISEASE CAUSED BY SKIN-BURROWING PARASITES. A RESEARCH SCIENTIST AT UW-MADISON INTEGRATES BIOLOGY AND CHEMISTRY IN ORDER TO FIND A CURE FOR THIS ILLNESS.

WRITTEN BY
TEJA BALASUBRAMANIAN

The study of the relationship between parasites and their hosts is captivating and offers the opportunity to discover ways to prevent devastating diseases. At UW-Madison's Morgridge Institute for Research, one project, led by Professor Phillip Newmark, focuses on the parasitology of schistosomiasis. This disease affects more than 240 million people in Africa, Asia and parts of South America. Schistosomiasis is considered by the World Health Organization as the second-most socioeconomically devastating parasitic disease, second-only to malaria. For decades there has been only one drug on the market used to treat schistosomiasis. Thus, there is an urgent need for alternative drugs.

The schistosome, more commonly known as a blood fluke, is the parasitic flatworm that leads to schistosomiasis. Schistosomes have a complex life cycle involving a snail intermediate host. The infectious stage of the schistosome, cercaria, shed from their snail hosts and burrow through human skin. During infection, the cercaria shed their tails and mature into egg-laying adult schistosomes. These eggs either get lodged in various internal organs (leading to organ failure/death) or they are released via human excrement. This excrement finds its way back into freshwater systems where the eggs can hatch into miracidia, infect the snails, and continue the cycle. Thus, schistosomiasis is a common disease in tropical areas where freshwater and human wastewater are not separated, allowing schistosomes to thrive.

The research group began their research on free-living flatworms called planaria which have remarkable regenerative capabilities. Their research in planarians eventually led them to begin their investigation into schistosomes in 2011. Newmark and a previous postdoctoral scholar, Jim Collins, incorporated schistosomes into the lab by utilizing many of the molecular and imaging tools that were already being used to study planarians. Professor Newmark's investigations focus on the life cycle of schistosomes and the identification of approaches to combat these parasites. For one of his graduate students, Jiarong Gao, this exploration is one of her main projects. Gao and colleagues reported the successful isolation of a natural compound capable of preventing schistosome infection. Gao joined this project in 2013, when she was still attending the University of Illinois-Urbana Champaign (UIUC). In 2016, she moved to the University of Wisconsin-Madison to continue her academic career and work on this project.

> **"SCHISTOSOMIASIS IS CONSIDERED BY THE WORLD HEALTH ORGANIZATION AS THE SECOND-MOST SOCIOECONOMICALLY DEVASTATING PARASITIC DISEASE, SECOND-ONLY TO MALARIA, WITH HUNDREDS OF MILLIONS INFECTED WORLDWIDE."**

Gao continued this work by focusing on cercaria and their intermediate snail hosts. Once the miracidium hatches and infects the snail, it develops into the next stage, known as a sporocyst. At this point, it reproduces and multiplies asexually. Gao stated that the sporocysts "produce thousands of cercaria which are unleashed in the water and seek out mammals to infect". In order to prevent this, Gao has worked with tiny aquatic creatures called rotifers which also live on these snails. In the 80s, a powerful observation was made by noticing that snails with rotifers shed cercariae that were not as motile. This led to the question of whether there was some compound being released by rotifers that result in cercarial paralysis. Gao discovered that these rotifers release a chemical compound, known as SPF, that paralyzes cercariae on contact.

Gao, together with colleagues (Jonathan Sweedler's lab at UIUC), worked on isolating the compound from rotifers and subsequently conducting experiments to test the paralytic effects of SPF on cercaria in vitro (essentially, "test-tube" experiments) and in vivo (performed on living organisms). Other chemically synthesized analogs of SPF were also discovered to have similar paralytic effects.

Gao stated that mass drug administration (MDA) relies on a single drug to treat schistosomiasis. Thus, there are chances for schistosomes to develop resistance to the drug. It is therefore essential search for find preventative drugs and other cures. Professor Newmark's research group has successfully discovered and isolated a natural chemical that acts as a potent drug against schistosomes – a truly incredible feat. Applying this knowledge could mean compelling results for not only those who suffer from schistosomiasis, but also for the expansive field of biochemistry and biomedical research.

DESIGN BY: ERIN CLEMENTS

OPPORTUNITIES ABOUND FOR MATERIALS SCIENCE

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT OFFERS A UNIQUE ARRAY OF OPPORTUNITIES TO DEVELOP SKILLS AND EXPAND PROFESSIONAL NETWORKS.

WRITTEN BY
GABRIELA NAWANGSARI
SETYAWAN

UW-Madison's Materials Science and Engineering department (MS&E) has an enormous array of opportunities for students who want to gain recognition in the professional engineering world and obtain scholarships to further their education. The department prepares students for life beyond the classroom through a variety of methods: from professional society connections to integrating real-world problems into the program. At the granular level, MS&E students can learn the basic principles of metallurgy, polymer science, ceramics, biomaterials, nanomaterials, computational methods, and more. On a larger scale, students will learn the importance of material properties and how to apply them in other fields and industries.

"We want our students to think both as a scientist and as an engineer. As a scientist, they learn how things work and as an engineer, they learn how to make things better," explains Sue Babcock, a Professor and the Department Chair in the MS&E department. Babcock also points out that the materials science field is very broad. It encompasses electrical engineering, mechanical engineering, and biomedical engineering, allowing for a lot of room for collaboration and integration.

"WE WANT OUR STUDENTS TO THINK BOTH AS A SCIENTIST AND AS AN ENGINEER. AS A SCIENTIST, THEY LEARN HOW THINGS WORK AND AS AN ENGINEER, THEY LEARN HOW TO MAKE THINGS

From employment opportunities such as co-ops and internships to being involved in student organizations and researching in a lab, the MS&E program itself at UW-Madison encourages students to pursue a broad range of learning experiences. While the program has a heavy focus on research, it does not limit students that want to go to industry. UW-Madison is uniquely equipped to satisfy a variety of student interests through the countless opportunities offered. This allows students to gain exposure in academic research topics as well as industrial projects. In fact, students who have research experience before their senior year will be more prepared for their capstone project. During their senior year, MS&E students work with on campus research groups and off-campus companies to propose a solution for a real-work problem.

Johnathon Brehm, a MS&E undergraduate senior and editor for our very own magazine, is the student representative for the International Metallographic Society (IMS), an affiliate of the American Society of Materials (ASM). Brehm wishes students would take advantage of more opportunities with their major. "From professional societies to opportunities here on campus, the number of scholarships and career advancement options available probably outnumber students by 10:1."

ASM is one of the societies Brehm wishes students would become more involved with. "They not only have a local chapter that meets in Milwaukee monthly, but they have a society for a wide assortment of applications. Do you want to go into Failure Analysis? There is a society for that. Metallography? There is a society for that. Thermal Spray? Electronic Devices? Regardless of where your interests lie in materials science and engineering, ASM International most likely has a society for you." These societies offer an assortment of opportunities that students can leverage to advance their careers. For example, the International Metallography Society hosts a metallography competition every year, where students and professionals alike get to showcase microscopic images of metals and project-based posters. Students can win up to $1,000 in this competition, and in addition to recognition in the professional world for their accomplishments

"A lot of people think that the materials science major is small -- that you are almost pigeonholed in this major, but you can apply it broadly," says Brehm, who was able to apply his classroom knowledge to real world problems. Outside of class, Brehm identified the structure of a Gibeon meteoroid. He purchased a sample online and compared the meteoroid with images of a text that classified it; however, the meteoroid he saw under the microscope and the data from his book didn't match with the website description where the sample was purchased. Brehm contacted the website and was able to convince them through his data that that the website description was incorrect. "You can make a project out of anything, your chances are higher than you think," says Brehm. He later used the meteoroid project to enter and win the IMS competition

The number and scope of opportunities for materials science and engineering students are out of this world. "Integration is a big thing now, there are a vast amount of application of materials science in many different fields of engineering," says Babcock. In the MS&E department, students are encouraged to pursue their own passion and the unique array of opportunities that can solidify their experience using classroom materials.

THE VIEW THROUGH A NOW ABANDONED MELTING FURNACE IN DODGEVILLE, WI. THE STONES LINING THE INSIDE OF THESTACK ARE STAINED GREEN FROM BOTH MOSS AND THE EFFECTS OF VAPORIZED METALS THAT WERE ONCE REFINED IN THIS FURNACE.

REWRITING THE TOXIC MINING HISTORY OF WISCONSIN

WRITTEN BY
PIERSON CHU

Wisconsin was one of the nation's biggest producers of lead and the state prospered as a result of its mining operation up until the beginning of the Civil War. Interestingly, the "Badgers" were a nickname given to miners in the early 1800's that dug hole shelters into hillsides for their off-hours. However, according to Professor Geoffery Siemering of the UW-Madison department of soil science, this mining boom could still be affecting the state today and for years to come due to the lead contamination of Wisconsin soils.

Miners initially produced lead rather than zinc due to the relatively simple techniques used to extract it. The ore is grinded into a fine powder, the impurities are separated by flotation processes, then the ore is sintered and reduced back to powder. The relatively simple process allowed lead processing plants to be built everywhere. Conversely, the much larger zinc production facilities were centralized due to the metal's complicated production processes, so miners needed to transport the ore throughout the state to be processed.

As the mining industry expanded during the 1820s, the environment was left on the backburner. Unusable lead and zinc ore was simply left on the ground. "[Piles of ore] could still be seen up there until 5 to 10 years ago" says Siemering. The remnants from the refinement processes likely dumped conveniently near the site, scarring patches of soil permanently. Additionally, the weathering from over hundreds of years of

wind and rain makes the ores impossible to separate.

This contaminated soil has serious effects on both plants and people, as zinc in excess is poisonous to plants, and lead is poisonous to humans. But today, many people remain in these areas, building or farming on the contaminated soil. Even more, the contaminated soil can also be washed into the water table or nearby drinking water sources, putting human health in jeopardy.

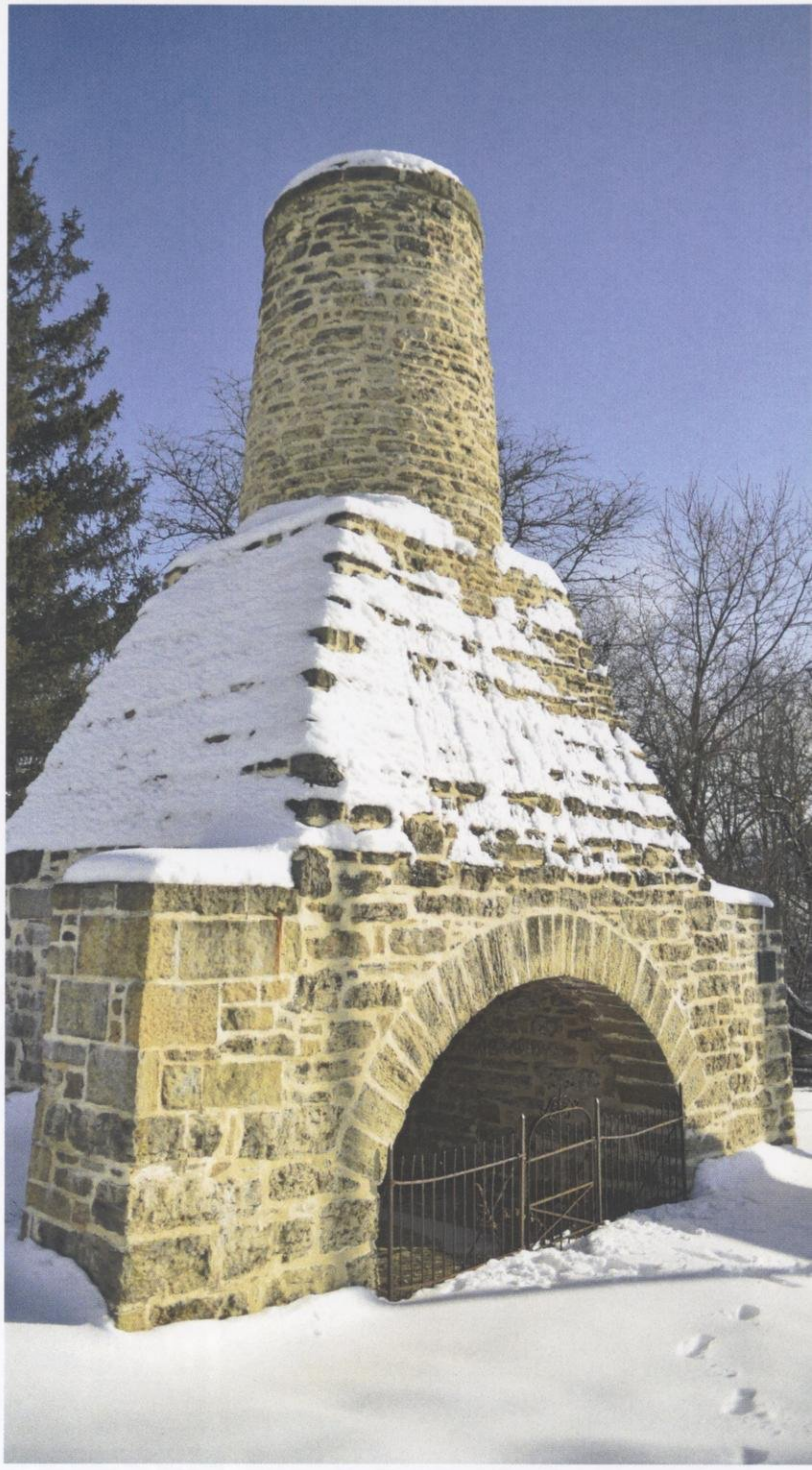
To help people and farmers in their transition into a better understanding of the soil they are surrounded by, Siemering and his colleagues have combined the history of mining with current mapping technology to create the Digital Atlas of Historic Mining Features in Southwestern Wisconsin and he says that "what the hope is, is to get system change".

Not only does Siemering hope to use the Digital Atlas to help land use planners understand the soil they are building on, but he also hopes to use this as a way to educate farmers about the soil they are exposed to on a daily basis. It is important for farmers to understand that "it is not only affecting their plants, but also affecting them" says Siemering, as high levels of lead can cause problems such as impaired mental and physical development and vitamin D deficiency. Furthermore, it can be difficult to determine by eye whether a plant actually has abnormally high or low zinc levels, as the signs are often similar. By making this atlas widely available, farmers are able to correctly identify and avoid contaminated areas.

Fortunately, Siemering's vision has already started to come to life. A few weeks after he and his colleagues published their atlas, he says that they "got a call from an environmental consulting firm, who were putting up a new water tower in one of the towns [covered by the atlas], asking how they could utilize data on the atlas."

In addition to the atlas, Siemering has also been developing low cost engineering solutions to reduce the effects suffered by farmers. For instance, testing using a microbial soil amendment called Quick Roots has shown a higher level of resistance to metal toxicity in plants. As a result, plants have been able to absorb more than twice the normal amount of zinc. In combination with growing deep-rooted prairie plants, contaminated areas could be repopulated with plants or become habitats such as pollinator islands.

The people who contaminated the soil are no longer able to remedy the situation, and those who are suffering from its effects often lack the information to make changes. Thus, it is up to scientists such as Siemering to bring the information and the solutions to today's citizens. This atlas extends far beyond science, but it is a way to bring change and educate a community that is being affected by its past.



A MELTING FURNACE IN DODGEVILLE, WI. THE STACK WAS ONCE CONNECTED TO A REFINERY THAT PURCHASED ORES FROMMINERS, REFINED THOSE ORES INTO USABLE RESOURCES AND THEN SOLD THE FINAL PRODUCT TO A FACTORY.

PHOTOGRAPHY BY
EZRA ECKERSON
GRAPHIC DESIGN BY
LAURA RODRICKS

Wisconsin Engineer Magazine
Room M1066
Engineering Centers Building
1550 Engineering Drive
Madison, WI 53706

Presort Standard
U.S. Postage
PAID
Madison, WI
Permit No. 658