# marquette engineer

OPUS COLLEGE OF ENGINEERING MAGAZINE **2021**

**Over the course of its 100-year history, the Marquette co-op program has risen to meet the challenges of an ever-shifting world.**

# The Heart of Ignatian Innovation

In the book *Innovator's Spirit*, our Innovator-in-Residence Chuck Swoboda, Eng '89, shares his insights and experience leading an innovative company. We call on our engineering students, staff and faculty to nurture their innovative mindset as well as their Ignatian mindset of reflection, gratitude and servant leadership. This past year, we have all had to find creative ways to live, learn, work, socialize and serve God. We were challenged to think and act differently, and at times, we struggled to practice gratitude and reflection when we were so isolated from the people and communities that define our everyday lives.

But we persevered, with that innovative and Ignatian spirit, to set the world on fire — whether we were suddenly teaching students online from our kitchens, driving our cars in birthday parades, attending church virtually in our living rooms, or offering online story time to reach out to staff families during the early days of COVID-19.

Despite the restraints that COVID-19 placed on our day-to-day operations, our people continued to boldly live out our mission. In this magazine, you will find our faculty are leading the nation in powering electric vehicles, tracking COVID-19 vaccinations and addressing mobility in children. Our cooperative education program continues to be a differentiator in providing students with real-world experience. And, a COVID-themed hackathon united many in our Marquette community to reduce the barriers created by isolation and safety protocols.

Love-driven leadership and perseverance to find a better way — that is the heart of Ignatian innovation. Marquette engineers wear this heart on their sleeves.

**Dr. Kristina Ropella**
Opus Dean
Opus College of Engineering

*Follow the dean on Twitter @DeanRopellaMU.*

## IGNATIAN MOMENT

Consider taking a digital pilgrimage to Marquette's sacred spaces. You can virtually visit 12 of our campus spiritual sites, including St. Joan of Arc Chapel and the Grotto of the Blessed Virgin. Discover these sacred spaces that beckon us to remember God's love and care for us, as well as our dynamic vocation to love, honor and serve our God and neighbor. Visit marquette.edu/sacred-spaces.

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2021




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# In the Driver's Seat

## Opus College collaboration gives children with mobility limitations a new lease on life.

"A walking, talking miracle" is how Katie Sheteron describes her daughter, Grace, who was diagnosed with multiple health conditions after her premature birth. A "missing puzzle piece" for Grace's amazing progress, according to her mother, is a program in which Marquette engineers and Children's Wisconsin physical and occupational therapists have participated since 2015: the international GoBabyGo program, which adapts motorized ride-on cars for children with mobility limitations.

While Grace's diagnoses are many, they do not define her. "We were initially told she would be in a vegetative state, so we celebrate all she can do," Sheteron explains. After being outfitted with her red VW Beetle, Grace soon found the confidence to move her body beyond rolling on the floor. Shortly thereafter, she started crawling at 15 months and walking three months later.

Marquette's GoBabyGo engineer is Molly Erickson, Eng '18, who learned about GoBabyGo when a child involved in her senior project received an adapted car. Her project adviser, Dr. Ben McHenry, Grad '13, former assistant research professor, previously built all of the adapted cars, and when Erickson reconnected with him last year, she learned of the GoBabyGo engineer position opening in the Opus College's Orthopaedic and Rehabilitation Engineering Center (OREC).

Now Erickson is at the wheel, designing and building four to six cars a month, which are given to families free of charge. She works with Children's Wisconsin partners Elizabeth Conrath and Allison Friel to customize each vehicle for the child's medical needs and limitations, such as giving it a one-button start that's easier to reach. "Some children are afraid to try their car at first, but soon their faces light up," Erickson says.

The cars have been so well received by local families that requests are revving up, and funders are increasing their donations. Most of the funding comes from the Children's Wisconsin Foundation, OREC and Variety, the Children's Charity of Wisconsin.

"We know that there is this critical window before the age of 3 where we want to give these children more opportunities for movement, socialization and cognitive development," says physical therapist Conrath, Arts '10, PT '12. "This program has been a beautiful collaboration … and we're hoping to grow it and offer these cars to more children with special needs throughout Wisconsin."

—LAUREN (HERB) SCHUDSON, GRAD '97

/ NEWS /

## News You Might Have Missed

With a pause in our magazine production due to the pandemic, we wanted to make sure some good news from the 2020 spring semester wasn't overlooked. Here are some celebratory highlights:

- **Dr. Taly Gilat-Schmidt** received a Marquette University Teaching Excellence Award and was also promoted to professor of biomedical engineering.
- **Dr. Anthony Parolari**, assistant professor of civil, construction and environmental engineering, and **Dr. Nathan Weise**, assistant professor of electrical and computer engineering, received Way Klingler Young Scholar Awards, which support promising young scholars in critical stages of their careers.
- **Dr. Jay Goldberg**, professor of practice of biomedical engineering, was named a Biomedical Engineering Society Fellow.
- **Isabelle Horvath**, Grad '20, a doctoral student in the Civil, Construction and Environmental Engineering Department, swept Marquette's 2020 Three Minute Thesis competition by winning first place and the People's Choice award. Horvath shared her prize money with her fellow Graduate School competitors.
- **Dr. James Richie**, associate professor of electrical and computer engineering, received the Opus College's Outstanding Teacher award, and **Dr. John Borg**, professor of mechanical engineering, received the college's Outstanding Researcher award.
- **Dr. Chandana Tamma**, adjunct assistant professor of electrical and computer engineering, was named an Engineering Unleashed Fellow by the KEEN Program, a recognition for her contribution to entrepreneurial engineering education.

## Comings and Goings

**The Opus College of Engineering welcomed five new faculty members this fall:**

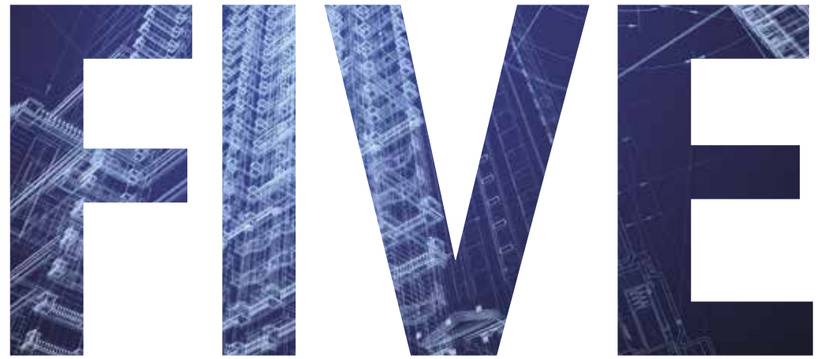
**Dr. Qindan Huang**, associate professor of civil, construction and environmental engineering; **Dr. Andrew Sen**, assistant professor of civil, construction and environmental engineering; **Dr. Jie Gao**, assistant professor of electrical and computer engineering; **Dr. Allison Murray**, assistant professor of mechanical engineering; and **Dr. Le Zhou**, assistant professor of mechanical engineering.

Staff additions include **Dr. Ben Correia-Harker**, who was hired as associate director of engineering and innovation leadership development; **Jill Schuettner**, who was hired as an office associate for the Department of Mechanical Engineering; and **Jason Chandler**, who was hired as a machinist.

**Dr. Gerald Harris**, Grad '78, '81, director of the Orthopaedic and Rehabilitation Engineering Center, earned professor emeritus of biomedical engineering status, and **Andrew Felske**, machinist, retired.


## Building Momentum

(Left) Acting Keyes Dean of Business Tim Hanley, Bus Ad '78, and Opus Dean Kris Ropella break ground for the new Marquette Business and innovation leadership programs building (above rendering), which is being constructed across the street from Engineering Hall at 16th Street and Wisconsin Avenue. The $60 million, 100,000-square-foot building, which was funded completely by donors, will house Marquette's expanded Excellence in Leadership (E-Lead) program and serve as an integral part of the innovation ecosystem across campus. The building is schedule to open at the end of 2022.




## Graduate Certificates for Practicing Engineers

Following the successful launch of the Master's Across Boundaries program, the Opus College of Engineering has taken another step toward its goal of reimagining graduate engineering education by expanding its master's certificate program to include five new certificates.

The certificate approach is designed to complement the existing master's programs and was developed in response to the needs of working engineers. The certificates give practicing engineers a way to keep pace with changes in their profession as well as options to gain specialized technical knowledge in their field along with taking complementary courses in law, business, communications and humanities.

The five new certificates include Environmental Engineering; Renewable Energy Technology and Integration; Essential Skills for Practicing Engineers; Systems Engineering; and Machine Learning for Engineering Applications. According to Dr. Jeffrey Starke, executive director of Master's Across Boundaries, each certificate was developed to fulfill specifically identified industry needs.

"In early 2019, we convened over 70 leaders in an Industry Advisory Board to begin the process. We continue to value these close relationships with our industry partners as we develop new ideas," he says.

Starke says that the main catalyst of the certificates is to meet the needs of practicing engineers, "to keep engineers current with new advances as part of the digital economy." The certificates can be pursued separately as desired but can also be integrated into meeting the requirements of a Master of Engineering degree. Also, the certificates can provide an opportunity for post-master's degree education.

Developing each certificate meant facing the challenge of designing courses for students who juggle a full-time engineering career, many with family obligations. Flexibility is crucial. "We wanted to make sure students can balance the demands of their personal and professional life and have started offering classes during the traditional lunch hour in a virtual, synchronous format," Starke says.

The certificates are being offered with a range of modalities to meet the way students feel they learn best. Opus College faculty have been working diligently to meet COVID-19 requirements and integrate lessons from the way industry performs work on global teams into the classroom experience. Additionally, Starke says, "Dean Kris Ropella has recognized the uncertainty associated with the pandemic and its economic challenges. As further incentive, students are eligible for financial support of up to five tuition credits, thus reducing the student's financial responsibility to seven of the required 12 credits."

For the future, Starke says several other initiatives are under development. "An initiative to have the Machine Learning and Systems Engineering certificates be part of the Master in Supply Chain Management has been proposed. We are also looking at a certificate to address skills within the manufacturing sector, and the ability to 'stack' certificates into a Master of Engineering degree is being studied."

—GUY FIORITA

**// FIVE NEW CERTIFICATES //**

**1** // ENVIRONMENTAL ENGINEERING **2** // ESSENTIAL SKILLS FOR PRACTICING ENGINEERS
**3** // MACHINE LEARNING FOR ENGINEERING APPLICATIONS **4** // RENEWABLE ENERGY TECHNOLOGY AND INTEGRATION
**5** // SYSTEMS ENGINEERING

EXCELLENCE LEADERSHIP

## E-Lead Expands Its Reach

With a 2019 gift from the Swoboda Family Foundation, E-Lead, the three-year innovation leadership development program for undergraduate engineering students, broadened its eligibility to all students on campus and welcomed non-engineering students to its 2020 cohort of 40.

The expansion compelled the program to reconsider its name and corresponding academic credentials in order to be inclusive to all of its potential applicants. With input from students and alumni, the E-Lead team changed the name from Engineers in the Lead to Excellence in Leadership.

"The name now incorporates two of the four pillars of Marquette's mission — excellence and leadership — and allows us to maintain the shorthand program name, E-Lead," says Kate Trevey, Bus Ad '04, the Opus College's director of engineering and innovation leadership development. "This helps us keep the name recognition and credibility we've earned with employers, engineering students and campus leaders."

The program also adapted its academic credential, which was previously only available to engineering students; the new concentration in innovation leadership will appear on E-Lead graduates' transcripts. Updated program objectives and outcomes now reflect an interdisciplinary focus yet remain committed to being a transformational program that helps students develop their capacity to lead in service of others with an emphasis on innovation.

Results from a national study of student-leadership development show that E-Lead participants grow in their leadership, confidence and resiliency at significantly greater rates during their time in college than their peers at Marquette and nationally. The insights confirm the impact of the program, which now boasts nearly 90 graduates.

Looking toward next year, Trevey is "filled with excitement," as E-Lead has set goals to continue refining its learning outcomes, recruit its most diverse cohort to date, and explore more opportunities to bring its leadership curriculum to corporate partners.

**92%**

**of E-Lead students say they are confident leading others, compared with 82% of their Marquette peers.**



## Young Researcher Rewarded

In spring 2020 Kassidy O'Malley, graduate research assistant and environmental engineering doctoral student, was awarded the National Science Foundation's Graduate Research Fellowship. The prestigious fellowships are given to individuals who have demonstrated, from early in their graduate careers, a potential for significant research achievements in science, technology, engineering, mathematics or STEM education.

Showing her research potential was something O'Malley, Eng '19, Grad '20, had done as a participant in SURF (Summer Undergraduate Research Fellowships), a program that provides undergraduate students the chance to partner with faculty in an outside-the-classroom, hands-on research project. SURF students receive a $5,000 stipend and the opportunity to present a poster on their research topic at the Opus College's annual Undergraduate Research Day. O'Malley participated in the summers after her sophomore and junior years, researching the efficacy of electrocoagulation for the removal of estrogens from drinking water.

Despite this success, O'Malley was surprised to receive the NSF fellowship. "It was the second time I applied, and I wasn't very optimistic," she admits.

Her advisers, however, were more confident. "She received the award thanks to her hard work, intellect and research ability, but beyond that she is also a great person who is engaging, considerate and thoughtful," says Dr. Walter McDonald, assistant professor of civil, construction and environmental engineering.

"She focuses on what she can do and what she is good at, sets a plan and executes it. She was very mature as an undergraduate student even from her freshman year," adds Dr. Patrick McNamara, Eng '06, associate professor of civil, construction and environmental engineering.

**"I hope that the outcomes of my research and my degree are significant and meaningful."**

—Kassidy O'Malley

O'Malley, who will start working under the fellowship in fall 2021, will focus her research on the input of antibiotic resistance into the environment from stormwater. "We sample storms as they occur in Milwaukee and target key stormwater infrastructure locations to identify if they are exacerbating this public health crisis and then determine how the infrastructures can be better engineered to reduce risk," she says.

For O'Malley, receiving the fellowship has already changed her life. "It's the reason I decided to pursue my doctoral degree; I initially was just going to do my master's," she says. "I hope that the outcomes of my research and my degree are significant and meaningful. After my degree I want to continue working at the point where human behavior and environmental impacts intersect and present any findings to the public in a beneficial manner." —GUY FIORITA

## Innovation Podcast Taps Thought Leaders

When alumnus Chuck Swoboda joined forces with the Opus College in fall 2019 as its first innovator-in-residence, one of his first endeavors was to launch *Innovators on Tap*, a podcast that encourages listeners to "challenge the status quo, think about what's possible and pursue the impossible." The podcast series effectively helps establish Marquette as a thought leader in the innovation space, as it gathers insights from top innovators and finds ways to apply these insights inside and outside the classroom.

"Our belief is that innovation is fundamentally about people, not process," says podcast host Swoboda, Eng '89. "So, we use the podcast to dive deeper into the beliefs and behaviors that are necessary for an innovator's mindset. It's a journey to discover the innovator's spirit in action."

By the end of 2020, Swoboda,* retired CEO of Cree Inc., and podcast producer Kyle Hagge recorded more than 70 episodes, which featured industry leaders from artificial intelligence, solar power, digital voting, nutrition, social innovation and other sectors. They have grown unique listeners to nearly 9,000 each month. As the podcast moves into another year, "We will continue to leverage it to deepen relationships with top leaders, produce innovation content in a variety of mediums, and gather qualitative data on key leadership and innovation theories," Hagge, Grad '19, says.

Listeners can subscribe to *Innovators on Tap* through Apple Podcasts and Spotify. Visit **innovatorsontap.com** for an archive of episodes.

**President's Society member*

**Class of 2024**

**247**
**students**

**32%**
**female**

**21%**
**first-generation**

**30%**
**non-white**

*2010 fall enrollment was 18% female; 18% first-generation; 17% non-white.*



## Peak Power

A 28-year-old company founded in the Opus College of Engineering has turned a new corner — Marquette Energy Analytics, which started up under the name GasDay, moved off campus in early 2019 to offices in Milwaukee's Third Ward. There, the company continues to do what it does best: draw from Marquette's undergraduate and graduate expertise to build and refine computer models that provide the natural gas sector with accurate demand forecasting — saving utilities and their customers millions of dollars annually.

"As we enter our third year outside the university, we remain committed to supporting student education, especially STEM education," says Tom Quinn, Arts '84, Grad '18, president of Marquette Energy Analytics (MEA).

Educational support comes by way of strong research ties to Marquette's GasDay Lab, originally directed by Dr. Ronald Brown, associate professor emeritus and chief scientist at MEA. Brown, who knew little about energy analytics but was an expert in computer modeling, worked with a team of students in 1993 to create a computer algorithm that accurately forecast natural gas demand for a 24-hour period. The timeframe is known in the industry as a "gas day" — hence the lab's name. The algorithm was so successful that some of the largest utility companies in the nation, including those serving San Francisco, Chicago and New York, licensed it.

Revenue dollars generated, often nearing $1 million annually, were directed back into Brown's lab to support graduate research and fund undergraduate jobs. As customers became more reliant on the forecasting, they were looking for assurances that GasDay wasn't going to disappear should a key researcher retire or graduate. It was time to spin off. Quinn said he wanted to keep "Marquette" in the new name because clients often referred to the algorithm as the "Marquette model." MEA was born, and GasDay became the name of the product.


Today, MEA serves more than 35 gas utilities nationwide and permanently employs 12 people, seven of whom are Marquette graduates. An additional five students work part time or as full-time employees through the Opus College's co-op program. MEA financially supports the GasDay Lab, including three graduate students.

The partnership's benefits go three ways, says Dr. Richard Povinelli, associate professor of electrical and computer engineering and director of the GasDay Lab since 2018. Students get to see their research turned into business solutions; MEA stays tapped into the latest research in energy analytics; and the GasDay Lab receives actual challenges that need to be solved. "As engineers, we tend to like to work on real problems," says Povinelli, Grad '99.

As it moves more fully into the business world, MEA is looking toward new ambitions. It's migrating its customers from on-site installed software to a cloud-based Software as a Service (SaaS) application and also expanding into the electric power sector. Quinn says he'd also like to see the company become more engaged in Milwaukee's community. "As soon as we're not breathing so hard, we hope to rejoin the community activities that we were active in when we were living in the university," he says. —TRACY STAEDTER

**// MARQUETTE ENERGY ANALYTICS //**

**35** // GAS UTILITIES SERVED NATIONWIDE

**12** // PEOPLE PERMANENTLY EMPLOYED

**7** // EMPLOYEES WHO ARE MARQUETTE GRADUATES

# Celebrating Our Distinguished Alumni

### Distinguished Alumnus of the Year Award

Brian P. Byrne, Eng '65

Sitting at his kitchen table in 1979, acting as a salesman, engineer, project manager and field superintendent, Brian Byrne could not have imagined the success he would have. That year, he launched Briohn Building Corp., a construction company with in-house architecture, interior design, general contracting, structural engineering and property management capabilities. As a first-generation college graduate, he believes his career was shaped with help from Marquette, especially his Jesuit education. As chairman of Briohn, Byrne's role today is mainly mentoring and interacting with his employees. "I am particularly proud that our organization is 40 years strong and has now passed to the next generation of our family," he says.

*President's Society member*

> **"Life is a mission; my beliefs are the guiding light, and giving back to others is a reward above all else.**
>
> —Paul M. Stillmank

### Professional Achievement Award

Anthony J. Binsfeld, Eng '74

Since 1991, when he was named the company's fourth president, Tony Binsfeld has been at the helm of J.F. Brennan Company Inc., a successful marine business based in La Crosse, Wisconsin. In 2019, the company celebrated its 100th anniversary. Binsfeld says it is a landmark reached by following the Ignatian approach to decision-making and leadership. "Servant leadership is a tenet of our culture," he says. As the current chairman of the board for the family-owned contracting firm, Binsfeld soon plans to turn over the company to the fifth generation. Then he can look back with pride on what he calls a long and exciting career in the marine industry.

*President's Society member*

### Entrepreneurial Award

Paul M. Stillmank, Eng '85

Paul Stillmank's lifelong dream was to be a founder and CEO of a company. When he launched 7Summits in 2009, little did he know that in just 10 years the Salesforce consulting company would grow beyond his wildest dreams and become one of *Inc.*'s 5,000 Fastest Growing Companies in the U.S., and a Best and Brightest Company to Work For in the nation, a recognition from the National Association for Business Resources. IBM recently acquired 7Summits. Stillmank attributes much of his business success to his Marquette experience, which he says provided him with an education grounded in empathy and the servant-based leadership that is the cornerstone of his thinking. "Employees don't work for me; they work with me. Life is a mission; my beliefs are the guiding light, and giving back to others is a reward above all else," he says.

*President's Society member*

### Young Alumna of the Year Award

Aleisha Palaniuk Jaeger, Eng '03

As director of project engineering for North America at Kerry Inc., Aleisha Palaniuk Jaeger feels that success comes from constantly growing personally and professionally. Though her career has taken her from developer to contractor to owner and given her the unique career experience of being on many sides of project management and construction, one thing has always remained the same: "From the very first project to the most recent, I am still fascinated by the collaboration of the people and process and love the opportunities to solve challenges," she says. A Marquette Mentor for five years and a Marquette Young Alumni Leadership Council member, Jaeger is also currently board secretary of the Chicago chapter of Commercial Real Estate Executive Women, which works to advance the power and success of women in the industry.

> **"I am still fascinated by the collaboration of the people and process and love the opportunities to solve challenges.**
>
> —Aleisha Palaniuk Jaeger

Nominate a deserving alumna/us for Marquette University Alumni National Awards at marquette.edu/alumni/awards/nominate.php.

# OPEN DOORS

## The Engineering Scholars Program provides educational opportunities and peer support for first-generation students like Emanuel Wasson.

BY SARAH KOZIOL, ARTS '92

Opus Scholar alumnus Emanuel Wasson is wrapping up his graduate studies at the prestigious Johns Hopkins Center for Bioengineering Innovation and Design and heading to New York City to work for an innovation consulting firm.

## "I AM EASILY PERSUADED:

If I see enough of an opportunity to really make a difference, I'm going to take it," says Emanuel Wasson, 2020 graduate of the Opus College of Engineering. That resolve must have made Marquette — with its parallel mantra, "Be The Difference" — an appealing choice for Wasson as he was considering his college choices. Add in a storied basketball program (he's a big fan), an opportunity to perform alongside the athletics teams as a trumpet player in Pep Band, and a world-class biomedical engineering program with strong industry connections, and Wasson was ready to seize the moment.

It was a big moment. As the first member of his family to go to college, he was faced with obstacles that might have derailed his plans. But with encouragement from his family, a tireless work ethic and high-quality academic credentials, Wasson earned one of five coveted spots in Marquette's Opus Scholars program, a four-year full-tuition and partial room-and-board scholarship for first-generation students with demonstrated financial need.

Once at Marquette, Wasson made the most of what he called the "open doors" in front of him. Outside the classroom, he says he "grew as a musician" not only in Pep Band, but in Jazz Band, Wind Ensemble and Symphonic Band. He became the equipment manager for Pep Band, responsible for making sure everyone's instruments made it to their away-game destinations.

Inside Engineering Hall, he cultivated different talents. He participated in the E-Lead program in which he learned "more about himself as a leader and how to best build a team." And he became a Student Ambassador for the Opus College, serving as a tour guide, writing letters to prospective students and working at orientation events for admitted students. He won't take full credit for it, but he likes to think he may have played a small role in the percentage upticks of female and first-generation students attending the Opus College this academic year.

The Opus Scholars Award that Wasson received is part of a suite of similar scholarships, including the Donald J. and Frances I. Herdrich Scholars and Michael J. Cudahy Scholars, which compose the Engineering Scholars Program. For the 2020–21 academic year, the program is supporting 26 students. There is more to this program than life-changing scholarships for first-generation, underrepresented engineering students. Academic support, social programming, leadership-shaping opportunities, community service and network building are integrated into each student's tenure, according to Jenna Lassila, Grad '16, assistant director of academic advising, who also serves as mentor to the Scholars Program students.

Peer support, not a formal component of the program initially, has since been added, and Wasson can take some credit for that, as well. In his junior year, he helped develop and lead a fall semester retreat, believing the scholars — of different ages and in different majors — weren't getting to know each other well enough. He also saw a need for juniors and seniors to reassure incoming scholars that they had a shoulder to lean on when struggles arose.

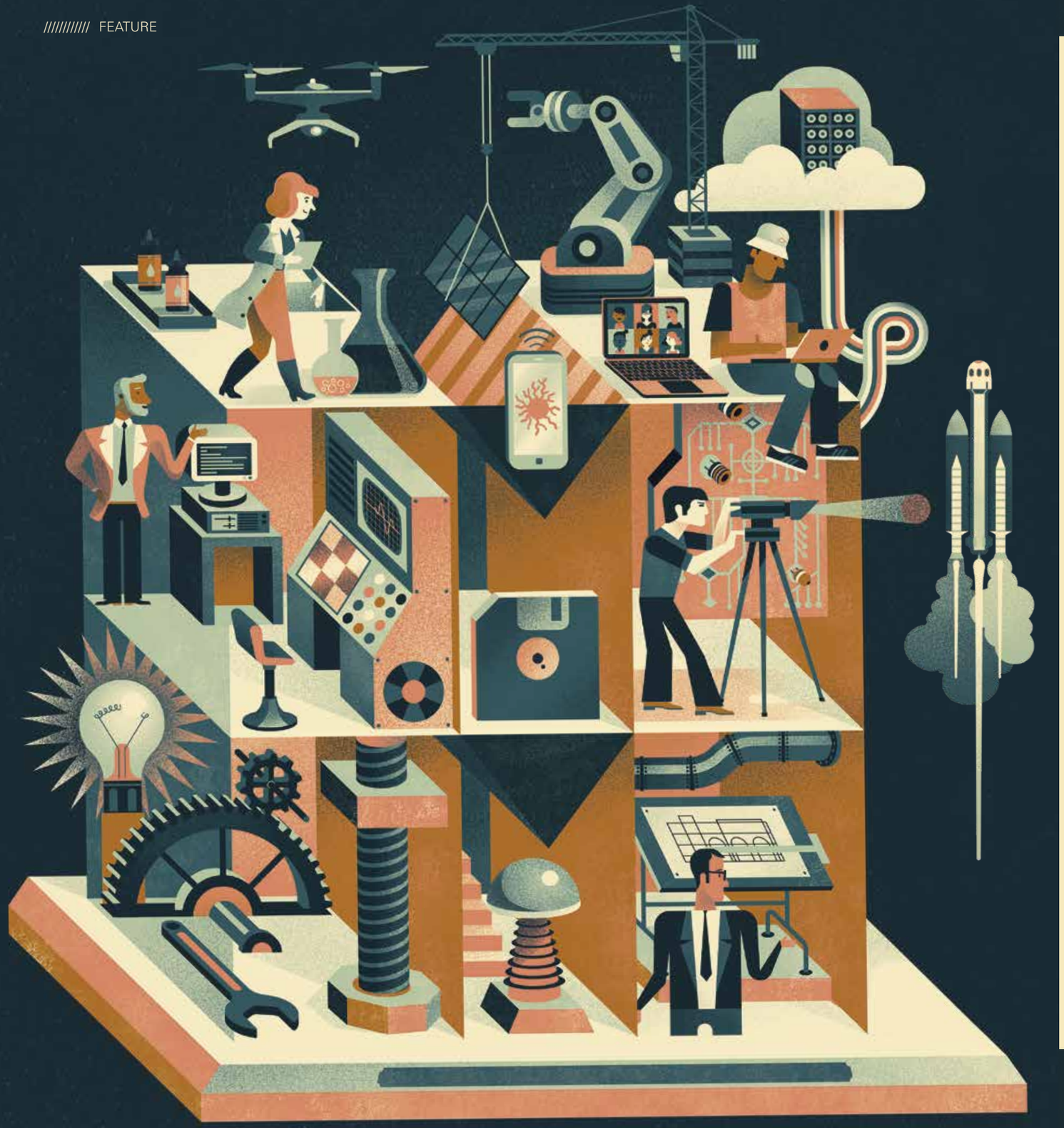
"It's amazing to see people from so many different backgrounds — Black, Latino, Asian, white — as first-generation college students trying to navigate this world that no one in our families knew how to navigate," he says. "Being able to navigate it together and share some of our anxieties and things we hoped for was really uplifting."

Wasson is graduating this spring from the prestigious Center for Bioengineering Innovation and Design master's program at Johns Hopkins University. His graduate studies have him partnering on projects with two ophthalmology enterprises — Eyedea Medical in the States and Aravind Eye Care System in India — to deliver innovative and equitable eye care. He says the program is another opportunity to make a difference that he couldn't pass up.

"Right now, I'm talking to some of the global leaders in ophthalmology including Wilmer Eye Institute, Wills Eye Hospital, the University of Iowa here in the U.S. as well as Aravind, Shroff's Charity Eye Hospital and LV Prasad Eye Institute in India. I have also had the pleasure to listen to some other amazing Hopkins clinicians — people who are reimagining the face of medical care and doing unimaginable heroics to fight this pandemic," Wasson says.

Whether this door leads to a future in biomechanical engineering work focused on eye care is still unknown. His next stop is New York City, where he will work as a consultant analyst for an innovation and transformation consulting firm after graduation.

"If you would have told me I'd be here, I would have told you, you were crazy," Wasson says. "But the Scholars Program gave me a pod of people who had those same hopes as I did for myself, this hope that you can achieve something more with your life than what you thought or what the world around you told you was possible."



# THE TEST OF TIME

**As the Opus College co-op program celebrates 100 years, it builds upon its purpose and strengths to evolve in an ever-changing world.**

BY ANN CHRISTENSON, CJPA '91

When Melissa Thill, Eng '13, Grad '18, presented the industry partner keynote address for Marquette's 100th Year Co-op Celebration in early 2020, she elaborated on the growth mindset that fosters lifelong learning she discovered during her co-op with the research and technologies team at Illinois-based Fenwal Inc. from 2010 to 2012. After graduation, Thill was hired by Fenwal and spent seven years with the company, which was acquired by Fresenius Kabi in 2012.

"Throughout my time at Fenwal, I utilized my physiology knowledge from my co-op experience combined with my Marquette education to provide a balanced and unique perspective to the design of automated blood-separation technologies," Thill said in a recent interview.

As a supervisor to Marquette co-op students during her tenure at Fenwal, Thill encouraged the co-op engineers to seek out tasks unfamiliar to them and take on challenging opportunities. In her keynote address, Thill, who now works for Abbott Laboratories, eloquently described her role as threefold: "to stand in front of (the co-ops), leading by example; to stand by their side, as we work as a team to accomplish a common goal; and stand behind them, when they need additional support. My goal is to help them discover their likes and dislikes, cultivate their strengths, provide constructive critiques, applaud their achievements, and inspire them to see the cathedral, even when they are hauling stones."

**The early years**

The world has experienced seismic changes since the Marquette co-op program's inception in 1919, and the program has evolved with the times. Mandatory for all engineering students when it was created, the co-op program became optional in 1946, when many returning World War II veterans enrolled in college on the GI Bill. Early employers to join the program included the City of Milwaukee, A.O. Smith, Eaton (previously named Cutler-Hammer) and the Wisconsin Department of Transportation (then known as the Wisconsin State Highway Commission).

From 2016 to 2019, more than 275 companies across 25 states participated in the co-op program. And Marquette continues to add new companies every year. Of the 48 percent of engineering students who choose to do a co-op, some 50 percent of them receive an offer for a full-time position from their co-op company and around half of those students accept the offer. Many co-op alums — such as Jim McShane, Eng '68, owner of the McShane Companies — have gone on to found their own companies and continue to stay connected to the university by hiring Marquette co-ops.

"The co-op program was a very important experience for me because I wasn't sure what area of civil engineering I was most interested in, until I started my co-op job. I was able to eliminate several areas and focus on structural design, which eventually led me to start a construction company," McShane says. "In turn, we have had good experiences hiring co-ops. It's good for them to experience construction, to see if this works for them, and it is good for us to see if they are a good fit for us after they graduate. Several of the Marquette engineers who started with us as co-ops are now key executives here."

Over the course of its 100 years, the Marquette co-op program continues to adapt to meet the changes of our always-shifting world. In 2008, in the midst of the Great Recession, Marquette cast its net and brought in more industry partners when some hard-hit ones weren't able to follow through on their commitments to co-op students. Dr. Mark Federle, associate dean of academic affairs and professor of civil, construction and environmental engineering, stepped in to help bring in a company whose relationship with Marquette would only deepen. When then-construction engineering student Mike Stern's original co-op fell through, Federle connected him with Milwaukee's J.H. Findorff & Son Inc., which is where Stern, Eng '10, eventually completed his co-op experience and now works. Findorff went on to build The Commons, Marquette's $108 million, state-of-the-art residence hall, in 2018, with Stern as the project manager.

**COVID-19 co-op challenges**

Alumna Thill describes the co-op program as focused on "exploration." As the world has become more global, co-op students are connecting across cultures. While companies temporarily aren't able to have students participate in co-ops abroad due to pandemic travel restrictions, students are able to join the daily business calls with their co-op industry partners in other countries. GE Healthcare is one such example, where budding engineers are able to hone their communication skills in early-morning phone calls to India, where GE has an office.

Construction engineering major Teddy Martin finished up his co-op at Atlanta-based ARCO Design/Build in summer 2020, amid the coronavirus pandemic. In his first term, he worked as a project manager co-op, a position that enabled him to be actively involved in the team. He participated in tasks such as writing contracts, getting bids and writing weekly reports. By his fourth term, Martin was working "out in the field." With COVID-19 safety protocols in place, he was still able to interact with the supervisors and work actively on job sites, he says. Of most value was "just getting the chance to interact with people in the field and learn about their experiences," Martin says. "Each term, I saw a different perspective, from the front end of estimating, the design, the building of the design, then seeing the finished building."

> **"It's good for them to experience construction, to see if this works for them, and it is good for us to see if they are a good fit for us after they graduate. Several of the Marquette engineers who started with us as co-ops are now key executives here.**
>
> —Jim McShane, Eng '68, owner of McShane Companies

The many challenges of COVID-19 notwithstanding, co-op students are learning essential interpersonal skills — the exchange of appropriately worded emails, the logistics of virtual meetings — and that is helping them not only as engineers but as communicators, says Katherine Atkinson, the Opus College's director of industry relations. As the world becomes more digital, co-op students are learning to build intentional relationships, be proactive, and appreciate being in person to learn, work and grow. And Marquette's co-op program is pivoting right along with them.

"Industry, technology and the world of work have evolved over the last 100 years and will continue to do so. For the co-op program to remain relevant and provide a valuable experience for companies and students, we listen carefully to the feedback students, co-op managers and companies share with us to ensure our students are prepared through their technical engineering curriculum and have the essential skills needed to be successful," Atkinson adds. "Many of these skills have stood the test of time and are naturally, yet intentionally, integrated into our engineers' education — problem-solving through discernment, emotional intelligence, responsible and ethical communication, leadership for the common good, and a commitment to justice and equity."

**The Opus College's EMPOWER Lab is building a name for itself with research in sustainable, cost-effective solutions for electric-powered vehicles.**



# SUP

BY CHRIS BARNCARD, COMM '03

## Electric vehicles have a bit of a sustainability problem.

To displace traditional gas- and diesel-guzzling engines on the road to a carbon-free future, vehicle-grade electric motors are designed with powerful magnets made with rare-earth elements.

"Rare-earth materials make higher-grade permanent magnets," says Dr. Ayman EL-Refaie, electrical and computer engineering professor. "The end result is they allow motors to be smaller in size and more efficient."

That's working for plenty of car buyers. Many popular mainstream vehicles are available in a hybrid version, and purely electric vehicles, or EVs, are as popular as ever.

"The most famous example is the Tesla, but GM and Ford and Toyota all are rolling out all-electric vehicles," EL-Refaie says. "But cost is the key driver. If you compare a pure EV car to a comparable conventional one, there is probably at least a $10,000 price difference. That's important, especially when the price of gas is not very high."

The 17 metals classified as rare earths are not actually all that scarce, unlike the uncommon magnetic power and tolerance of high temperatures that made them the materials of choice in early generations of motors in hybrid and electric cars. Their utility has driven sharp growth in other applications — from fishing reels and electric guitars to MRI scanners and wind turbines. The resulting demand has put enough pressure on a market with global political implications (China is the dominant producer) to make replacements an attractive investment.

"There has been a push to try to reduce or eliminate use of these rare-earth materials as much as possible because they're expensive, so that helps reduce the costs," says EL-Refaie, "and also from a sustainability point of view, so that we don't have to keep dealing with political issues and price fluctuations."

The next advance in electric drive development could be a big step for alternatives to automobiles burning fossil fuels. In October, the U.S. Department of Energy awarded $5 million to EL-Refaie, the Thomas H. and Suzanne M. Werner Endowed Chair in Secure and Renewable Energy Systems, to incorporate alternatives to rare-earth magnets into a redesigned car motor. It's one of several Department of Energy-funded projects putting EL-Refaie and his colleagues in Marquette's EMPOWER Lab at the forefront of making electric motors cheaper, smaller and more efficient in cars, trucks and even planes, as well as more useful and convenient through improved charging technology.

The new wheeled-vehicle project aims to update every part of an electric (and hybrid) car's drive and motors, except the batteries, with a mainstream benchmark in its sights.

"The ultimate goal of the project starts from a commercial baseline, and that's the pure electric Chevy Bolt," EL-Refaie says. "Our starting point is the electric drivetrain for the Chevy, and the ultimate deliverable is to develop technologies that GM will help integrate and test in their facilities."

Collaborators at Virginia Tech are working on a new inverter, packing the electronics that convert the direct current electricity of batteries into the alternating current used by the motors.

Another partner, the Department of Energy's own National Renewable Energy Lab (NREL), is doing similar work to replace typically separate cooling systems serving individual components with a single system that should save space and weight by managing the heat for a group of more tightly integrated parts. Cooling is important, as rare-earth magnets can do their thing at over 160 degrees Celsius — much higher than alternatives.

The replacement for rare-earth materials will come from permanent magnets made by Minnesota-based Niron Magnetics from a metal called iron nitride. The iron nitride magnets are high-performers and more affordable, though not yet as strong as rare-earth magnets.

"Iron nitride has many good features, but it won't work simply as a one-to-one replacement for rare-earth permanent magnets," says EL-Refaie, who came to Marquette in 2017 with nearly two decades of electric motor design experience. "That's where we come in, to maximize the benefits of using iron nitride."

In electric motors, permanent magnets serve as rotors, spun by the electromagnetic field created around them by a stator, which is usually made of copper wire wound in an arc around the rotor.

EL-Refaie says, "Higher voltage has a couple of benefits. It improves efficiency and, maybe most importantly, battery charging can happen faster at higher voltage." The higher voltage will require further changes in the motor design, especially in terms of the insulation system and cooling system.

The sky is the limit for the lab's work to reduce the size and weight of electric motors. Or maybe the sky is the goal. The team's newest project involves another multimillion-dollar grant, this one from the Department of Energy's Advanced Research Projects Agency–Energy to improve electric drive systems for airplanes.

Weight is a big deal on a plane. According to EMPOWER Lab member Dr. Nathan Weise, assistant professor of electrical and computer engineering, batteries can't yet match the weight of energy produced by liquid aviation fuel, limiting electric planes to small four-seat models.

"If we put enough batteries on a plane so that we have the power to take off with hundreds of people on board, it'd be too heavy. That's a show-stopper," Weise says. "You need an immense amount of energy, and you need a way to turn that into power, for thrust for the plane, without adding a huge amount of weight or taking up much space."

While researchers elsewhere tackle power storage, Weise and EL-Refaie are working on shaving pounds from the system while increasing the power of the power converters and electric motors. For aeronautic needs, rare-earth magnets are still welcome. But the Marquette engineers can employ methods similar to those in the electric car project — remaking the stator — by doing away with the usual wrapped copper wire altogether in favor of lighter aluminum 3D-printed into new shapes.

"Additive manufacturing can enable innovative cooling and system integration schemes," EL-Refaie says. "With advanced cooling, you can send more current through the windings. And if you can send more current through, you get more power out of them for the same weight."

"Distributed and innovative power electronics is another key technology development area in this demanding project," Weise says. "Distributed power converters enable inherent fault tolerance, crucial in any aviation application."

In addition, tight integration of the electric motor, power electronics and thermal management will be key to meeting the very challenging system requirements.

Collaborators at Florida State University will work on the development of the insulation system, NREL works on developing the thermal management system while Raytheon works on the system integration and verification testing.

The relentless quest for smaller, lighter and integrated comes through even in projects that aren't self-propelled. With Washington-based StorEdgeAI, Weise is working on combining every part of a solar energy system except the solar panels into a portable package.

"Think of a storage container full of batteries and power electronics, minimizing the volume and weight," Weise says.

After a disaster like a tornado or a hurricane, the units could be hauled in on trucks and dropped off, making electric power available and useful in a place — like on the road or in the skies — where it once seemed impractical or even impossible.

"This is where our expertise is," EL-Refaie says. "Now is a moment when that can contribute to quite a few areas to improve sustainability."

# OPUS COLLEGE RESEARCH & INNOVATION

The Opus College of Engineering is transforming engineering education by preparing today's engineers to be creative problem solvers. We invite you to read how our professors and programs are seeking **SOLUTIONS TO OUR WORLD'S GREATEST CHALLENGES,** all the while leading the way for the next generation of Marquette engineers.

## HEALTH & HUMAN PERFORMANCE

**6**
**Total number of individual labs**

under the umbrella of Marquette's Integrative Neural Engineering and Rehabilitation Laboratory (INERL). The INERL, led by Dr. Brian Schmit, Eng '88, professor of biomedical engineering and associate dean for research, is dedicated to advancing knowledge within the field of neural engineering and rehabilitation of people with neural disabilities. Schmit's research focus is on spinal cord injuries and neurorehabilitation for stroke survivors. Recently, he was named the Hammes Family Endowed Chair in Biomedical Engineering, a position supported by a $2 million gift to the Marquette University and Medical College of Wisconsin Department of Biomedical Engineering from Ann and Jon Hammes, a Marquette trustee. The gift is the largest donation received by the joint department in its four-year history.

**DR. ROBERT COOPER**
BIOMEDICAL ENGINEERING

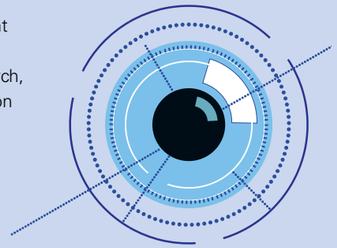
### A NEW VISION FOR EYE CARE

With approximately one in 2,000 people worldwide struggling with inherited retinal degenerative diseases that often lead to significant vision loss or complete blindness, Dr. Robert Cooper, assistant professor of biomedical engineering, is researching new uses of advanced imaging devices to improve clinicians' diagnoses and treatment of such diseases.

Cooper's novel research, funded by the Foundation Fighting Blindness, will assess photoreceptor degenerations at the individual cell level.

Photoreceptors are special cells in the eye's retina responsible for converting light into signals sent to the brain; they help us see color and at night. At the moment, the best tools ophthalmologists have to examine the photoreceptors' function are microperimetry, which requires the patient to react to a dot of light, or an electroretinogram, which uses an electrode on a patient's eye while the device flashes bright lights into it.

"Besides being uncomfortable, both of these have their limitations, which center around their ability to sensitively determine if the photoreceptors are functioning properly," Cooper, Eng '09, Grad '16, says. "My research uses a device called an adaptive optics scanning laser ophthalmoscope to image and examine the function of individual photoreceptors in these patients' eyes, all without electrodes or long exams."



This is a big deal for patients who don't have a lot of photoreceptors left or for those going through clinical trials aimed at restoring the photoreceptors' function, because those older tests simply aren't sensitive enough to tell doctors whether their treatments are working until months later. Cooper's techniques could allow clinicians to determine within weeks whether a treatment is working.

"The goal of my research is to help clinicians and patients have a better understanding of the function of their retinas, so that treatments and cures can be found faster than if they had been using less sensitive techniques," Cooper says. "It's my hope that this will contribute to the restoration of vision for individuals with all kinds of acquired and congenital retinal diseases."

**half**
**the adults in the U.S.**

**"HCMV infection is a significant issue in human health and will continue as such until targeted approaches to control infection are developed."**
—Dr. Ranjan Dash

**There is no vaccine for human cytomegalovirus,** or HCMV, which the Centers for Disease Control and Prevention states infects over half the adults in the U.S. by age 40. Although it does not cause serious problems in healthy children and adults, HCMV can be life-threatening to patients with suppressed immune systems and is the leading viral cause of congenital birth defects. Dr. Ranjan Dash, professor of biomedical engineering, and Dr. Scott Terhune, professor of microbiology and immunology at the Medical College of Wisconsin, received a two-year $423,500 grant from the National Institutes of Health to develop a computer model that simulates thousands of cellular interactions that occur as HCMV infects a human and attempts to multiply and divide. The model could help identify key cell functions that, if targeted with antiviral therapies, could stop HCMV in its tracks. "HCMV infection is a significant issue in human health and will continue as such until targeted approaches to control infection are developed," Dash says. —**Tracy Staedter**

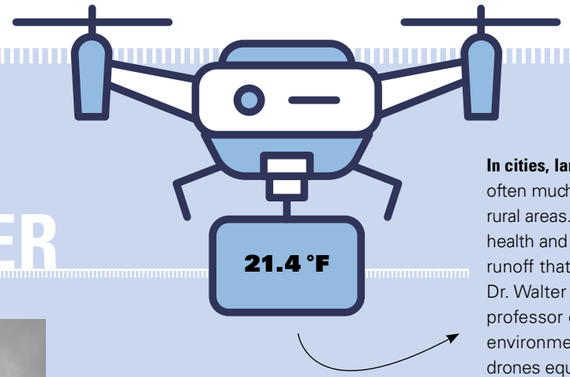
**DR. FRANK PINTAR**
BIOMEDICAL ENGINEERING

### IMPROVING SOLDIER SAFETY

Explosives accounted for more than 75 percent of all military injuries during Operation Enduring Freedom and Operation Iraqi Freedom, operations from which new trends in soldier injuries emerged as improvised explosive device attacks became a primary threat to the U.S. military in the Middle East. Military vehicle design testing needed to adjust to the novel type of warfare in order to improve outcomes for the soldiers injured by the under-body blasts (UBB).

Dr. Frank Pintar, Kern Chair and Professor of the Marquette University and Medical College of Wisconsin Department of Biomedical Engineering, has spent decades researching the biomechanics of brain and spinal cord injuries, and military and motor vehicle crash trauma. He directs the Neuroscience and Biomechanics laboratories located at the Clement J. Zablocki Veterans Affairs Medical Center that include a thrust-acceleration sled and a full-scale vehicle crashworthiness laboratory to investigate mechanisms of injury. It's there where he has been contributing to the building and testing of a virtual and physical human-like dummy that is specific to the military environment. The Warrior Injury Assessment Manikin (WIAMan) includes an advanced array of sensors and data acquisition systems that allow Pintar and his team to fully understand the physical stress a human occupant would experience in a UBB explosion. Lumbar spine fractures and lower leg trauma are common in such UBB events.

"Army researchers previously have had to rely on auto industry crash test dummies for the development and testing of safety countermeasures to under-body blasts in military vehicles," says Pintar, Eng '82, Grad '86. Auto industry crash test dummies were designed to assess human injury in horizontal crash events, whereas the new Army dummy is designed to assess injury in a vertical explosion mode. "With the availability of WIAMan, a device that actually mimics the human body's experience in such a military environment, the Army will be able to improve the technology design of vehicles and personal protective equipment."




# WATER

**DR. PATRICK MCNAMARA**
CIVIL, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

## ADAPTING BACTERIA

Municipal drinking water that flows through rusted metal pipes carries with it a range of human health issues. Although lead poisoning is at the top of the list, Dr. Patrick McNamara, associate professor of civil, construction and environmental engineering, is investigating the presence of antibiotic-resistant bacteria. As the primary researcher on a $420,000 grant from the National Science Foundation, McNamara is studying how metal particles sloughing from rusty pipes, as well as chemicals used to inhibit corrosion, may increase the abundance of these tenacious pathogens.

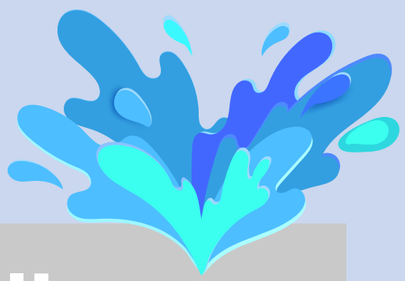
"It turns out that bacteria have developed defenses that work against both metals and antibiotics," says McNamara, Eng '06.

The ability comes from genetic mutations that allow certain bacteria to excrete metal particles that would otherwise kill them. The same adaption also allows them to pump out antibiotics. Of the corrosion inhibitors used to stop pipes from rusting, one of them — zinc phosphate — has a metal base. McNamara thinks that even if it prevents rust, zinc phosphate could still trigger antibiotic resistance in bacteria. Field research and laboratory experiments will bring him closer to an answer.

"These findings can help engineers and municipalities make decisions about which corrosion inhibitors and which pipe materials to use to help mitigate the spread of antibiotic resistance," he says.
—Tracy Staedter

**In cities, land surface temperatures** are often much higher than the surrounding rural areas. The heat threatens human health and can produce hot stormwater runoff that can harm aquatic life. Dr. Walter McDonald, assistant professor of civil, construction and environmental engineering, is using drones equipped with thermal cameras to evaluate the variability of surface temperatures down to a resolution of 5 inches. That's much finer than sensor data collected from satellites and airplanes, which range in resolution from 13 feet to 3,200 feet. The information gleaned can be incorporated into stormwater models used to design more effective infrastructure solutions.

In a recent research study published in *Remote Sensing*, McDonald found that the temperature of urban land surfaces varied up to 21.4 degrees Fahrenheit, depending on surface material, traffic, weather and urban geometry. "We hope that the knowledge that we produce — a better understanding of the urban water cycle — can ultimately be used to advance equitable solutions to water and environmental problems," McDonald says. —Tracy Staedter



## $2.3 Million+

The Water Equipment and Policy (WEP) Industry/University Cooperative Research Center (I/UCRC) has funded more than $2.3 million in research at Marquette over the last 10 years. The National Science Foundation I/UCRC program was initiated by Congress in 1973 to fund promising technologies created by university scientists and transfer them from their laboratories to companies and organizations where they can be applied to benefit society and enhance business and the U.S. workforce. In 2010, Marquette University, University of Wisconsin–Milwaukee and six companies formed the WEP I/UCRC, which is the nation's only I/UCRC focused solely on advancing technology and policy in water-related industries. In the research center's latest round of funding, Marquette engineering faculty received more than $200,000 to advance projects.

# TRANSPORTATION & INFRASTRUCTURE

**DR. JOSEPH SCHIMMELS**
MECHANICAL ENGINEERING

## CUSTOMIZED ROBOTIC FLEXIBILITY

Building on his decades-long research ambition to design robots to manipulate objects as adeptly as humans do, Dr. Joseph Schimmels is embarking on a new project to develop customized passive compliance capabilities in multi-robot systems to achieve a dexterity level far beyond what is possible in robots today.

Robots are better than people at executing prescribed motions in free space but are not nearly as adept at performing tasks in which motion is constrained in some way — tasks such as opening a bottle, closing a container or assembling furniture. In these types of tasks, accuracy in a robot's absolute positioning is not as important as accuracy in its relative positioning. When performing a constrained task, if a conventional position-controlled robot has positioning inaccuracies, positions that conflict with constraints will lead to excessive contact forces and task failure, according to Schimmels, Eng '81, Robert C. Greenheck Chair in Design and Manufacturing.

Schimmels and co-principal investigator Dr. Shuguang Huang, research associate professor of mechanical engineering, have a three-year $750,000 National Robotics Initiative grant through the National Science Foundation to fund this project, which aims to provide a robot system with the human-like ability to continuously adjust its inherent mechanical behavior as a task progresses.

"Our approach to improve dexterity is to first select the appropriate passive compliance for the task and then realize that custom compliance by modifying the real-time adjustable inherent mechanical behavior of a multi-manipulator robot system," Schimmels says. The task-customized compliance will be passively realized with multiple arms or multiple fingers, each having variable-stiffness actuators in each joint — novel types of actuators that Schimmels has designed in prior and ongoing research to enhance robot programmable flexibility.

"Improved robot dexterity through customizable passive compliant behavior will facilitate the use of robot assistants in many areas important to the U.S. economy, including agriculture, construction, health care, nuclear remediation and manufacturing," he says.

## *0.000001 seconds*

**The window of time in which Dr. John Borg,** professor and chair of mechanical engineering, wants to take a picture of the temperature distribution in a heterogeneous material under dynamic loading, such as an impact. When a heterogeneous material — any material composed of different constituents such as concrete fiberglass — is impacted, the different material constituents absorb deformation energy and convert it to heat. The different constituents can quickly come to different temperatures, thus in fiberglass, the glass strands may heat to a different temperature than the bonding resin. Understanding the various pathways in which the energy flows through heterogenous materials is critical in making them stronger during impact events. Borg received a one-year $154,900 grant from the Air Force Office of Scientific Research to support the purchase of a high-speed thermal imaging camera that can take photographs of heat maps while a material is undergoing a dynamic event.

## 2M MILES

**The U.S. maintains about 2 million miles** of natural gas distribution mains and pipelines, 321,000 miles of gas transmission and gathering pipelines, 175,000 miles of hazardous liquid pipelines, and 114 active liquid natural gas plants that are connected to natural gas transmission and distribution systems, according to the National Conference of State Legislatures. Dr. Qindan Huang, an associate professor of civil, construction and environmental engineering who joined the Opus College this fall, has been involved in several projects sponsored by the Department of Transportation's Pipeline and Hazardous Materials Safety Administration's (PHMSA) Pipeline Safety Research Program. PHMSA's mission is "to protect people and the environment from the risks inherent in transportation of hazardous materials by pipeline and other modes of transportation." In 2019, Huang received a three-year $250,000 grant from PHMSA to develop a probabilistic performance evaluation framework of aging pipelines under interactive threats. This project is expected to result in better knowledge of the propagation and quantification of prevailing uncertainties in prediction models for the quantitative risk management of pipelines.

**DR. NATHAN WEISE**
ELECTRICAL AND COMPUTER ENGINEERING

## UP CHARGE

Despite the growing buzz, electric cars remain a novelty, with sales dampened by anxiety over driving range, a lack of charging infrastructure and time spent recharging batteries. Dr. Nathan Weise, assistant professor of electrical and computer engineering, and his team are tackling one of those challenges by building an ultrafast charger designed to pump 1 megawatt of electricity — enough to power 100 homes for an hour — into a car battery in 120 seconds.

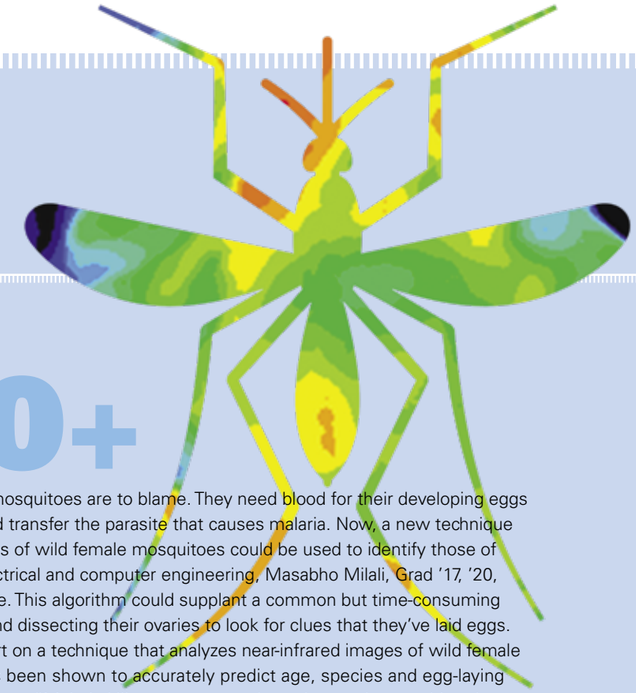
With $632,437 in U.S. Department of Energy funding, the researchers have built a device with semiconductor switches made from silicon carbide, which operates at much higher frequencies than commonly used silicon, resulting in a significantly more compact, lightweight charger and reduced charging times. Weise's team has set its sights on building a charger that boosts and converts electricity from 480 volts AC, common in industrial applications, to 1,000 volts DC at a rate of 1,000 amps. If commercialized, each ultrafast electric-vehicle charger will need to be connected to the grid and extract a whopping 120 megajoules of energy.

**"For me, it's the creativity — coming up with a solution that nobody's thought of before. That's what keeps me motivated."**

Weise says other parts of the EV infrastructure will need to come online for ultrafast charging to be realized. EV filling stations with multiple chargers will need to draw many megawatts of electricity from the grid, pushing the limitations of utilities. And a cable big enough to deliver 1 megawatt of electricity would be so heavy, it might require a robotic arm to assist EV owners.

Weise says he'd like to see a fossil fuel-free future, but that's not the only reason he's working on the charger. "For me, it's the creativity — coming up with a solution that nobody's thought of before. That's what keeps me motivated," he says. —**Tracy Staedter**


**Breast cancer is the second most common cancer among women** in the U.S., according to the Centers for Disease Control and Prevention, and of the millions of women afflicted by it each year, about one-half to two-thirds will undergo breast conserving surgery or lumpectomy. The goal of such surgeries is to remove the tumor while preserving as much normal tissue as possible. Although outcomes have improved over the last decade, women with cancer cells at the surface of the surgical specimen have a twofold increased risk of their cancer reoccurring. Dr. Dong Hye Ye, assistant professor of electrical and computer engineering, Dr. Bing Yu, assistant professor of biomedical engineering and PI, Dr. Taly Gilat-Schmidt, professor of biomedical engineering, and MCW partners Tina Yen, M.D., and Julie Jorns, M.D., have teamed up to develop a deep-UV scanning fluorescence microscope that can be used to accurately and rapidly detect cancer cells on the surface of surgically removed breast tissue. After testing nearly 50 tissue samples, the team has concluded that the method allows either visual or quantitative detection of cancer cells on the surgical specimens, which could lead to reducing the rates of breast cancer patients undergoing secondary surgeries.



# 400,000+

More than 400,000 people die each year from malaria. Female mosquitoes are to blame. They need blood for their developing eggs and, in the process of biting animals and people, can acquire and transfer the parasite that causes malaria. Now, a new technique that uses a machine-learning algorithm to analyze infrared images of wild female mosquitoes could be used to identify those of egg-laying age. Drs. Richard Povinelli, associate professor of electrical and computer engineering, Masabho Milali, Grad '17, '20, and George Corliss, professor emeritus, developed the technique. This algorithm could supplant a common but time-consuming and costly approach that involves trapping female mosquitoes and dissecting their ovaries to look for clues that they've laid eggs. In research published in *PLOS*, Povinelli and his colleagues report on a technique that analyzes near-infrared images of wild female mosquitoes. The quick, non-invasive, chemical-free method has been shown to accurately predict age, species and egg-laying status — called parity — of laboratory-raised and wild mosquitoes. "Malaria kills so many people each year that anything that can help eliminate it is very good," says Povinelli, Grad '99. —**Tracy Staedter**

**DR. CRIS ABABEI**
ELECTRICAL AND COMPUTER ENGINEERING

## UNDERGRAD RESEARCH PROSPECTS

To offer more research opportunities for undergraduates, the Electrical and Computer Engineering Department is hosting a Summer Research Experience for Undergraduates (REU) Site in summer 2021. This program is funded through an REU award from the National Science Foundation and Air Force Office of Scientific Research.

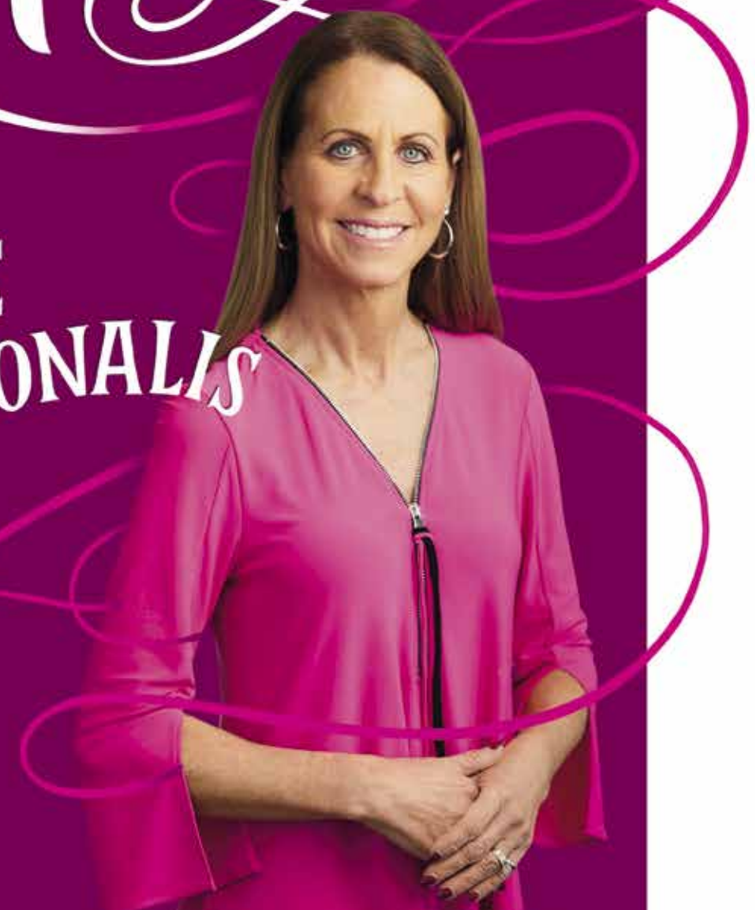
Dr. Cris Ababei, associate professor of electrical and computer engineering, and Dr. Majeed Hayat, chair and professor of electrical and computer engineering, are both investigators of and participating faculty in the research program, which is focused on the theme of interdisciplinary environmental monitoring research. From fireworks air-pollution monitoring to algal bloom processes monitoring to energy forecasting, 10 undergraduates will be recruited locally and nationally from majors in electrical and computer engineering, mechanical engineering, civil, construction and environmental engineering, and computer science. These students will be matched with 12 participating Opus College faculty to work on research projects that involve various aspects of hardware and software development for environment monitoring. While immersing students in research and on-campus experiences, a primary goal of this program is to engage them in writing research publications as primary co-authors when projects are complete. Students, who will work 40 hours a week for 10 weeks, receive a weekly stipend and university housing.

**"The research of this REU Site project is centered on a holistic approach for water- and air-quality monitoring, with the larger goal of developing solutions to address pollution issues."**

"The research of this REU Site project is centered on a holistic approach for water- and air-quality monitoring, with the larger goal of developing solutions to address pollution issues," Ababei says. "That longer-term goal aligns well with the idea of preserving a better planet for future generations."

# Ignatian Inspired

## GRIT, RESILIENCE & CURA PERSONALIS



**Opus Dean Kris Ropella leads the college with Ignatian values as her guide.**

BY LEXI (LOZINAK) SCHLINDWEIN, COMM '13, GRAD '20

Where others may shy away, Dr. Kristina Ropella has always been ready to lean in. Celebrating 30 years at Marquette in 2020, she's gone from one of few women in the classroom to setting the agenda for change as Opus Dean of the very college where she was once a student. Her journey came with its fair number of challenges and obstacles. But more importantly, it came with a great deal of grit, resilience and care for others — making her one of the most beloved deans and professors at Marquette.

**What got you interested in engineering?**
Growing up, I wanted to be everything from an airline stewardess to a ballerina. As I began thinking about college, I knew I enjoyed math and science, but the traditional majors in those areas didn't quite grab my attention. It was not until my mom brought home a brochure on biomedical engineering at Marquette that I finally found the confluence of all my interests.

**Who were some of your greatest influences growing up?**
I've been fortunate to have had many throughout my life, both professionally and personally. But I have to really credit my father and mother. They were emigrants from Hungary and had a strong focus on hard work and education. I appreciated how they came from nothing and were able to provide for me and my siblings. As a scientist himself, my dad nurtured my love for STEM, while my mom ensured that I still knew the importance of English, spelling and grammar.

**Over the past 30 years, what's the most significant change you've seen as an engineering educator?**
Engineering education has become more applied. Theory is just the foundation. Over the years we have developed more ways for students to apply what they're learning in the classroom in a more exciting, challenging way. Our research, co-op and internship experiences help students prepare for that next step into life after college.

**As a woman, what changes have you seen in this male-dominated field?**
For women and people from other underrepresented backgrounds, the field is diversifying. Engineering at its core is solving problems — problems that impact people from all walks of life. We still have a way to go, but we are beginning to change the face of engineering, to welcome people from all backgrounds into such a rewarding profession.

In the early days of my career, it was really tough. I watched many of my female counterparts drop out of school or leave careers early. We did not have the kinds of family-oriented workplace cultures that we have now. I often felt that I had to hide my pregnancies and family obligations. As a leader, I have learned from this and want families to be celebrated; I want both men and women to have the opportunities to have families and fulfilling careers.

**What is your proudest accomplishment?**
I am proud of having three children (Kathleen Ropella Panagis, Eng '12; Mark Ropella, Eng '16, Law '19, and Dominick Ropella, Eng '18) who are successful, independent adults. Together with my husband, Paul (Eng '86), they are our greatest joy. While all engineers, it is exciting to watch them grow and each choose different paths that fit their unique personalities, talents and gifts.

**When you look back in another 30 years, what do you want your Marquette legacy to be?**
I hope my legacy is that I helped other people to be successful. Whether it is my faculty, staff, students or others in the Marquette community, I hope I created a culture for them to achieve their dreams and visions.

**How does your faith play a role in how you lead others?**
Jesuits are big on practicing gratitude, and I try to bring that into my work as much as possible. Whether it is appreciating my faculty and staff, or having my students take out their phones and text someone they are grateful for, I believe we should practice gratitude daily. The biggest piece, though, is that we are called to love others. We love God through our love of others. For me, that is through the way I teach, the way I make decisions and the way I interact with others. Sometimes that can be a tough love!

**Your job as dean comes with many different responsibilities. Which is your favorite?**
Teaching and the education of students is the central piece of our mission and why I went into academia. When I became dean, I insisted that I still teach at least one course. I love helping students through their challenges and watching that light bulb go off. It gives me purpose for the other parts of my day, and it is an honor to be a small part of their lives in that way.

**You've experienced Marquette through so many different lenses: student, alumna, parent, professor, administrator. What makes Marquette different?**
It's the people. Marquette is really good at people development and considering the whole person — *cura personalis*. We develop people who have the courage to speak up, try something different, and create positive change in our world. Our alumni go on to serve in a variety of bold ways, but they always remember where they came from. Our students see that. Our prospective students see that. The relationships that I and so many other Marquette community members have forged are truly lifelong. You can't find that everywhere.

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