EXEMPLAR

WAYNE STATE
College of Engineering

FALL 2019

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College of Engineering

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FALL 2019

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GREETINGS FROM **THE DEAN**

Dear alumni and friends,

Innovators are opportunists. They use their expertise, persistence and ingenuity to find new, and often complex, solutions that not only create a better world, but fill gaps in the market and in the realm of science and technology. We are fortunate to have many innovators here in the Wayne State University College of Engineering, and I'm pleased to showcase their efforts in this edition of *Exemplar*.

The driving force behind growth in our rapidly-changing world is innovation. In the College of Engineering, we nurture an environment where students, faculty and alumni not only pursue engineering excellence, but also cultivate novel ideas with relevant quality-of-life implications.

Some of these endeavors contribute to the economic renewal of Detroit and Southeast Michigan. Many are interdisciplinary collaborations covering a wide range of applications and engineering domains. And while not all of our innovations are created in the spirit of entrepreneurship, they are all derived from the college's core mission to make the world safer, greener, healthier — or more simply put, better.

In 2014, a monumental $25 million gift led to the establishment of the James and Patricia Anderson Engineering Ventures Institute. This afforded our engineers even more pathways to push their projects beyond the classroom or lab to potential new enterprises with social and economic impact. The Anderson Institute has played a key role in establishing numerous successful startups —including a select few that have been presented to potential investors in Silicon Valley over the last two years — and supporting hundreds of participants in the annual Student Innovation and Design Day events.

The innovative atmosphere in the College of Engineering is a key factor in why students choose Wayne State for their education, why our faculty are renowned leaders in research, and why business leaders want to partner with us. Undergraduate enrollment continues to grow at a record pace, and our graduate student population is 33 percent higher than when I began my deanship in 2011. Research activity is at its highest level in three years, and initiatives such as the Corporate Partners Program and the Industry Mentor Program are helping us strengthen our curriculum and established direct channels to connect students and faculty with industrial influencers.

Please enjoy this issue of *Exemplar*, and I look forward to seeing you on our campus soon.

Sincerely,

Farshad Fotouhi
Dean

INNOVATION

A new idea or method,
or the use of new ideas and methods.

Welcome to the special issue of *Exemplar* focusing on innovations in the College of Engineering.

Innovation in engineering is a cornerstone of social and commercial developments improving individual quality of life, economic strength and resilience of society. It only takes a moment to think of engineering innovations, coupled with the drive for design excellence and new venture creation, to see the impact — from the telegraph to the smart phone; from steel mills to composite materials; from the stethoscope to Magneto-Resonance Imaging (MRI) and Computer-Aided Tomography (CAT) scans; from the astrolabe to the Global Positioning System (GPS); from the postal service to the internet and social media.

Engineering innovation is transformative, and the Wayne State University College of Engineering is devoted to promoting innovations, innovation training and dissemination into society. Engineering innovation walks hand-in-hand with new venture creation — whether the new venture is a commercial company, a social initiative, a new division or a new product line within a mainstream company. Our innovation initiatives "walk on two legs" — engineering creativity with practical and relevant applications, and developing channels to enter into the marketplace of ideas and make a difference.

In this issue we will highlight some of the current initiatives within the College of Engineering and promising engineering innovations created by students, faculty and staff. We review the impact and evolution of the James and Patricia Anderson Engineering Ventures Institute, a variety of promising student and faculty engineering innovations, new partnerships and sponsored projects promoting engineering innovation, community engagement initiatives and updates on alumni engineering innovators.

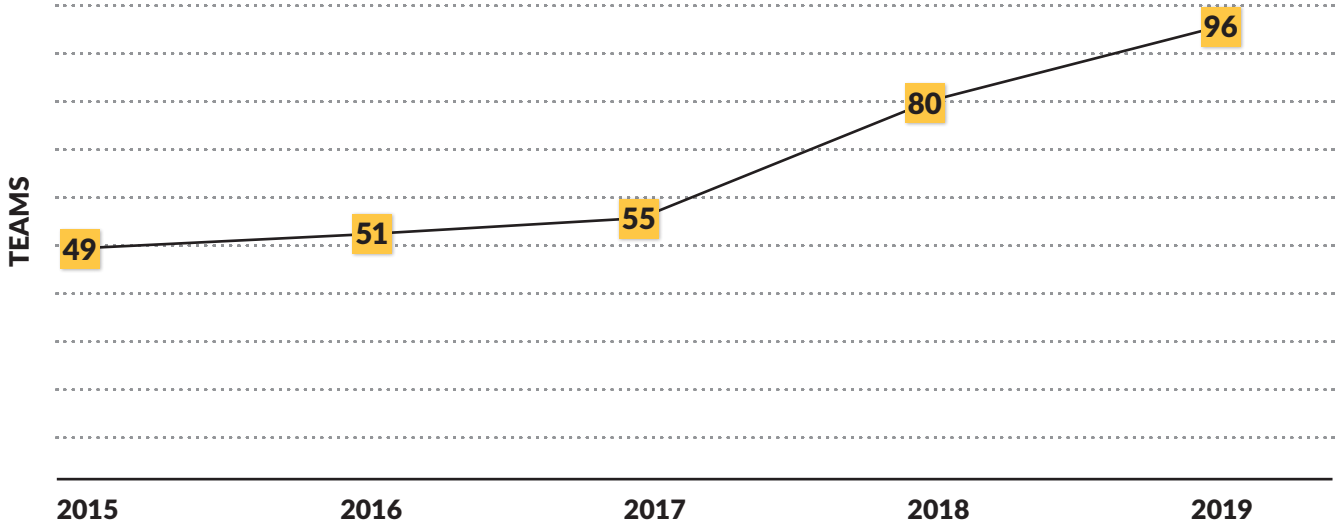
SORIN DRAGHICI
Associate Dean for Innovation and Entrepreneurship
Professor, Computer Science

GARY WITUS
Associate Director for Student Programs
Associate Professor, Industrial and Systems Engineering

James and Patricia Anderson
ENGINEERING VENTURES
Institute
College of Engineering

Founded in 2014 with
$25 million gift

STUDENT INNOVATION AND DESIGN DAY



Since 2017

Startups/projects funded
13

Total funding distributed
$688,500

MORE THAN 750 STUDENTS HAVE PARTICIPATED IN FIVE YEARS

SINCE 2014 | COLLEGE OF ENGINEERING

New IDFS
100

Patents issued
81

40

MOVING FROM R&D TO I&E:

A look at three success stories of Wayne State's entrepreneurial ecosystem

The Anderson Institute plays an important role in a comprehensive effort throughout the university and the Midwest region to coordinate and enhance opportunities for students, faculty and alumni to reap the benefits of entrepreneurship education, technology commercialization and community partnerships. These three startups offer a sampling of the College of Engineering's success in its ongoing mission to help people translate research and development into innovation and entrepreneurship.

Enbiologics is a health and wellness company that aims to create healthy, affordable and effective products to promote better care for both animals and humans. The company was founded in 2016 based on burn and wound care technology that Wayne State biomedical engineering alumni Sean Carroll and Ramy Habib have been working on since they were part of a class doing clinical observation work at Detroit Medical Center.

Their original product was a honey-based topical substance that was easier to apply and offered superior moisturizing, scar reduction and antibacterial properties. While in the DTX Launch program at TechTown, Carroll and Habib pivoted to address burn and wound care in animals because of high preliminary costs in the human care market as well as the lack of animal care products by comparison to their human counterparts.

In 2017, HoneyCure launched on the market and was targeted for horse owners and Equestrian practitioners. Today the company sells its product in 12 states and Canada, tripling its growth in 2019 over the previous year. Along the way, Carroll and Habib have been immersed in the region's entrepreneurial network. They have enjoyed success in various pitch competitions including the Wayne State Warrior Fund and the Quicken Loans Detroit Demo Day, and received funding from the Anderson Institute, the Michigan Economic Development Corporation and other sources.

EnBiologics completed a clinical trial that will be published this year and is expanding its business by adding veterinary professional sales efforts, moving into new offices and forming additional partnerships.

"As devoted Detroit residents, we've worked hard to bring a healthy product to pets everywhere while building a Detroit-based business that will have a lasting impact in the community," said Carroll.

www.enbiologics.com

Energy Emissions Intelligence (E2I) is a technology startup that provides institutions, governments and corporations with the ability to quickly reduce carbon emission profiles by as much as 30 percent without investing in costly equipment upgrades or renewable energy systems.

E2i is commercializing the Locational Marginal Emissions Methodology (LEEM) technology developed at Wayne State University. This technology forecasts the carbon-intensity of grid-electricity for specific locations at specific times. With LEEM data, energy managers and systems can easily reduce carbon emissions by reducing and shifting electricity loads away from high emissions periods.

Roughly 30 percent of carbon emissions in the U.S. come from generating electricity from fossil fuels. For many utilities, carbon reduction options are limited to buying higher-efficiency pumps or installing solar/wind power, all of which are effective solutions but often cost prohibitive.

"If a utility has semi-flexible loads such as filter washing, pumping and storage, it's likely that the operators will be able to take in LEEM's day-ahead emissions data and adjust pumping schedules to immediately lower carbon emissions — all without reducing or disrupting service, upgrading equipment, re-engineering flows or investing capital," said Carol Miller, professor of civil and environmental engineering at Wayne State.

Miller co-founded E2i in 2016 with business development strategist Loch McCabe and electrical grid technology specialist Stephen Miller. E2i has received funding from numerous sources, including the Great Lakes Protection Fund, the National Science Foundation, the American Water Works Association and the Anderson Institute. The company expects to be profitable by 2021 and is eager to connect with more utilities and other entities looking to reduce their carbon footprint.

www.e2intel.com

"Art For Everyone" is the mission of **Palacio**, a California-based startup that produces Canvia, a smart frame that displays art from an expansive collection and gives customers control to explore and select pieces best suited to their taste and environment.

Canvia's patent-pending ArtSense technology adapts a digital display to conserve artistic details and create a realistic print effect, making it difficult to differentiate Canvia from real wall-hanging art.

"Canvia uses the confluence of innovative technologies, device features and curated content to redefine art as an experience," said Rahul Ranjan, co-founder of Palacio.

The fully-searchable collection offers a range of genres and eras of art, including photography. Customers can interact with the collection using the company's app or website and explore unique options such as caption overlays that provide more information about the artworks and artists.

Ranjan, who holds a master's in computer engineering from Wayne State University, has over 16 years of experience in connected devices with companies such as Intel, Qualcomm and TP-LINK. He partnered with Shailesh Kumar, an expert in video and image processing, and Tom Stimson, a specialist in technical media project management, in 2017 to form Palacio, combining Ranjan's vast technical knowledge with a childhood passion for art.

The company generated over $400,000 through pre-sales of Canvia devices and content subscriptions, and has established partnerships with more than 500 artists, building a library of 11,000 pieces of art. Palacio has completed initial customer installations of Canvia devices, and expects to quickly establish retail channels to significantly increase sales to individual consumers as well as hotels, hospitals and other enterprises. ▪

www.canvia.art

FIFTH ANNUAL DESIGN DAY

spotlights record number of engineering student innovations

Nearly 100 projects created by more than 250 students in the Wayne State University College of Engineering were on display at the fifth annual Student Innovation and Design Day, sponsored by the James and Patricia Anderson Engineering Ventures Institute.

"This year's Design Day was the most successful such event so far," said Sorin Draghici, professor of computer science and director of the Anderson Institute. "It truly showcased both the knowledge and the capabilities of our students."

Design Day projects cover a wide range of applications and engineering disciplines, and demonstrate students' solutions to engineering challenges as well as commercial and social needs. The event offers up to $1,000 in cash prizes to the best projects, and reflects the mission of the Anderson Institute to foster entrepreneurism through investment in marketable technologies.

"Project topics ranged from methods to improve upon industrial processes, to an autonomous vehicle that can track and catch falling objects, to a foldable wheelchair that can adjust its height electronically, to a device for towing aircraft," said Draghici. "Many of these new ideas will be pursued by their teams on a commercialization path with the help of the Anderson Institute."

Two teams tied for first-place honors. Biomedical engineering student Jean-Yves Azar presented a new biomaterial filler for nerve gaps that could lead to functional recovery of nerves severed due to injury.

"Two years ago, I heard about ongoing research in biomaterials from my professor (Harini Sundararaghavan), and I soon after joined her research project. As a chemical engineering student starting in a biomedical engineering lab, I brought a unique perspective and a diverse skillset," said Azar. "I discovered that participating in undergraduate research helped to cultivate my engineering skills using principals of design and experimentation."

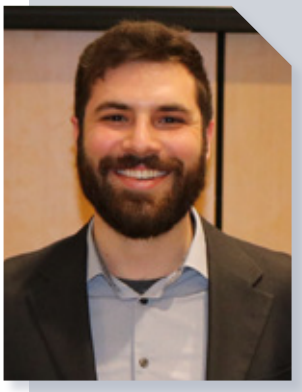
The other top project was submitted by chemical engineering student Laura Paz Herrera, who proposed a study on new design methods for producing 3-D catalytic environments to minimize use of non-renewable precious metals while increasing atomic activity and improving nanoparticle stability.

Second place was awarded to Gui Chen and Marcella Gatti, who presented titanium nitride nanotube electrodes intended to provide improved biocompatibility and reduced tissue damage when implanted as a neural probe. The team of Ahmad Allan, Hanady Bazzi and Omar Alali received third place for their autonomous robotic car capable of recognizing lanes, stop signs and traffic lights. Both teams represented the Department of Electrical and Computer Engineering.

These and other promising projects were selected for a pitch competition during the Design Day event. Students were invited to give an oral presentation for a panel of judges comprised of successful entrepreneurs, venture capitalists, senior managers from various companies, and Wayne State faculty including Draghici and Gary Witus, associate professor of industrial and systems engineering and associate director for student programs. Presenters were graded on technical quality, commercialization potential, and overall presentation quality.

"Design Day was an amazing opportunity to showcase my undergraduate research to my peers and mentors," said Azar. "I am proud of our accomplishments and I am thankful to the Anderson Institute for their sponsorship of Design Day and promoting innovation among Wayne State student engineers."

SUMMARY OF TOP PROJECTS



First place (tie)

Jean-Yves Azar

Harini Sundararaghavan, *Advisor*

Characterization of Electroactive Nanofibers for Nerve Regeneration
Development of a nerve gap conduit to promote functional recovery of severed nerves.

First place (tie)

Laura Paz Herrera

Eranda Nikolla, *Advisor*

Design of 3-dimensional Active Sites for Selective Catalysis
Modification of the 3-D environment of catalytic surfaces to maximize atom efficiency and stability while minimizing use of precious metals

Second place

Marcella Gatti, Gui Chen

Mark Cheng, *Advisor*

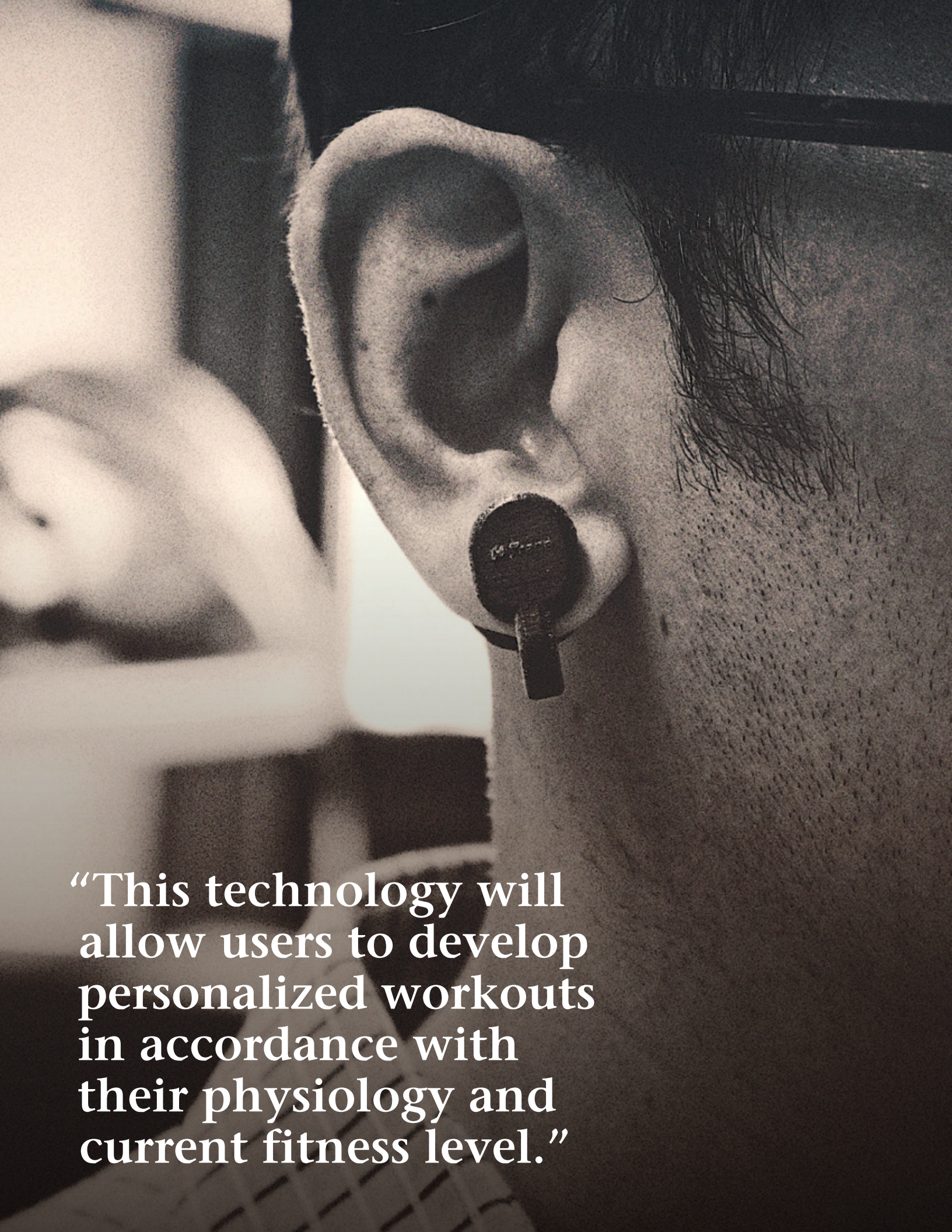
Titanium Nitride Nanotube Electrode
A corrosion-resistant implantable nanotube electrode that works as a neural probe and offers improved biocompatibility, reduced tissue damage, reduced cost and increased usability.

Third place

Ahmad Allan **Hanady Bazzi** **Omar Alali**

Yang Zhao, *Advisor*

Autonomous RC Vehicle — a Machine Vision Demonstration
A robotic car with hardwire control, lane detection and path planning capabilities



"This technology will allow users to develop personalized workouts in accordance with their physiology and current fitness level."

TRACE offers HIIT athletes

COMFORTABLE AND ACCURATE HEART RATE MONITORING

Many elite athletes, particularly cyclists and triathletes, incorporate high-intensity interval training (HIIT) into their fitness strategy because of its proven effectiveness to boost anaerobic endurance and weight loss at significantly faster rates. To perform HIIT workouts optimally, athletes rely on wearable heart rate monitors (HRMs) to ensure they are within the targeted heart rate zone at each interval.

Most HRMs on the market are either wristwatches or chest straps. However, the prevailing opinion among many athletes is that watches produce erroneous data and chest straps, while more accurate, are uncomfortable to wear.

Amar Basu, associate professor of electrical and computer engineering, has been researching wearable health technologies for nearly a decade. Basu is developing a product called TRACE, an advanced HRM that mounts to a person's earlobe.

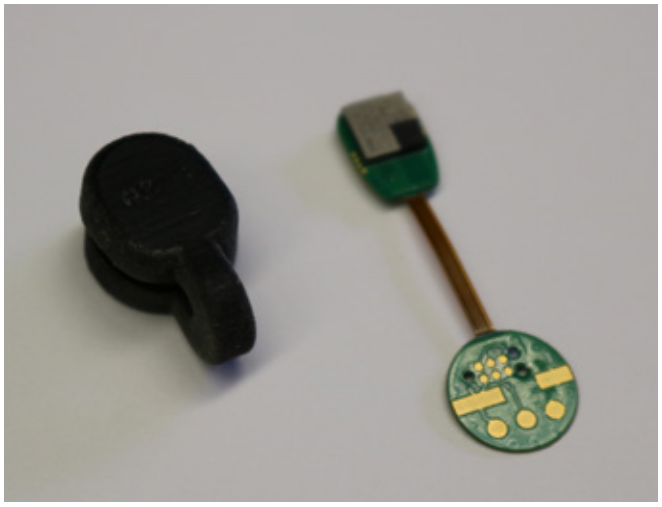
According to Basu, the limitations associated with common HRMs, particularly wrist-worn devices, are caused by motion artifacts that interfere with data interpretation. Blood flow is less predictable in the wrist, while the earlobe provides a much more stable physiological location for a monitor.

"Today's monitors can give you pseudo-continuous heart rate, but most can't give you advanced fitness metrics like adaptation and recovery rates," said Basu, who also holds a joint position in the Department of Biomedical Engineering. "Heart rate recovery is a key indicator of fatigue, and one of several pieces of data athletes need to ensure they are in the right zone for the right time during HIIT workouts."

The centerpiece product of Basu's startup, TRACE is backed by patented optical proximity sensing technology that was issued in 2019 and has been cited by such market leaders as Fitbit and Samsung. The device is small, comfortable, highly accurate and safe in that it does not obstruct one's ear canal to impede hearing.

TRACE also offers intelligent coaching feedback through a mobile app, developed with assistance from Wayne State computer science students.

"This technology will allow users to develop personalized workouts in accordance with their physiology and current fitness level," said Basu.



Future versions of the device are expected to be able to monitor activity and pulse oximetry, which Basu believes will be key differentiators in the $17 billion global fitness market and allow the business to grow into other spaces within health care and wellness.

Basu, a fitness enthusiast who published his first paper on wearable sensors in 2010, has received funding from the Michigan Translational Research and Commercialization (MTRAC) program and patent application support from WSU Technology Commercialization in the Division of Research. ■

Wayne State spinoff

ADVAITA SUCCESSFULLY COMPETING WITH GLOBAL COMPANIES

in biomedical software industry

Advaita Bioinformatics, an Ann Arbor-based company spun out of Wayne State University in 2005, is making waves in the precision medicine and biomedical data interpretation space, emerging ahead of some well-established competitors as the preferred provider of pathway analysis software for numerous domestic and international clients.

Founded by Sorin Draghici, professor of computer science at Wayne State, Advaita provides a collection of advanced software for variant and pathway analysis as well as disease subtype discovery. The company has developed products that are used by several pharmaceutical and biotechnology companies. It recently unseated Qiagen as the favored technology of Millennium Science, a major Australian distributor of biotechnology.

"In summary, it's a David vs. Goliath story," said Draghici, who also serves as associate dean for innovation and entrepreneurship and directs the Anderson Engineering Ventures Institute. "Qiagen is a $1.5 billion multi-national corporation that has all the resources in the world to buy whatever technology and people they want, yet we manage to provide a better product."

Advaita's technology is also used by a large number of universities, including Stanford, Harvard, Ohio State, Michigan, Washington, Tennessee, Delaware, Maryland, Utah, Indiana, UC San Diego and the University of Chicago.

The core of Advaita's product offerings are iPathwayGuide, a tool for functional interpretation of genes and proteins; iVariantGuide, a genetic variant analysis platform; and iBioGuide, a search engine revealing connections between genes, pathways, drugs and more.

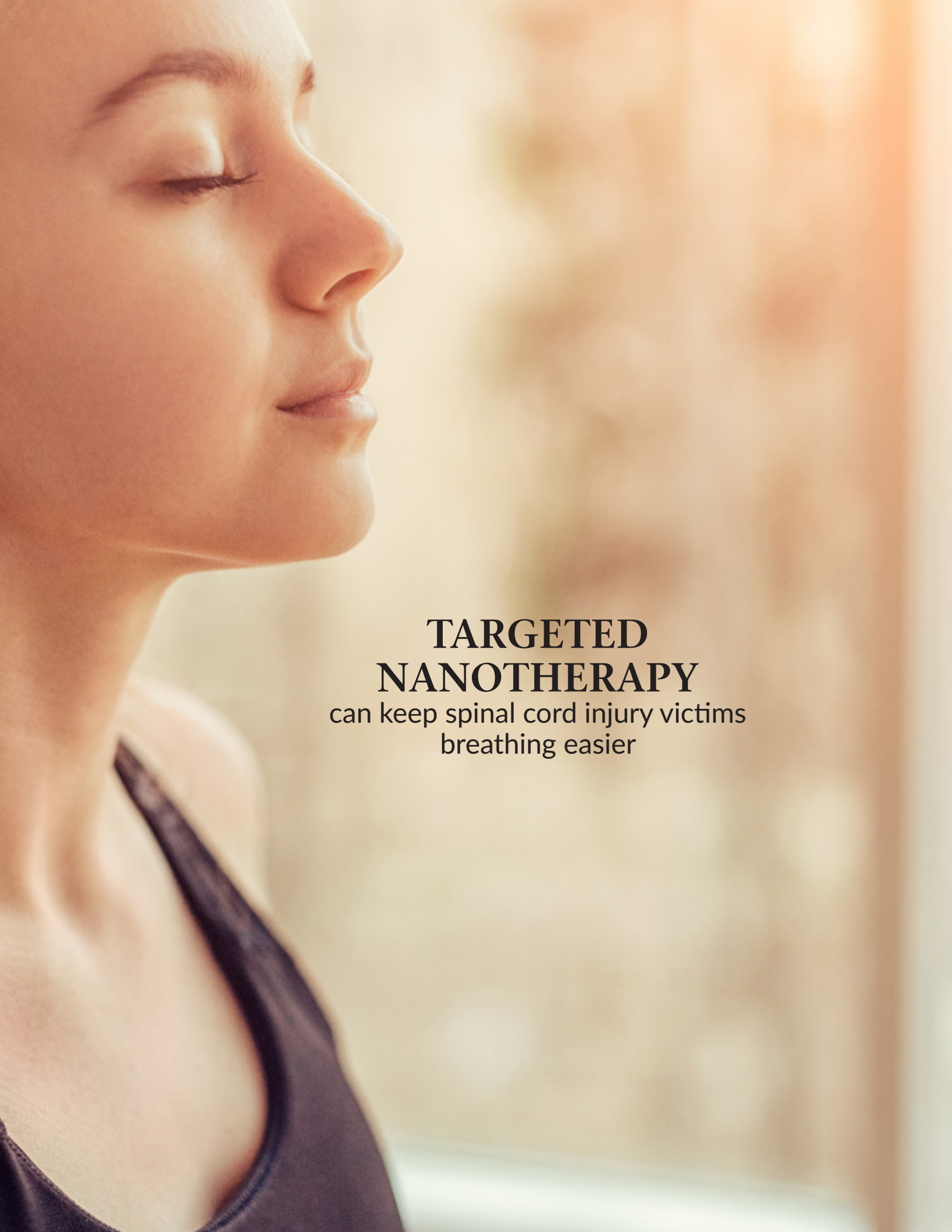
Draghici and his colleagues received a second patent in April for a computational method that detects and reduces pathway crosstalk. Pathways describe cellular-level interactions of genes and proteins. Data analysts typically calculate a pathway's probability value, or p-value, to quantify its significance to a particular medical condition, and these p-values can influence each other — a phenomenon known as crosstalk — to create false positives.

While traditional analysis methods examine unordered gene sets, iPathwayGuide builds a complex model to capture key genetic roles, signals and interactions of the genes involved. iBioGuide indexes information from the Advaita Knowledge Base as well as the internet to create a one-stop shop for researchers in this field.

In July, a third patent was issued to Advaita for a method to develop a diagnostic test based on reading the response of the immune system of a patient. The company also has three provisional patents for other emergent bioinformatics tools, including a means to differentiate disease subtypes and aggression levels, an innovation featured in the 2018 edition of *Exemplar*. Such predictive analysis methods are promising for clinicians and patients who might not otherwise use a necessary treatment, or who might wish to avoid unnecessary treatments.

Advaita's technology is a spinoff from Draghici's research at Wayne State and has been supported by more than $4.5 million in grants from the National Institutes of Health, the National Science Foundation and other agencies.

Draghici is currently entertaining requests from potential partners in Japan, South Korea, Africa and Europe that are interested in distributing Advaita's products in those parts of the world.



TARGETED NANOTHERAPY

can keep spinal cord injury victims breathing easier

A new method of treatment developed at Wayne State University that may aid spinal cord injury (SCI) victims in respiratory recovery received funding from the Innovation Grants to Nurture Initial Translational Efforts (IGNITE) program, sponsored by the National Institute of Neurological Disorders and Stroke (NINDS), a division of the U.S. National Institutes of Health (NIH). The R61 phase funding of the R61/R33 IGNITE grant application is $683,913.

The 250,000 to 500,000 people each year around the world that suffer an SCI are two to five times more likely to die prematurely. The leading cause is infection of the weakened respiratory system. Not only is there no cure, but the methylxanthines used to treat patients are often too toxic.

Guangzhao Mao, professor and chair of chemical engineering and materials science in the College of Engineering, and Harry Goshgarian, professor of anatomy in the School of Medicine, collaborated to develop a nanoconjugate that delivers drugs selectively to the respiratory neurons to restore breathing function.

"Our objective is to reduce or even completely eliminate the drug toxicity by targeted drug delivery," said Mao.

This method combines the characteristics of adenosine receptor antagonists, retrograde transporter proteins and nanoparticle carriers. Biocompatible and non-toxic gold nanoparticles are used as a platform for a drug-carrying compound that, when injected into the paralyzed diaphragm, is transported by the protein through the central nervous system to the respiratory centers of the brain, where it releases the drug that induces respiratory recovery.

"To the best of our knowledge, our approach is the only one in the world to achieve motor recovery after spinal cord injury using targeted nanotherapeutics," said Mao. "Our innovation could broadly benefit drug delivery to the brain by using intracellular transsynaptic transport to bypass the blood-brain barrier."

Compared to a free drug, a nanoconjugate is advantageous because it can remain longer at the target site in increased concentrations, reducing the number of injections needed as well as the dosage and side effects. Multiple drug loading with a nanoconjugate can also facilitate combination therapy.

The NIH NINDS IGNITE translational neuroscience grant will move this patented technology from the basic research stage to clinical applications. Mao and Goshgarian are working with other spinal cord injury researchers and clinicians to test the nanoconjugate's consistency, bioavailability, safety and efficacy.

A team that includes Drs. Abdulghani Sankari and Samiran Ghosh, associate professors in the School of Medicine, aim in the initial R61 phase over the next two years to formulate a stable solution suitable for in vivo efficacy studies that would occur during the subsequent R33 phase. The team will work closely with the Office of Technology Commercialization through this process.

"I am particularly excited by this collaborative project and the potential for broad impact," said Stephen Lanier, vice president for research at Wayne State University. "It is a great team and a creative funding program from the National Institutes of Health that have aligned to tackle a major health issue."

The ultimate goal is to give hope to people living with SCI, including the more than 17,000 new cases reported in the U.S. each year.

"Imagine a world where we can cure spinal cord injury by permanently restoring breathing function," said Mao.

The grant number for this NIH NINDS IGNITE award is 1R61NS112443-01. ■

“The key innovative feature of this technology is that it improves the poor stability and durability challenge of super-hydrophilic polymer coatings when applied in the water environment.”

Wayne State spinoff Repela Tech awarded two competitive National Science Foundation grants for

MARINE COATING TECHNOLOGY

Repela Tech, LLC, a Detroit-based materials technology startup, was awarded two National Science Foundation grants in 2019, including a $225,000 Small Business Technology Transfer (STTR) grant and a $50,000 I-Corps award for research and development on a patent-pending eco-friendly anti-fouling technology for the marine and shipping industries.

The company was co-founded by Zhiqiang Cao, associate professor of chemical engineering at Wayne State University, and Edward Kim, an entrepreneur and investor who also serves as an advisor for the James and Patricia Anderson Engineering Ventures Institute.

The highly competitive grants awarded reflect a commitment from both Repela and NSF to bring a disruptive innovation to replace toxic anti-fouling coatings — those that are applied to the outer hull of a vessel to slow the growth or facilitate detachment of plants, animals and other organisms — that are currently being delivered to and utilized by the industry.

Unlike fundamental research grants, the NSF STTR program supports startups and small businesses in pushing inventive products or services out of the lab and into the marketplace. Through I-Corps, grantees benefit from a network of established entrepreneurs who understand best practices of customer discovery and how to identify valuable product opportunities.

"We are pleased to partner with NSF to develop and commercialize our anti-fouling coating technology," said Kim. "The goal of the Phase 1 award is to advance our translational research, foster strategic relationships and accelerate the commercialization efforts."

Current marine coating products leach biocides into the water, indiscriminately killing marine life around the vessel. These chemicals, which have been subject to increasing global regulations, can remain active in river and lake beds for many years. Repela is introducing a non-biocide material with equivalent anti-fouling performance as well as other benefits.

"It can deliver a disruptive coating solution that can improve vessel maneuverability, increase fuel efficiency, and address environmental concerns by replacing current toxic coating products," said Cao.

Commonly used anti-corrosion and anti-fouling products contain hydrophobic substances. Hydrophilic materials, known for their high capacity in resisting biofouling, tend to dissolve in water.

"The key innovative feature of this technology is that it improves the poor stability and durability challenge of super-hydrophilic polymer coatings when applied in the water environment," said Cao. "This coating material is effective against biofouling while achieving durability and robustness required in aqueous environments."

Repela has received extensive support from the Wayne State University Technology Commercialization office, which provided incubation funding and mentorship, and the Mike Ilitch School of Business, which delivered business model guidance through its Entrepreneurship and Innovation program. ■


“A recent study reported more than 50,000 Microsoft developers were spending 10 to 15 percent of their time on average in code reviews.”

WSU researcher developing system to bolster

FLOSS PROJECT CODER COMMUNITIES

The viability of open source software (OSS), which is used by an estimated 78 percent of companies to run part or all of their operations, is largely dependent on contributions from volunteers. Coders who spend at least a year on an open-source project are consider long-term contributors, and they play a critical role in OSS projects as managers, reviewers and mentors to newcomers. However, many new coders looking to join a project are hindered by delayed or unfair feedback on their submissions, and as a result fail to become long-term contributors themselves. "Since newcomers often have to wait two to six times longer than a long-term contributor to get reviews for their changes, they often become frustrated and abandon their onboarding efforts," said Amiangshu Bosu, assistant professor of computer science at Wayne State University.

Bosu is developing an automated model called RevRanker to address the issue. He recently received a nearly $175,000 grant from the National Science Foundation to support the project.

RevRanker aims to remove barriers in free/libre open source software (FLOSS) projects which stem from a newcomer's struggle to identify experienced and capable reviewers. Using a mixed research method, Bosu will build a theoretical understanding of useful code reviews, which will be utilized to train and evaluate RevEval, an automated model to predict the usefulness of reviews.

"Using the RevEval model as well as leveraging multiple historical dimensions of the files under review, RevRanker will be developed and evaluated," said Bosu.

FLOSS projects are community-driven enterprises that some in the tech profession believe will surpass proprietary software in popularity. Bosu is hopeful that RevRanker will be a tool to maintain, sustain and grow the community.

"RevRanker will also save time of experienced FLOSS contributors, as even long-term contributors sometimes encounter difficulties to identify appropriate reviewers," said Bosu.

Outside the realm of FLOSS, RevRanker has the potential to make a significant industrial impact by improving the effectiveness of code review, a process that today is mandatory in such well-known software companies as Microsoft, Google, Facebook and VMWare. A recent study reported more than 50,000 Microsoft developers were spending 10 to 15 percent of their time on average in code reviews.

"Assuming that Microsoft pays on average $40 per hour to its developers, the company is spending $12 million per week on code reviews," said Bosu. "Therefore, even a 5 percent improvement of the code review effectiveness can save Microsoft more than $30 million per year." ▪

The NSF award number for this project is 1850475.

Wayne State researcher continues to break new ground in

DIAGNOSTIC MEDICAL IMAGING

The interaction between the engineering and medical communities — a subject that was highlighted in the 2018 edition of *Exemplar* — is particularly significant at the diagnostic stage of health care. Advances in medical imaging technologies are steering biomedical research to levels of unparalleled progression, and among the researchers leading the way is Mohammad Avanaki, assistant professor of biomedical engineering at Wayne State University.

Avanaki and his various research teams are adapting innovative imaging instrumentations to enhance clinical analysis and medical intervention for a range of health matters.

A novel neonatal brain imaging method

Preterm and low-birth-weight babies are at high risk for intracranial hemorrhage (ICH) due to birth trauma or oxygen deprivation during the birth process. Complications result in shunt dependence and lifelong problems such as cerebral palsy and visual or cognitive dysfunction.

Currently, MRI is the most reliable diagnostic tool to study ICH. This method requires moving clinically unstable newborns out of the neonatal intensive care unit and sedating them, which creates additional risks such as hypotension, hemodynamic changes or allergic reactions. In addition, MRI scans are costly.

Avanaki received a four-year, $1.5 million R01 grant from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) of the National Institutes of Health to develop a novel TransFontanelle Multispectral Photoacoustic Imaging (TFMPI) method that will improve the detection of brain hemorrhage in infants without the need for sedation, radiation or radionuclides.

TFMPI is safer and less costly than current, clinically used neuroimaging methods. TFMPI will allow for earlier treatment, which could circumvent neural complications and improve functional outcomes from cerebral palsy and cognitive impairments.

The project is a collaboration between Wayne State's Department of Biomedical Engineering, the neonatology program in Wayne State's School of Medicine, Harvard Medical School and the University of Michigan. The

"This technology will not only reduce the number of biopsies and improve patient experience, but will also allow for earlier detection of melanoma and reduce health care costs."

team plans to fully test the TFMPI technique for future potential clinical use.

"After discussion with over 20 neonatologists across the United States, we have determined there is a great need for an imaging method that is safe, low-cost, has a high sensitivity to blood, is portable and can be used bedside as a point-of-care diagnostic screening method to improve health outcomes in preterm newborns." said Avanaki.

Using radiomic signatures to identify non-invasive melanoma

Biopsies have long been considered the diagnostic standard for melanoma, a globally worsening public health problem that has emerged as the deadliest form of skin cancer. Researchers have explored alternative ways to diagnose melanoma, using different imaging techniques to try and reduce the reliance on biopsies.

"Performing biopsies can result in pain, anxiety, scarring and disfigurement for patients, as well as a considerable cost to the health care system," said Avanaki. "However, imaging devices suffer from various drawbacks that result in limited specificity or sensitivity, and are therefore of reduced benefit to the clinician."

Avanaki is leading an international research team — including clinicians and engineers from Wayne State University, Karmanos Cancer Institute, Sharif University of Technology in Iran, AC Camargo Cancer Center in Brazil and Technical University of Denmark — to develop an original non-invasive method for accurate detection of melanoma using optical coherence tomography (OCT). The findings from this study, partially funded by the American Cancer Society, were recently published in the *Cancer Research Journal*.

Using this method, the suspect skin region and its nearby healthy skin are imaged and analyzed using a sophisticated algorithm based on a well-defined model that describes the interaction of light with skin.

"The analysis takes only a fraction of a second," said Avanaki.

The algorithm uses machine learning to develop unique optical radiomic signatures pertinent to melanoma and benign nevi, and based on the obtained knowledge can identify melanoma.

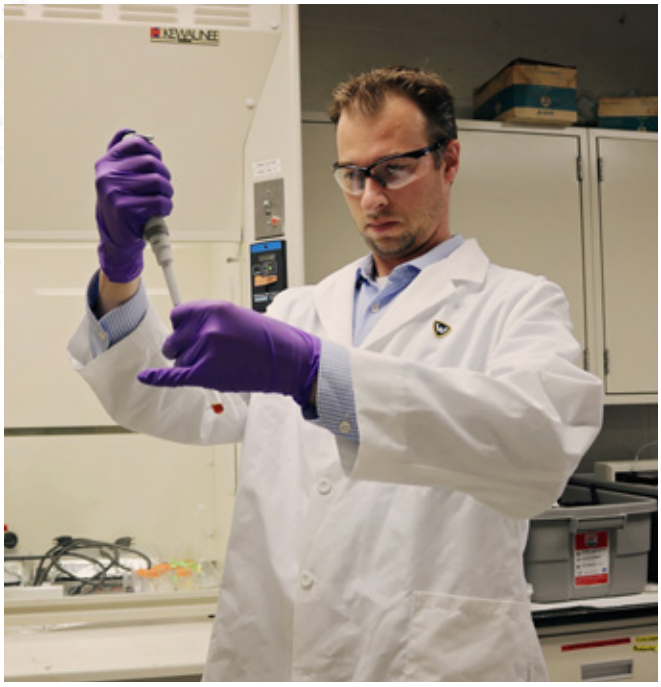
Data from lab evaluations that included testing on 69 human subjects showed significant differentiation between benign skin blemishes and malignant melanoma with 97 percent sensitivity and 98 percent specificity.

"This technology will not only reduce the number of biopsies and improve patient experience, but will also allow for earlier detection of melanoma and reduce health care costs," said Avanaki. ▪

"The main innovation in the project is to modify molecules currently used with MRI contrasting agents so that we can get them to stick on a solid surface to separate rare earth elements."

Wayne State leads DOE-funded research on RARE EARTHS EXTRACTION from coal ash

Rare earth elements are vital to many modern technologies, from consumer electronics and communications systems to renewable energy and military hardware. With China controlling more than 90 percent of the REE market since the 1990s, the U.S. has actively searched for domestic supplies of these metals to reduce this economic and technological gap.



While not particularly "rare" in terms of prevalence, REEs — specifically the 15 lanthanides (57 through 71 on the periodic table) plus scandium and yttrium —are not found in large concentrations and are difficult to separate and purify. However, one source of REEs that has gained interest in the last decade is coal and its byproducts, such as fly ash.

Various extraction methods have been developed in this space, making good use of the 1.5 billion tons of fly ash in landfills across the U.S. A team of researchers from Wayne State University, the University of California, Los Angeles, and the Los Alamos National Laboratory has proposed a new process using alkaline hydrothermal leaching and a novel sorbent material. Funded with a $540,000 grant from the U.S. Department of Energy, the project involves dissolving REEs from fly ash to an aqueous solution and transferring the metals using a silica-based nanomaterial with REE-specific binding sites.

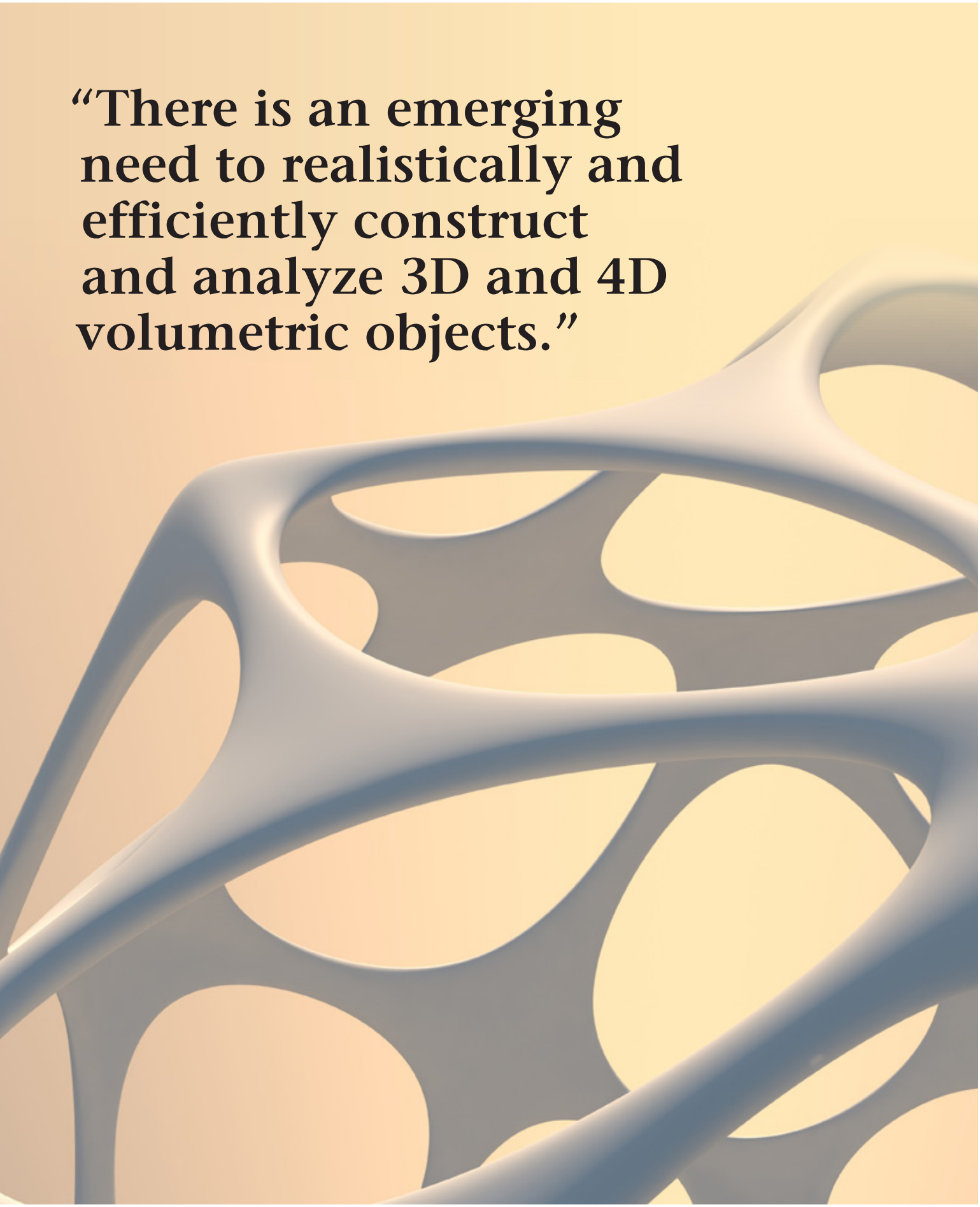
"The main innovation in the project is to modify molecules currently used with MRI contrasting agents—chemicals a doctor injects into a patient so they can see certain organs on an MRI — so that we can get them to stick to a solid surface to separate rare earth elements," said Timothy Dittrich, assistant professor of civil and environmental engineering at Wayne State and the project's principal investigator. Matthew Allen, chair of the Wayne State Department of Chemistry, is a partner on the project and works extensively on developing the contrasting agents.

The team is collecting fly ash from a Detroit power plant and has been running a series of tests to establish ideal conditions and bonding systems for effective REE removal. Once optimized, the technique will be used to extract concentrated amounts of REEs for conversion to oxides, and eventually refined metals.

"Using this separation technique will result in a solvent-free extraction process that is more environmentally benign than many liquid-liquid extractions that typically incorporate organic solvents," said Dittrich.

In addition to the reduced environmental impact, this method is less costly and labor intensive than its predecessors. Successful completion of this project can lead to expansion of REE fly ash extraction and establish a richer domestic supply of catalysts and magnets found in smartphones, electric vehicles, wind turbines, military guidance systems and more. ▪

"There is an emerging need to realistically and efficiently construct and analyze 3D and 4D volumetric objects."



Wayne State researcher Zichun Zhong earns NSF CAREER AWARD for innovation in 3D/4D anisotropy

Geometric modeling tools are rapidly increasing in popularity across many engineering sectors, including automotive, health care and medical imaging, aerospace and defense, and artificial intelligence. There is an emerging need to realistically and efficiently construct and analyze 3D and 4D volumetric objects with complex geometric structures and anisotropic properties.

The research of Zichun Zhong, assistant professor of computer science at Wayne State University, aims to facilitate more efficient creation of such objects, addressing the lack of parallel computational framework that, when put into action, would allow for more intricate design and a less tedious process.

For his work in this domain, Zhong was recently awarded a five-year, $500,000 Faculty Early Career Development (CAREER) award from the National Science Foundation.

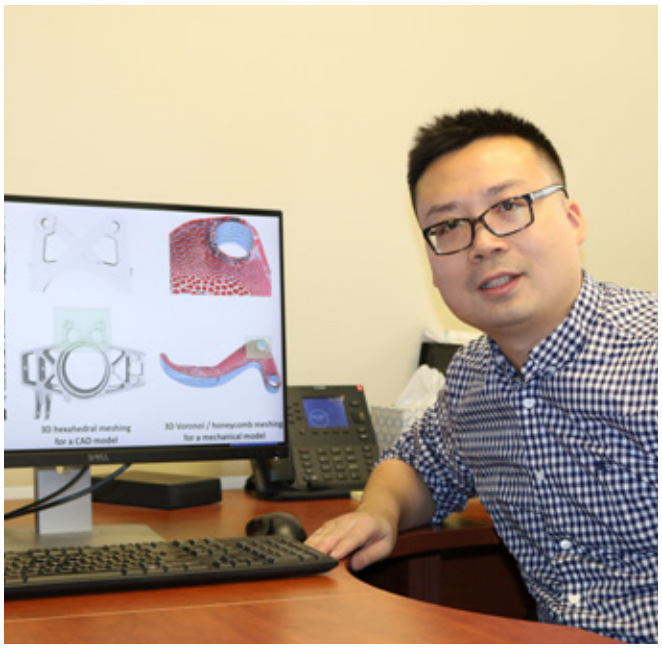
One of the most overt applications for Zhong's method is in the realm of additive manufacturing, or 3D printing. This project proposes that anisotropic 3D printing will surpass traditional methods because the process will require less materials but be stronger in quality. The parallel computing aspect of the project will streamline fabrication and allow for multiple steps to be carried out at once.

"This will significantly impact the next generation of mechanical component design, as 3D objects will come at a lower cost and a lighter weight," said Zhong.

NSF CAREER awards, the most prestigious honor bestowed by the organization to rising researchers, emphasize the integration of research and education. Zhong plans to develop an interactive 3D education program to enhance the classroom experience for WSU engineering students and to engage K-12 students during outreach events such as STEM Day.

Zhong joined the Wayne State faculty in 2015 after serving as a postdoctoral fellow in the Department of Radiation Oncology at the University of Texas Southwestern Medical Center. He holds a Ph.D. in computer science from The University of Texas at Dallas, and is actively researching such domains as computer graphics and animation, geometric modeling, medical image processing, and GPU algorithms. ▪

The grant number for this NSF CAREER award is 1845962.



Wayne State's Abusayeed Saifullah earns

NSF CAREER AWARD

to advance low-power, wide-area wireless networks

The Internet of Things (IoT) is a key element of smart city infrastructure, as it holds the pathways to connect sensors and devices for exchanging data. With the notion that IoT connectivity should extend beyond urban zones, challenges regarding range limits and scalability in traditional wireless networks must be met.

Abusayeed Saifullah, assistant professor of computer science at Wayne State University, is working on a unique solution. His research was recently backed by a $550,000, five-year National Science Foundation CAREER award, the most prestigious honor bestowed by the organization to rising researchers.

According to the Federal Communications Commission, nearly 40 percent of the rural U.S. lacks access to advanced broadband. Connected Nation Michigan says that there are 381,000 households in the state that lack access to fixed broadband internet, 97% of which are in rural areas. To support IoT applications in smart farming, oil field management and other rural area-based industries, a new category of wireless communication has emerged in the last few years known as low-power, wide-area networks (LPWANs).

LPWANs are popular due to their energy efficiency, low cost and long range operability, but have limitations when it comes to transferring data frequently or in large volumes. They rely on a wired infrastructure, which presents logistical challenges for wide-area applications, and are not designed to support real-time communication due to low bandwidth.

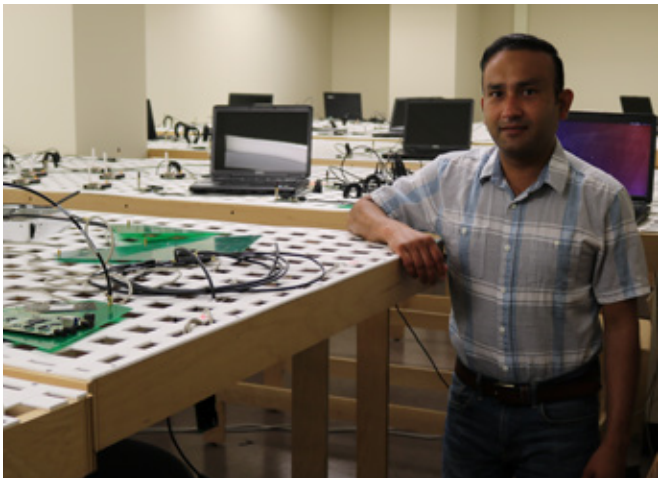
Saifullah's project will further the development of a technology proposed by his research team called SNOW, an acronym for sensor network over white spaces, a term used to define unused television broadcasting frequencies.

"SNOW is the first highly-scalable LPWAN over TV white spaces that enables asynchronous, bidirectional and massively concurrent communication between numerous sensors and a base station," said Saifullah.

White spaces offer a greater number of less crowded channels compared to conventional ISM radio bands. Their lower frequencies — as low as 54 MHz in the U.S. — present better characteristics for long-distance broadcasting and for transmitting through obstacles.

"This project will design and implement an LPWAN architecture and complete protocol stack based on SNOW to support scalable integration, coexistence, mobility and real-time communication," said Saifullah. "The protocols will be evaluated through experiments in two different radio environments: an urban test-bed and an agricultural field piloting smart farming."

There are approximately 47,000 farms in Michigan, and the agriculture industry accounts for more than $104 billion of the state's economy. Harnessing this technology could be a critical step to unlocking the full potential of agricultural IoT, including advanced data analytics, process control and cost management.



Saifullah came to Wayne State in 2017 after a two-year assignment as an assistant professor at Missouri University of Science and Technology. He has authored more than 50 published papers and is actively researching such domains as cyber-physical systems, embedded and real-time systems, wireless sensor networks, and distributed and parallel computing. He holds a Ph.D. from Washington University in St. Louis. ▪

The grant number for this NSF CAREER award is 1846126.

Center for Advanced Mobility

at Wayne State University to launch this fall

The Michigan Mobility Institute announced the Wayne State University College of Engineering as its inaugural education partner to develop the world's first holistic, advanced mobility educational curriculum. The organizations are collaborating to create the Center for Advanced Mobility at Wayne State as a hub for programming that will power new mobility careers in Detroit and around the globe.

The new center expands on the College of Engineering's current cyber-physical systems programs and features plans for a broader set of degrees and certificates focused on autonomous driving, connectivity, smart infrastructure and electrification. Students will have the opportunity to enroll in offerings for autonomous driving and new courses that provide an overview of mobility fundamentals for engineers. The college also expects to offer a new master of science in robotics for all 2020.

"This will be a leading global center for the future of mobility," said Farshad Fotouhi, dean of the College of Engineering and professor of computer science. "Together we are poised to create something very special as we embark on a shared mission to create the premiere institution focused on educating the mobility engineer of the future."

The Center for Advanced Mobility will further leverage Wayne State's recently acquired Industry Innovation Center, a 45,000 square foot facility in the TechTown neighborhood at the heart of the Detroit Urban Solutions Innovation District, for laboratory and demonstration space, and for a planned speaker series to kick off in the fall.

"This announcement represents something of immense consequence: the creation of a world-leading center for mobility in the heart of Detroit by institutions and leaders who call Detroit home," said Chris Thomas, president and co-founder of the Detroit Mobility Lab, the Institute's sister organization. "The interest and engagement we're seeing from employers and educators domestically and internationally strongly validates there is a shared understanding of the urgency of coming together. Now is the time for leadership, and we feel privileged to be at the forefront of equipping the mobility engineer of the future with the tools to build and win."

In January, the Boston Consulting Group and the Detroit Mobility Lab found that the national demand for engineering graduates with required skills for mobility careers could be up to six times greater than expected supply. Autonomous driving, connectivity and electrification will help create more than 100,000 industry jobs in the next decade, including up to 30,000 jobs for engineers with degrees based in computer-related subjects.

"By placing students and industry professionals at the center of this curriculum design, we know that these programs will meet their needs as they begin or transition into mobility careers," said Jessica Robinson, executive director of the Michigan Mobility Institute. "We conducted hours of additional interviews with startups and established industry professionals to map career paths and learning gaps. Employers are eager for mobility engineers who are comfortable with new approaches to problem solving and have hands on experience with the latest technology."

Managing microplastic pollution:

WSU research team secures $929k in funding for science-based mitigation initiative

More than half of waste released in a given year contains plastic materials. About 10,000 metric tons of plastic enter the Great Lakes every year, and another 8 million goes into the ocean. While plastic never decomposes, it does break down into much smaller — but no less environmentally hazardous — components called microplastics.

As these pollutants enter water supplies and marine environments, they create more profound problems for ecological and human health. Reducing microplastic pollution is one of the top priorities of leading environmental organizations, including the Great Lakes Protection Fund, which awarded Wayne State University researchers with a three-year, $929,000 grant to develop technology that will not only help zero in on microplastic sources but will also accelerate a targeted outreach and mitigation campaign.

The project is led by Yongli Zhang, assistant professor of civil and environmental engineering; Mark Cheng, associate professor of electrical and computer

engineering; Weisong Shi, professor of computer science; Carol Miller, professor of civil and environmental engineering; and Donna Kashian, associate professor of biological sciences.

"The issue of plastic pollution — and more specifically microplastic pollution — is beginning to get more attention," said Zhang. "However, this is still a relatively new issue for most people, and a great deal of outreach is still needed to make positive changes to public awareness and engagement."

Microplastics are often remnants from larger plastic items such as water bottles, one of which can break up into over 10,000 pieces. They also come from products that contain microbeads, such as soap or toothpaste, and from textile fibers in laundry wastewater. Microplastics present a significant health threat for several reasons. Because of their tiny size — smaller than five millimeters — they easily enter food systems, often without detection. They act as toxic sponges, absorbing large amounts of persistent organic pollutants, which can lead to serious illnesses, and interact with microbiota such as bacteria and fungi, which play key roles in our ecosystem.

The pathway to promote positive social changes is an innovative Internet of Things (IoT) technology developed by Zhang's team that incorporates optical sensors, machine learning and edge computing to allow for more cost-efficient and timely monitoring and sourcing of microplastic pollution. The belief is that this knowledge will benefit public understanding of the problem and lead to behavioral changes.

"The advantages of our IoT sensors include high-throughput, low-cost and automatic measurement of chemical composition of microplastics," said Cheng.

"By integrating the IoT technology with machine learning tools, the sensors will provide abundant critical information for microplastic monitoring, including the quantity, size, chemical composition and age, as well as the correlation to the location and weather conditions," said Shi.

The research team will deploy its sensors at testing sites in Pontiac, a city situated about 25 miles from Wayne State's campus, and Williamston, located just outside of Lansing. They will monitor microplastic inputs from multiple sources including wasterwater discharge, urban runoff and agricultural zones.

"The team will leverage this data to promote mitigation initiatives such as microplastic-filtering laundry bags, street side garbage bins and green water infrastructures," said Miller.

"This project can be scaled up to engage with greater numbers of community members, civic leaders and students both at the university and K-12 levels," said Kashian. "This will further public awareness and pollutant reduction efforts."

In addition to the WSU research team, two community partners — Ingham Conservation District and ReRoot Pontiac — will collaborate on the project. ■

Materials design research at Wayne State creating new possibilities for U.S. Air Force systems

As military operations become more advanced, so must the materials used to create resources that allow optimal operational effectiveness. New developments in traditional materials — such as camouflage or body armor — coupled with scientific breakthroughs in next-generation materials (e.g. self-healing substances and nanomaterials) or manufacturing strategies (e.g. 3D printing) have opened up a wide array of possibilities for protective military solutions.

With so many variables to consider, materials design and manufacturing is critical. New research by Helen Durand, assistant professor of chemical engineering and materials science at Wayne State University, aims to spur advances in this domain. Her lab is developing computationally tractable optimization-based design and control strategies for materials development and manufacturing, with a focus on advanced materials and control of material behavior during their use.

Durand received funding from the U.S. Air Force Office of Scientific Research to support this project. She was one of 31 scientists and engineers across the country to receive grants through the Air Force's Young Investigator Research Program.

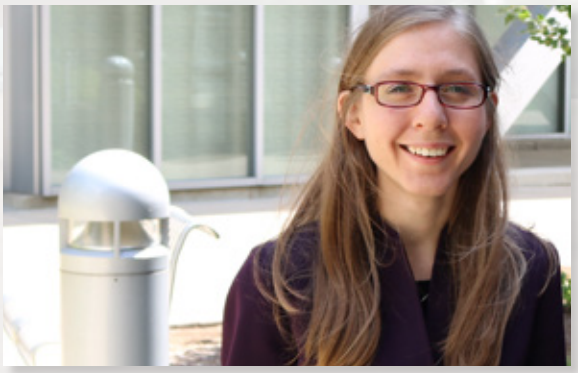
"Materials are key to effectively accomplishing things as mundane as dish-washing to things as complex as flight," said Durand. "However, despite improvements in computational modeling, current methods of designing new materials that respect desired properties remain largely driven by experiment."

Without molecular-level analysis, modeling relies on measured experimental data, which can be costly to obtain and requires a high degree of trial and error that slows progress. Additionally, as comprehension of chemistry and physics escalates, new materials that exploit molecular forces are challenging to take from the conceptual stages to large-scale manufacturing.

"One of the exciting parts of computational work is that it allows us to investigate possibilities systematically," said Durand. "There are many types of materials and material behavior that would be expected to have a significant impact on the Air Force's capabilities if they could be developed and manufactured. We hope to create a framework that provides a systematic means for creating these materials using mathematics, optimization, and control theory."

Durand's research includes development of a reduced-order modeling framework and output feedback control designs for manufacturing. Her team will investigate techniques suitable for reducing the computation time required to simulate dynamic behavior, permitting more accurate predictions of material properties under different external influences.

The Air Force's investment in Durand and other researchers ensures that materials that comprise protective gear, machinery and weaponry meet specific needs while maximizing capability and functionality.



New training modules developed at Wayne State University stress importance of **construction workplace safety**

Construction is a high-hazard industry that exposes its labor force to physical dangers as well as overall health risks. In the U.S., the annual total costs of fatal and non-fatal injuries in the construction industry are estimated to be over $10 billion — a figure that does not account for the latent diseases caused by exposure to harmful chemicals, substances and particulates.

These consequences can be reduced, however, by maintaining high standards of safety in the workplace. A research team led by Emrah Kazan and Mumtaz Usmen in the Department of Civil and Environmental Engineering at Wayne State University has been focused for several years on occupational safety and health investigations and training, mainly for the construction industry.

In addition to conducting numerous studies involving statistical analysis and modeling of workplace injuries and illnesses, the team has developed and implemented various training modules to more than 2,500 construction industry employees and employers at no cost to them. These intervention strategies have been largely supported by grants from the U.S. Department of Labor (DOL) Occupational Safety and Health Administration (OSHA), specifically by the Susan Harwood Training Grant, which they have received continually for the last five years.

For the past two years, the OSHA grants have been augmented by support from the Michigan OSHA Consultation Education and Training program to reach out to additional trainees via an online training portal, which has a distinct advantage in being able to avail training to people in remote areas.

"Our training grants also have an evaluation component that allows us to investigate different tools and methods — including in-class and online delivery — to reach out to targeted audiences, including underserved, low-literacy and low English proficiency personnel," said Kazan. "After the grant period, the developed training materials are published by the federal agency to be utilized nationwide and globally."

The objective of the most recent Harwood grant — a $142,000 award from USDOL received by Kazan and Usmen — is to increase awareness of the health hazards associated with exposure to crystalline silica, a natural compound often present in construction materials such as sand, concrete and mortar.

"When workers cut, grind, drill, blast, jackhammer or crush these materials, dust particles that are very small in size can become airborne," said Kazan. "Unless they observe safe work practices, workers may inhale sufficient amounts of silica dust particles to cause silicosis, an incurable and sometimes deadly lung disease."

Respirable crystalline silica has also been linked to lung cancer, chronic obstructive pulmonary disease (COPD) and kidney disease. In most cases, these diseases are diagnosed after many years of exposure. A new standard issued by OSHA is expected to reduce silica risks by as much as five times, and the supporting training tools developed at Wayne State will include identification of silica hazards, safe work practices, engineering controls and personal protective equipment.

The research team works closely with an advisory committee composed of safety and health experts and organizational leaders from the International Union of Operating Engineers, Associate General Contractors of Michigan, Masonry Institute of Michigan, Michigan Laborers' Training and Apprenticeship Institute, and private firms from the Michigan construction industry.

"This group of key stakeholders has a keen interest in training their constituencies to protect them, while also promoting and achieving compliance with the new standard," said Kazan. "The training program we offer is directly aligned with both goals."

Wayne State welcomes industry partners for first look at new

Smart Manufacturing Demonstration Center

As the Smart Manufacturing Demonstration Center (SMDC) at Wayne State University has begun to take shape, the College of Engineering hosted an open house for nearly 50 industry leaders on April 24 to demonstrate the university's capabilities for innovative manufacturing research and workforce development.

The SMDC has been in development since late 2017 through a partnership with Cisco Systems' State Digital Acceleration (SDA) initiative. Michigan is the first state to join the program, which was developed to advance the digital agenda, bolster financial growth, attract new investment and increase innovation potential.

The 25,000-square-feet high bay area of the college's Manufacturing Engineering Building at 4815 Fourth Street is being converted into the SMDC, a hub focused on developing the next generation of digital manufacturing professionals and leaders in automation and robotics. It will house a variety of equipment and software, connected with Cisco's secured systems infrastructure, that will enable research and education in such domains as collaborative robots, additive manufacturing, computed tomography (CT) scanning, automated laser scanning, and resistance spot welding. The lab will also allow researchers to explore aspects of the Internet of Things (IoT), including data management, storage, infrastructure and security.

"As Michigan emerges as a leader in the high-tech global marketplace, faculty and students in the Wayne State University College of Engineering are working tirelessly to deliver advanced manufacturing solutions that ensure convenience, safety and efficiency," said Dean Farshad Fotouhi. "The SMDC presents us with an opportunity to harness the power of Industry 4.0 and enhance our understanding of how cyber-physical systems and IoT make smart manufacturing a reality."

The SMDC is outfitted with the Cisco Kinetic IoT platform, infrastructure, wireless data acquisition systems, and data servers to store data collected from various industry-supported processes, including resistance spot welding provided by Ford Motor Company and computed tomography scanning courtesy of Wenzel America. A real-time optimization framework with ESTECO's modeFrontier will enhance data processability, and real-time location platforms supported by HERE Technologies will enhance tracking and automation.

"These partnerships align perfectly with our innovative and proactive approach to challenges facing traditional manufacturers," said Fotouhi.

The SMDC will be fully operational in the fall. ▪

SMASH Academy brings high schoolers to Wayne State for **immersive STEM experience**

Detroit is on the rise, and the city's growing influence in the high-tech marketplace is one of the hallmarks of this resurgence. With this growth comes an opportunity to break barriers in diversity and inclusion. Although 88 percent of Detroit's population is Latino/Hispanic or African American, these groups still remain largely underrepresented in the tech space on a national level.

In the spring of 2018, Wayne State University announced a partnership with SMASH, the signature education program of the Kapor Center in California, to level the playing field and close the gap for minorities and women. SMASH was established 15 years ago at the University of California-Berkley and launched its first Midwest location in Detroit. The three-year STEM accelerator is free of charge and has a proven model, as 100 percent of its scholars graduate from high school and more than 90 percent obtain a college degree.

With the first two summer programs concluded, SMASH is a hit with Detroit's youth and stands to make a significant impact for years to come. Nearly 80 high school students completed the rigorous five-week schedule and the feedback was overwhelmingly positive, according to Site Director John Ray. Pre- and post-impact surveys and assessments indicated educational growth as well as greater ambitions to pursue careers in STEM fields.

The partnership between the university and the academy allows SMASH to reach its goals while

giving participants a glimpse into student life at Wayne State. Scholars take classes at the College of Engineering as well as in Old Main, Manoogian Hall and Science Hall. They stay at Thompson Home and eat meals at Towers Café.

"It is important to expose the scholars to the different resources that Wayne State has to offer so they know what is available to them when they get to college," said Ray.

Even the application process is akin to the college admissions process. A pool of 70 hopefuls supply essays and letters of recommendation before advancing to online and in-person interviews, the latter of which hone in on non-academic characteristics such as teamwork and problem-solving.

In addition to college-level STEM classes, SMASH incorporates courses in writing, entrepreneurship and African-American studies to constitute a well-balanced curriculum. There are also networking events, workshops and guest speakers.

"We make sure they have the necessary tools to tap into their potential," said Ray.

Another critical aspect of the program is developing coping strategies and self-care to combat not only a lack of diversity but also a high turnover rate for traditionally underrepresented population groups.

"Although we encourage our students to go into engineering, tech or computer science, we also realize there are not a lot of women or people of color in these industries," said Ray. "So we teach them strategies to deal with being one of the few, or the only, in those spaces and to feel like part of the community."

Students are able to see real-world applications of their education with field trips that include the U.S. patent office, Quicken Loans headquarters in Campus Martius, and startups StockX and DPop. These visits, combined with other adventures more recreational in nature, provide an immersive experience in Detroit.

"They are welcome to all these spaces, and it shows them that you don't have to leave the city or state to find a better opportunity," said Ray. "Those opportunities exist here."

Ray is a Detroit native and spent part of his career as an educator in the city and in Houston before moving into management consulting for school districts and non-profits in Baltimore. He said making learning engaging and relevant is what drives him and as SMASH was looking to expand, he was excited to take this role.

"I wanted to get back to my hometown and help kids from similar schools and backgrounds as me to make sure they have every opportunity to be successful," he said.

Ray works closely with Jasmine Roberson, director of community engagement for the WSU College of Engineering, to leverage her expertise on outreach programs and determine what spaces in engineering are well suited for SMASH. He envisions more engineering classes to be added to the curriculum in subsequent years of the program.

When the summer academy concludes, SMASH students stay engaged with college readiness workshops and panel sessions on Saturdays during the school year. Meanwhile, adding the incoming cohort in the summer of 2020 will bring nearly 120 scholars to Wayne State's campus. ▪

For more information about the program, visit smash.org. For partnership opportunities and questions, contact Site Director John Ray at john@smashprogram.org.

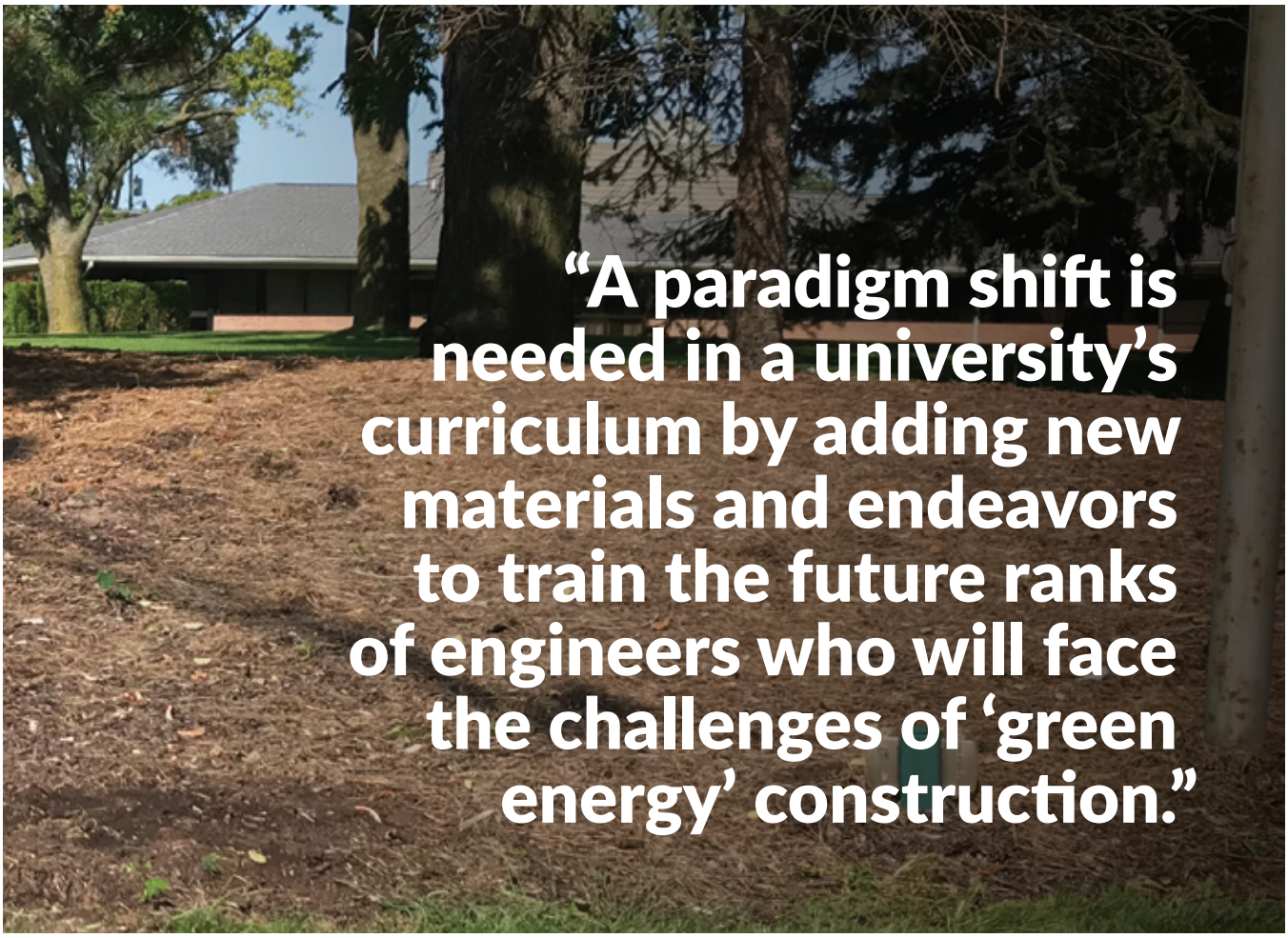
Wayne State University construction management seniors

volunteer 200 hours at Judson Center

For the past three years, seniors enrolled in the construction management program at Wayne State University, led by Program Director Joseph Vaglica, Ph.D., have been participating in the annual ELECTRI International/NECA Green Energy Challenge, which is integrated into the engineering capstone program. The main component of the competition is to challenge students to propose an energy upgrade design and simulation for a facility that provides community services.

This year's competition was held March 23 at the Judson Center, a mental health and social services provider based in Royal Oak, Michigan.

Students were instructed to achieve a net zero facility — meaning the total amount of energy used annually by the building is approximately equal to the level of renewable energy created on site — by incorporating energy saving measures and distributed energy resources based on the



unique needs of the building and its climate. The competitors were expected to provide detailed technical solutions in the proposal by examining the past years’ utility expenses, planning the renovation design, estimating new system costs, and demonstrating energy efficiency improvements.

In addition, students were required to seek funding sources, such as state grants and tax benefits, and to perform a minimum of 200 hours of community service at the Judson Center.

“The environmental impact and the continuous increase in energy costs are driving the construction industry to pursue new design and technology alternatives. A thorough understanding of the science of building performances and effective design is required to achieve maximum energy efficiency and best cost-performance ratio,” said Vaglica. “Therefore, a paradigm shift is needed in a university’s curriculum by adding new materials and endeavors to train the future ranks of engineers who will face the challenges of ‘green energy’ construction.”

Students upgraded the landscaping on the campus grounds and installed a new security system which will allow Judson Center staff members to see guests before they enter the building and remotely allow guests to enter via an intercom and camera system. Other projects included caulking windows, changing lights, painting and assisting with housekeeping needs.

The Judson Center is a non-profit human service agency that provides comprehensive services to children and families throughout southeast Michigan that have been impacted by abuse and neglect, autism, developmental disabilities and mental health challenges. The organization has provided care to more than 10,000 children, adults and families each year since it first opened in 1924.

BUILDING ON A LEGACY **OF INNOVATION**

Detroit is a city built by engineering, and its revitalization is fueled by discovery and innovation. The College of Engineering is seizing new opportunities while creating pathways to emerging industries. Students are empowered to be creative, collaborative professionals in diverse fields including biomedical engineering, automotive systems, clean water and energy, and big data to name a few. As the innovation economy strengthens, the College of Engineering will lead the way.

PIVOTAL MOMENTS CAMPAIGN

Wayne State University's Pivotal Moments campaign was an ambitious effort with a goal to raise $750 million by September 2018. The College of Engineering's goal was to raise $50 million. It is with great pleasure that we announce both the college and the university have surpassed these goals, and endowments for the college have increased substantially. We thank all of you who have partnered with the college to achieve this goal. We are continuing to move forward with the momentum already achieved to focus on the college's five high-impact practices for this coming year.

HOW YOU CAN PARTNER WITH THE COLLEGE

We need your assistance in taking the College of Engineering to the next level and pave the way as our innovative economy strengthens. We would welcome your thoughts on ideas on how to move the college forward. How do you want to help change the lives for others at Wayne State? This is your opportunity to directly engage with the college and help future generations of students, faculty and community members.

Please contact our development professionals to see how you can change lives at Wayne State:

KRISTYN THEISEN
Senior Director of Development
313-577-8576 | kristyn.theisen@wayne.edu

CLAIRE BRENDER
Senior Major Gift Officer
313-577-4707 | cmbrender@wayne.edu

AUDREY STEPHENS
Alumni and Donor Relations Officer
313-577-6810 | audrey.stephens@wayne.edu

GIVING TO THE COLLEGE OF ENGINEERING

The College of Engineering has focused on five high-impact practices to strengthen student experiences and success. These priorities represent shared focus areas of strategic importance throughout the college and university.

Experiential learning
Through internships and co-ops, students learn interdisciplinary skills that translate across a variety of professional settings. You can support this practice through scholarships and professional development funding.

Global Perspective
Engineers must be global citizens, able to navigate diverse cultures and economies around the world. To develop students' global perspectives, you can support study abroad scholarships.

Undergraduate Research
Research opportunities for undergraduate students set Wayne State apart from its peers. You can support improved laboratories; renovated workspaces; research awards; and endowed chairs, professorships and fellowships.

Hands-on Experience
Students gain valuable skills in national engineering competitions, building everything from Formula-style racing cars and robots to concrete canoes and model steel bridges. You can provide real-world experiences by supporting flexible learning spaces, equipment and programs.

Community Engagement
The College of Engineering offers programs that introduce K-12 students to teaching labs and research facilities, providing a glimpse of higher education and career opportunities. You can support this practice by investing in youth science and engineering programs.

Wayne State receives $1M gift

to create Nancy Philippart and Thomas McGrail Center for Global Engineering Education

The College of Engineering at Wayne State University received a $1 million gift from Nancy Philippart '80, M.A. '87, Ph.D. '14 and Thomas McGrail '82 to create a new center for global engineering education. The couple previously created an endowed scholarship at the college for students to pursue overseas educational opportunities.

The Nancy Philippart and Thomas McGrail Center for Global Engineering Education will be the primary point of access and coordination for all international programs and global initiatives within the College of Engineering. In addition to study abroad, the college's existing programs offer students opportunities to participate in research, internships and service learning abroad.

Nancy Philippart serves as an adjunct professor in the College of Engineering, drawing on decades of experience as an engineer and global business executive in the automobile industry. "The ability to work across cultures and countries is essential, particularly in many engineering fields where international offices have teams working together," she said. "Students who have the opportunity for global learning are going to have life-transforming experiences that shape their future success."

The Nancy Philippart and Thomas McGrail Center for Global Engineering Education also will house programs that attract international students to Wayne State, such as the 3 + 2 program. The program allows students from partner universities to study for three years at their home institution, then study at Wayne State for two years to complete a master's degree.

"Innovation and ideas are global," said Thomas McGrail, who earned his bachelor's degree in business administration at Wayne State. "Having a base for this knowledge at the College of Engineering increases connections between students and international universities and companies, furthering the economic growth of Detroit's engineering sector."

Wayne State engineering students have gained research and industry experience in countries including China, Japan, the United Arab Emirates, Nigeria, France and Austria. The college is currently in discussions with institutions in Europe and South America about creating opportunities for even more students.

"We are grateful to Nancy and Thomas for sharing our vision that engineering students must have a global understanding of different cultures," said Farshad Fotouhi, dean of the College of Engineering. "That is part of our strategic plan, and this center helps the college expand student access to global experiences while also welcoming international students to Wayne State."

In addition to enhancing existing programs, the Nancy Philippart and Thomas McGrail Center for Global Engineering Education will establish new programs as global engineering and the international marketplace evolve. The couple have ensured support will be permanently available for students by investing their gift in an endowed fund at the university.

"This new center will provide global experiences for generations of students, through the generosity of Nancy Philippart and Thomas McGrail," said Wayne State University President M. Roy Wilson. "It is critically important that our students become global citizens who are able to navigate diverse cultures and economies."

The center was announced in November 2018 in conjunction with International Education Week, a joint initiative of the U.S. Department of State and the U.S. Department of Education. ■

Wayne State alumnus gives $5 million

to College of Engineering for scholarships and new testing laboratory

Local business leader and philanthropist Avinash Rachmale, M.S. '89 and his wife, Hema Rachmale, Cert. '92 have donated a total of $5 million to the Wayne State University College of Engineering under the auspices of The N. Rachmale Foundation: $1 million to create an endowed scholarship fund and $4 million to build a structures and materials engineering testing laboratory in Highland Park, Michigan.

"The first employees I hired were Wayne State engineering students," Rachmale said. "And I have roots at Wayne State and Detroit that go back more than 30 years. I owe so much to this city and university; it is my honor to give back to College of Engineering students, especially those who want to make a difference in Detroit."

The Rachmale Detroit Engineering Scholars Program annually incentivizes five high-performing students from Detroit Public Schools to attend Wayne State's College of Engineering and assists them in the transition from high school achievement to career success. The 8,000-square-foot N. Rachmale Foundation Structures and Materials Laboratory is expected to be completed in 2020, providing Wayne State civil engineering students and faculty members with unprecedented opportunities to engage in large-scale, real-world structures and materials testing projects.

Structures and materials testing is essential to verify and understand the behavior of key infrastructure components such as bridges, roads and buildings. Because Wayne State's on-campus civil engineering testing facilities have restricted access to the large trucks needed to transport such products as steel and concrete bridge girders, bridge decks, pipes, and steel and fiber-reinforced polymer rebar, the College of Engineering has been unable to pursue projects involving these and other civil structural components.

"The facility will potentially be used by agencies including the Michigan Department of Transportation and Army Corps of Engineers, and corporate partners of the college," said Farshad Fotouhi, dean of the College of Engineering. "Our new laboratory will have

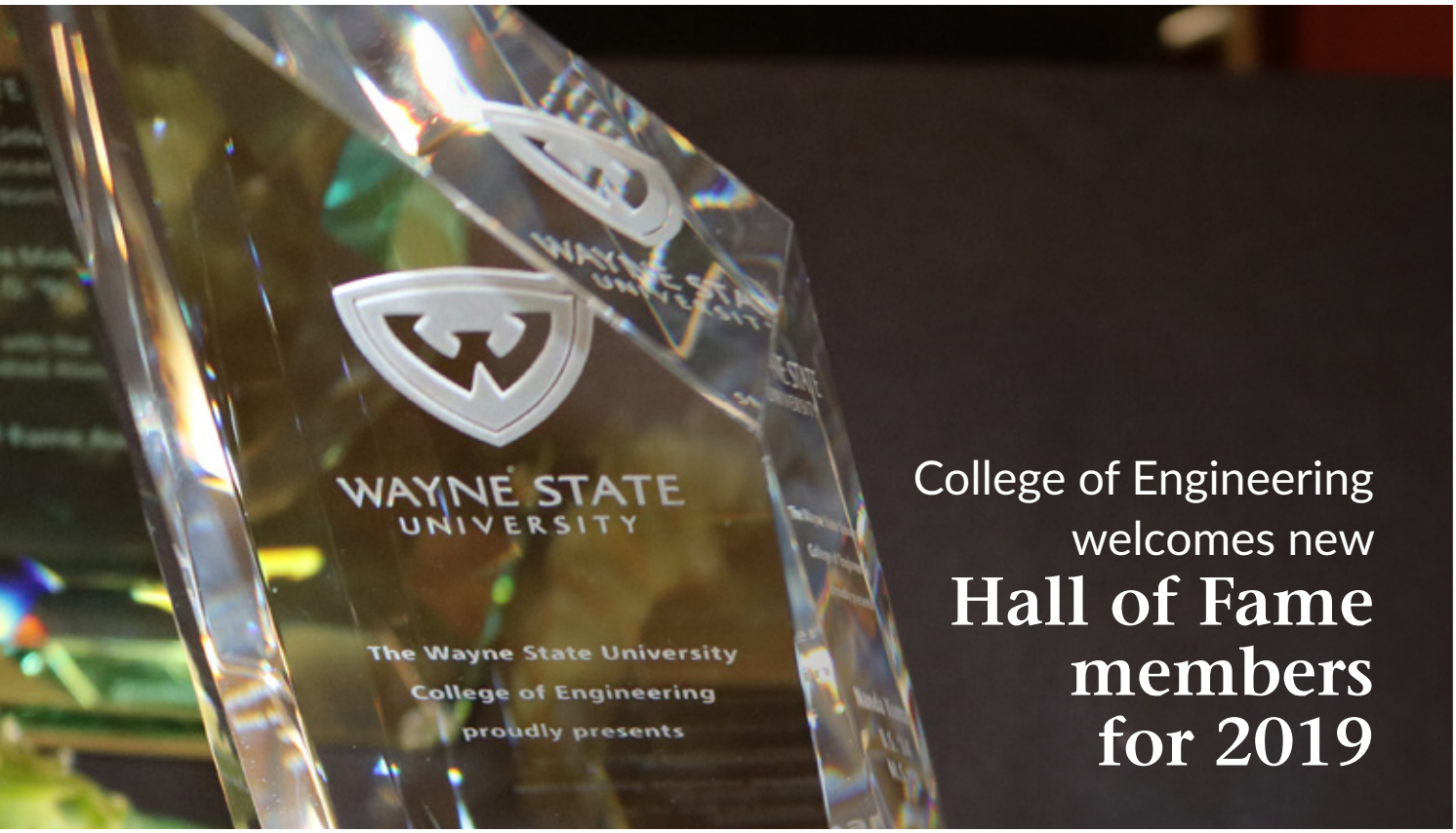
state-of-the-art testing equipment we can use to assess characteristics like tensile and compressive strength and evaluate various materials' performance under specific temperature and humidity conditions." The building will feature a strong floor, strong wall, office spaces, restrooms, safety shower, spaces for testing machines, storage, and hydraulic power units, and an environmental chamber.

Rachmale received a bachelor's degree in civil engineering from the Government Engineering College in Aurangabad, India in 1985 before moving to the United States and earning his master's degree in civil engineering at Wayne State. In 1994 he founded Lakeshore Engineering Services in Detroit, which assessed, cleaned and replaced fuel storage tanks at 200 service stations with only one employee — Rachmale — on staff. Lakeshore became one of the country's leading civil engineering and public works contractors and in 2010 acquired TolTest, another leader in worldwide construction management services. The new entity was renamed Lakeshore TolTest, and Rachmale served as its CEO.

Since 2015 Rachmale has served as CEO and chair of LGC Global, an engineering firm headquartered on Woodward Avenue in Detroit's New Center area. LGC Global has over 500 employees in more than 40 offices worldwide. The company's projects include the renovation of several Detroit Public Schools buildings, national and international infrastructure, and residential and commercial development. Rachmale received the U.S. Small Business Administration's Champion Award for Entrepreneurial Success in 2009 in recognition of Lakeshore Engineering's innovation and community investment during the country's economic recovery. In addition to being a longtime, generous supporter of Wayne State, Rachmale is an active contributor to Detroit-based nonprofits assisting children from underserved populations.

The generous alumni gift provides a fitting bookend to Wayne State University's historic Pivotal Moments campaign, which celebrates its closing along with the university's sesquicentennial on October 26. The campaign has raised a total of $776.5 million, making it the most successful in Wayne State's 150-year history.

"We are incredibly grateful to Avinash and Hema for their continued support of Wayne State University," President M. Roy Wilson said. "Their gifts will enhance the study of civil engineering at Wayne State for generations to come, helping us recruit top talent and forge new relationships with government agencies as well as private companies. This is a perfect example of a pivotal moment made possible through philanthropic support."▪



College of Engineering welcomes new Hall of Fame members for 2019

The Wayne State University College of Engineering honored 10 prominent alumni at its Hall of Fame awards dinner on Thursday, April 18, at the Outdoor Adventure Center in Detroit.

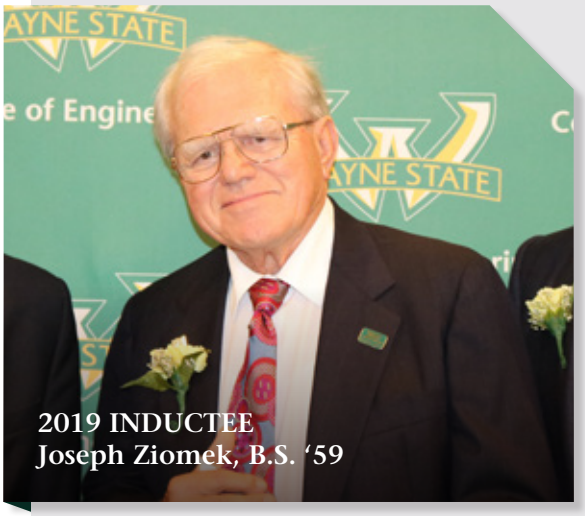
Nanda Kumar, B.S. ’84, M.S. ’91, and Joseph Ziomek, B.S. ‘59, composed the Hall of Fame class of 2019 and brought membership to 146 honorees since the Hall of Fame’s inception in 1983.

The College of Engineering also recognized distinguished engineers or computer scientists from each of its eight departments. The event capped off a busy day highlighted by the Tapan Datta Boulevard dedication and the college’s annual Student Innovation and Design Day, presented by the James and Patricia Anderson Engineering Ventures Institute.

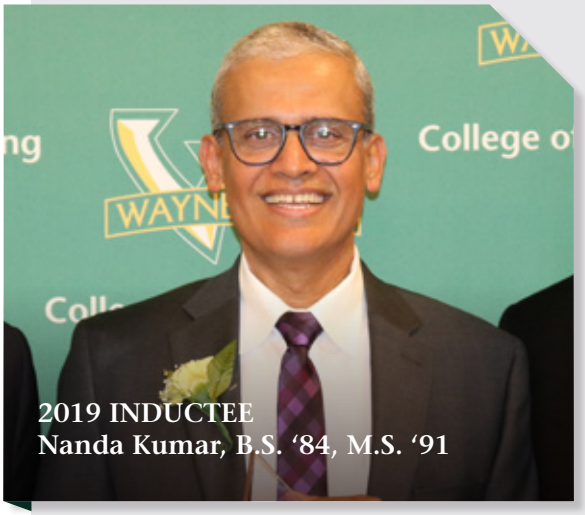
Kumar has risen through the ranks at Eaton, a diversified power management company that provides energy-efficient solutions to customers in more than 175 countries. He began his Eaton career in 1990 and held positions of increasing responsibility in plant management and business systems. Kumar’s leadership has been instrumental in streamlining operations in manufacturing, supply chain, environmental, and health and safety. In September 2015 he assumed his current role as president of Eaton’s Aerospace Group, a world leader in the design, manufacturing and integration of innovations in hydraulics, fuel systems, motion control, and engine solutions. Kumar holds a bachelor’s in mechanical engineering from Bangalore University in India, a master’s in mechanical engineering from Wayne State University, and an M.B.A. from the University of Michigan.

Ziomek has been in the automotive electronics business for more than 55 years. The Cass Tech alumnus enrolled at Wayne State in 1954 at age 16. Ziomek worked for Ford Motor Company from 1963 to 1979 in advanced electronics research and composites vehicle design. He joined TRW in 1979 and formed the Transportation Electrical and Electronics Operation, which pioneered electronics applications for passenger cars, light trucks, heavy duty trucks and buses, and agricultural and off-road vehicles. In 1987, he was named TRW’s director of advanced safety restraint systems, later joining Takata in 1989 in a similar role. Ziomek, who has served as a consultant and expert witness since his retirement, co-founded the Convergence Education Foundation (now called Square One), a STEM pipeline for more than 20,000 high school students.

The distinguished engineers and computer scientists included:



2019 INDUCTEE
Joseph Ziomek, B.S. '59



2019 INDUCTEE
Nanda Kumar, B.S. '84, M.S. '91

Biomedical Engineering
Ernest Chiodo, M.D. '83, J.D. '86, M.S. '07, M.S. '09
Physician and attorney

Chemical Engineering and Material Science
Luis Spitz, B.S. '60
Soap industry consultant

Civil and Environmental Engineering
Russell Gronevelt, M.S. '82
President (retired), Orchard, Hiltz, McCliment, Inc.

Computer Science
Uma Raghavan, M.S. '94
Founder and Advisor, Integris

Electrical and Computer Engineering
Maninder Chhabra, M.S. '90
Founder and CEO, Cloudwick

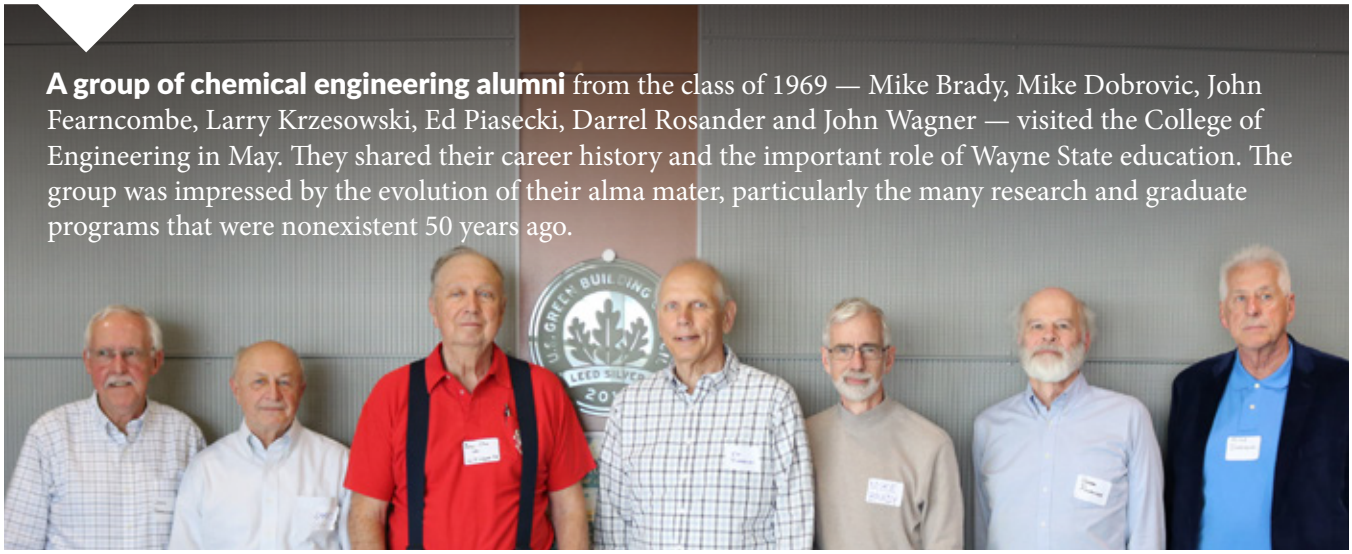
Engineering Technology
Mark Reinhard, B.S. '82
Founder and President, Forward View Displays

Industrial and Systems Engineering
Nabil Raad, Ph.D. '18
Director of Product Development Analytics, Ford Motor Company

Mechanical Engineering
Mousa Mohsen, Ph.D. '91
Professor and Dean, School of Engineering at the American University of Ras Al Khaimah

The honorees had the opportunity to attend Design Day in the afternoon and peruse a showcase of Wayne State students' capstone projects and startup companies, all of which present solutions to engineering challenges and commercial or social needs in the spirit of entrepreneurship. All were also invited to the Tapan Datta Boulevard dedication in the morning.

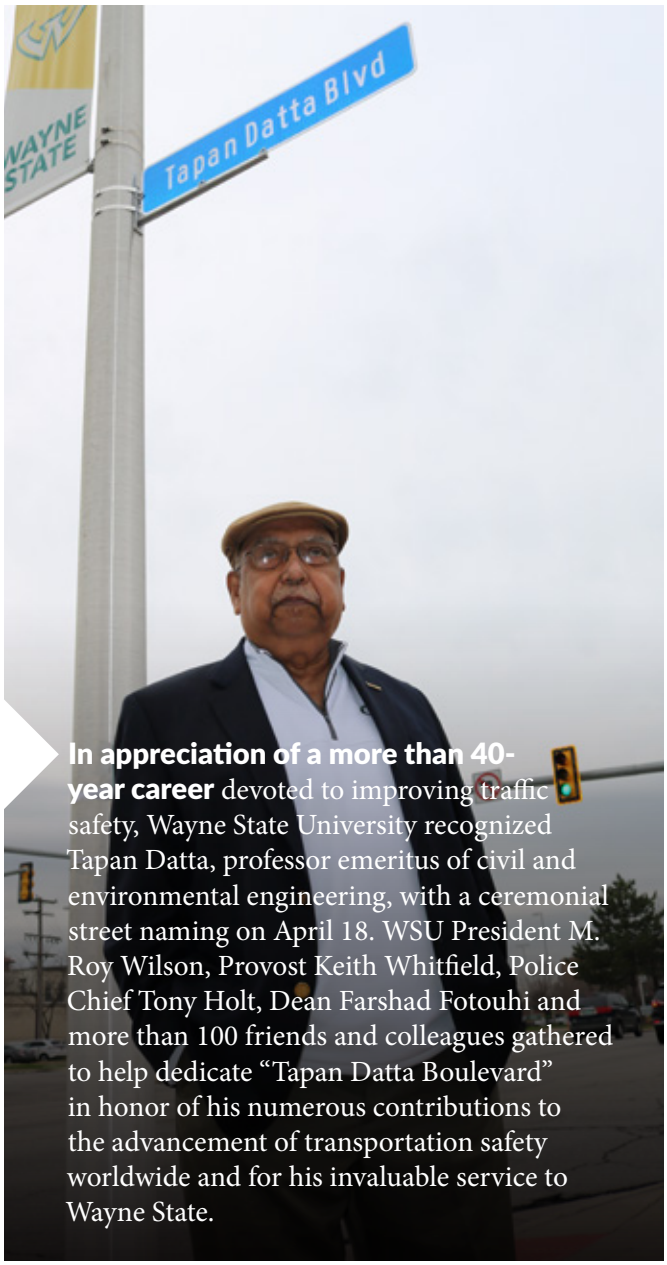
Dean Farshad Fotouhi and the Engineering Alumni Association then welcomed the honorees and their families — as well as colleagues, alumni and industry leaders — to the awards dinner, with proceeds benefiting scholarships and student programs.



A group of chemical engineering alumni from the class of 1969 — Mike Brady, Mike Dobrovic, John Fearncombe, Larry Krzesowski, Ed Piasecki, Darrel Rosander and John Wagner — visited the College of Engineering in May. They shared their career history and the important role of Wayne State education. The group was impressed by the evolution of their alma mater, particularly the many research and graduate programs that were nonexistent 50 years ago.

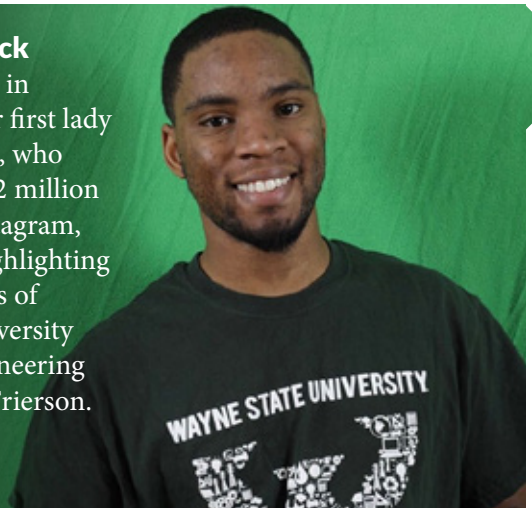
Leela Arava, associate professor of mechanical engineering, was presented a Career Development Chair award in April at the Wayne State University Academic Recognition Ceremony, a celebration of Wayne State faculty and staff who have made significant contributions to the university, academic community and pursuit of professional interests. Arava, pictured with Provost Keith Whitfield, joined the Wayne State faculty in 2013 and, among several scientific achievements, co-holds eight patents and has co-authored over 90 peer-reviewed publications. He was the recipient of a five-year, $519,241 NSF CAREER Award in 2018 for his work on next-generation battery technology and energy storage systems. Arava also contributes to STEM education in Detroit-area K-12 schools through outreach efforts such as his Mobile Energy Lab.

Mechanical engineering senior Meredith Weidner, a member of the women's golf team, was one of eight student-athletes to earn a Deans' Award at the 19th annual Wayne State Academic Recognition Luncheon for having the highest cumulative grade-point average among all student-athletes in their respective schools or colleges. Pictured with Weidner is Jeffrey Potoff, associate dean for academic and student affairs.



In appreciation of a more than 40-year career devoted to improving traffic safety, Wayne State University recognized Tapan Datta, professor emeritus of civil and environmental engineering, with a ceremonial street naming on April 18. WSU President M. Roy Wilson, Provost Keith Whitfield, Police Chief Tony Holt, Dean Farshad Fotouhi and more than 100 friends and colleagues gathered to help dedicate "Tapan Datta Boulevard" in honor of his numerous contributions to the advancement of transportation safety worldwide and for his invaluable service to Wayne State.

In honor of Black History Month in February, former first lady Michelle Obama, who has more than 32 million followers on Instagram, shared a post highlighting the achievements of Wayne State University mechanical engineering student Jaquan Frierson.

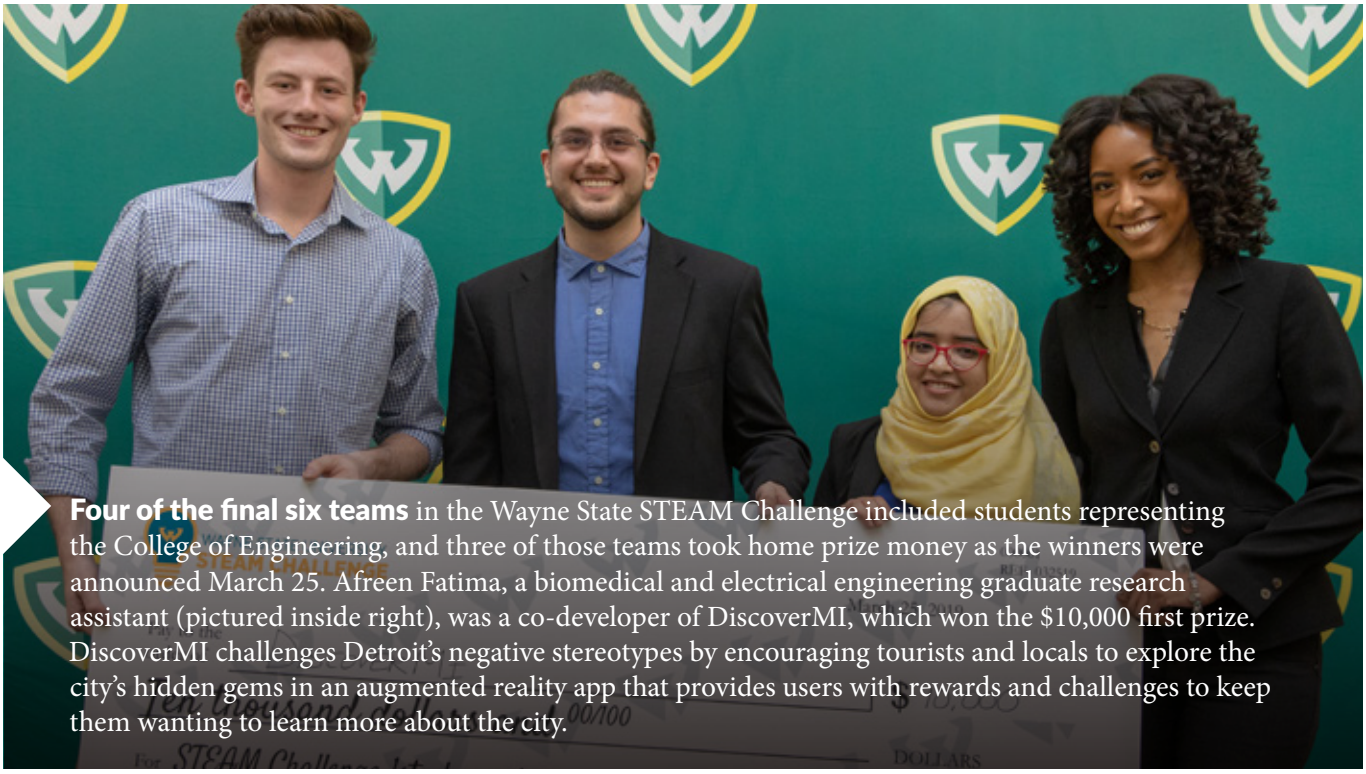


michelleobama Jaquan Frierson is the next young history-maker I want to tell you about for #BlackHistoryMonth. I saw Jaquan last year at the @motownmuseum with a group of inspiring young men from @waynestate —and it turned out he'd celebrated #CollegeSigningDay in Detroit with me 3 years earlier, too. He's been busy since I saw him last.

Jaquan is a first-generation college student. He's studying mechanical engineering. He's conducting research into new sources of renewable energy. He's a volunteer math tutor for Detroit public schools. And he started his own record label.

There are a lot of roads in front of Jaquan—he hopes to start a business in Detroit someday—just like there are unlimited pathways for all those students like him across the country. They might be the first in their families to get a college degree, but they won't be the last.

Now, I want to hear from you! Share a story of a first-generation college student paving the way for those behind them by using #ShareBlackStories. #FlashbackFriday

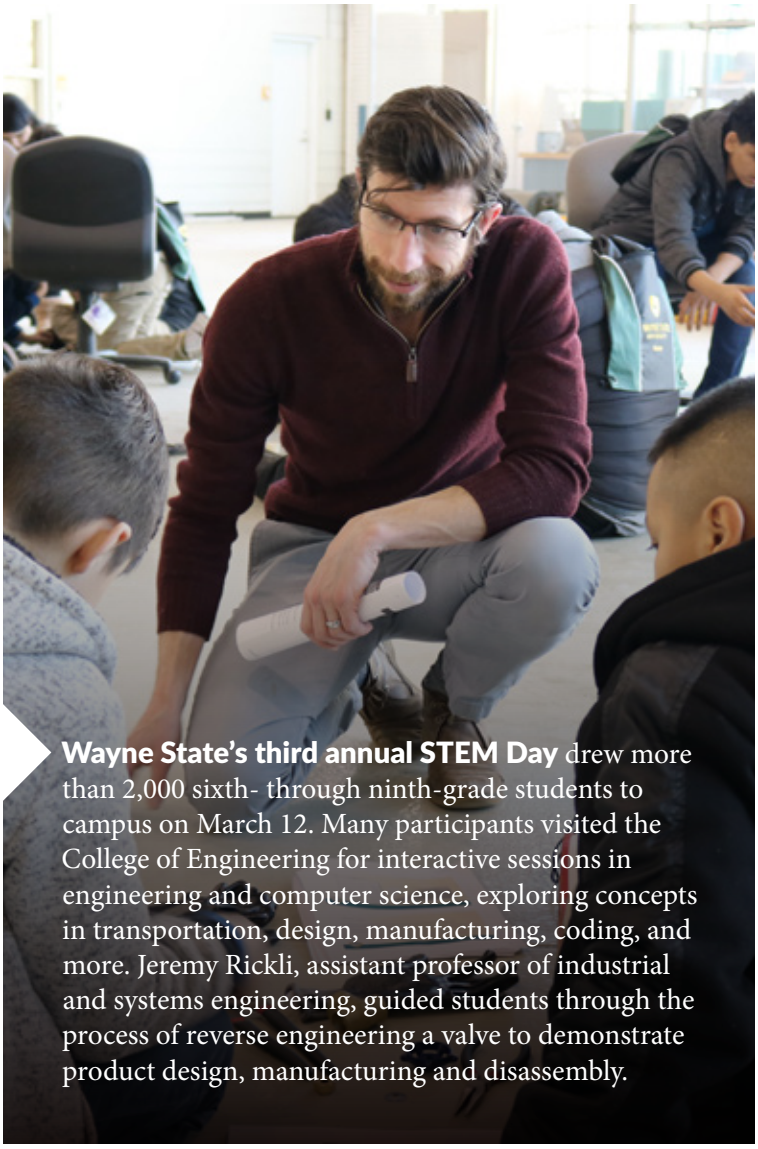


Four of the final six teams in the Wayne State STEAM Challenge included students representing the College of Engineering, and three of those teams took home prize money as the winners were announced March 25. Afreen Fatima, a biomedical and electrical engineering graduate research assistant (pictured inside right), was a co-developer of DiscoverMI, which won the $10,000 first prize. DiscoverMI challenges Detroit's negative stereotypes by encouraging tourists and locals to explore the city's hidden gems in an augmented reality app that provides users with rewards and challenges to keep them wanting to learn more about the city.

More than 500 students attended Wayne State University's K-12 engineering summer camps to learn from engineering graduate students, attend guest lectures from professors and explore Detroit during various field trips. The week-long, age-appropriate sessions ranged from coding and game design, to robotics and photography, to construction technology and biomedical engineering. The annual camps are aided greatly by collaboration with the educational community and partnerships with such industry leaders as DTE, Ford Motor Company, Google, General Motors and Microsoft.

The Industry Mentor Program was launched as a pilot program in 2017 as a joint effort between the Department of Chemical Engineering and the Office of Alumni Relations. It has since expanded across six engineering departments and had its highest level of participation last fall with 48 mentors and 63 students. Mentors share information about their own career paths, help with setting goals, and provide guidance, motivation and emotional support to their protégés. If you would like to be a mentor, please contact program coordinator Audrey Stephens at 313-577-6810 or audrey.stephens@wayne.edu.

The sixth annual Big Data and Analytics Summit, held March 21-22 at Wayne State University, brought together top-level academic and industry leaders from across the region to discuss how big data, analytics, and artificial intelligence strategies can drive success across all industries and enterprises. More than 500 guests from over 130 companies attended the two-day conference built around 30 case studies in areas ranging from manufacturing, finance, retail and health care to privacy and security. Attendees also enjoyed the various tutorials, networking opportunities and panel discussions, as well as a keynote address from Paul Ballew, vice president and global chief data and analytics officer at Ford Motor Company.



Wayne State's third annual STEM Day drew more than 2,000 sixth- through ninth-grade students to campus on March 12. Many participants visited the College of Engineering for interactive sessions in engineering and computer science, exploring concepts in transportation, design, manufacturing, coding, and more. Jeremy Rickli, assistant professor of industrial and systems engineering, guided students through the process of reverse engineering a valve to demonstrate product design, manufacturing and disassembly.

Eranda Nikolla wins national award for women in science

Each year, the Women Chemists Committee (WCC) of the American Chemical Society (ACS) recognizes five outstanding, early-to-midcareer women scientists with the Rising Star Award. Eranda Nikolla, associate professor of chemical engineering and materials science at Wayne State, was among the 2019 awardees and received a stipend for travel expenses to the 257th National Meeting of the ACS in Orlando, Florida, where she accepted the award and presented her innovative research in the field of electrocatalysis.

For Nikolla, minimizing emissions and reliance on fossil fuel is the ultimate goal. "Fossil fuels are a dwindling resource, and substantial release of CO2 from their processing has become a contemporary challenge," said Nikolla. "The research in my lab is guided by the aim of addressing this challenge through designing cost-effective catalysts for efficient and environmentally friendly energy and chemical conversion."

This award is the latest on an extensive list of Nikolla's professional accolades. She has also received CAREER Awards from the National Science Foundation and the Department of Energy, the 2016 Camille Dreyfus Teacher-Scholar Award, the Young Scientist Award from the International Congress on Catalysis, and an Influential Researcher distinction by the editors of *Industrial & Engineering Chemistry Research*, a weekly journal published by the ACS.

Wayne State and Amesite partner to offer professional certificates in AI and blockchain

Amesite, Inc., an Ann Arbor-based artificial intelligence software company, has partnered with Wayne State University to foster new online professional certificate programs intended to advance knowledge and skill in the burgeoning technological domains of artificial intelligence and blockchain.

These six-week programs are tailored to engineers seeking the latest innovations and applications of this technology, or professionals in other fields who can benefit from a greater understanding of technology trends.

The blockchain course guides students through the fundamentals of data storage, including security and privacy issues, regulatory questions and ways to increase efficiency and reduce costs. Students in the AI program are introduced to applications, markets and key players in AI, as well as concepts such as data collection, machine learning and natural language processing.

Both programs will emphasize how these technologies impact jobs and everyday life, and give learners a platform to engage with expert instructors as well as peers to grow their professional networks.

Mohammed Ismail honored with UNESCO Medal for renowned influence on nanoscience

In recognition of his contributions to the development of nanoscience and nanotechnologies, Professor Mohammed Ismail was among 10 prominent scientists to receive the UNESCO Medal last winter at the organization's headquarters in Paris, France.

Ismail, who joined Wayne State as chair of electrical and computer engineering in 2016, is a founding director of the Khalifa Semiconductor Research Center in the United Arab Emirates. His achievements include the development of the world first self-powered wearable device that can predict the onset of a heart attack. He is well known internationally as one of the pioneers in the field of analog, RF and mixed signal integrated circuit design in digital CMOS processes, which has led to the successful integration of many of today's complete CMOS systems-on-chip in mobile phones, notebooks, biochips and other IoT devices.

Ismail joins elite company as a UNESCO Medal recipient. Among the past awardees are Zhores Alferov and Isamu Akasaki, winners of the 2000 and 2014 Nobel Prizes, respectively, in physics; Chunli Bai, president of the Chinese Academy of Sciences; and the Massachusetts Institute of Technology.

Wayne State joins Road to Zero's effort to eliminate traffic fatalities

Enlisting in a nationwide initiative to end roadway fatalities within the next three decades, Wayne State University has partnered with Road to Zero, a coalition that develops and promotes lifesaving tactics built on evidence-based strategies and a systematic approach to eliminating risks.

Steven Lavrenz, assistant professor of civil and environmental engineering, has committed Wayne State's Transportation Research Group to join the coalition as its objectives align with the university's ongoing efforts to develop and evaluate transportation safety innovations and integrate its research into policies and programs involving engineering, education and enforcement.

"The Road to Zero Coalition is about promoting the concept of safe mobility for all people. Whether driving, walking, biking or using public transportation, there should be a universal expectation of safety and comfort on Michigan roadways," said Lavrenz, who was involved with Road to Zero while working for the Institute of Transportation Engineers in Washington, D.C., prior to his arrival to Wayne State last fall. "Through programs like Drive Safely to Wayne, the Transportation Research Group has a well-established record of promoting traffic safety in Detroit."

According to the National Safety Council, which manages the Road to Zero initiative, approximately 40,000 traffic fatalities were reported in 2018 in the U.S. for the third consecutive year.

Warrior Racing celebrates 15 years of competition

Since being established in 2003, Warrior Racing has become one of the most active and prominent student organizations within the College of Engineering. This year, with a record-high 59 group members, the team competed in the annual Formula Society of Automotive Engineers (SAE) Michigan, a four-day event at Michigan International Speedway in May, and took 55th place out of 120 teams. The following month, Warrior Racing placed 19th out of 80 teams at Formula SAE Lincoln in Nebraska.

"The road to FSAE Michigan 2019 started a year ago," said President Andrew Cucchiara. "Back in May 2018, Warrior Racing was headed to competition with a well-known and very reliable car, Road Warrior (RW) 11. Soon after FSAEM 2018, the team sat down to start making design decisions and relentlessly test RW11. We got to work on the design of RW12 in the late summer with the main goal of carrying forward many of the successful designs from RW11."

The team strategically added wings to the front and back of the car, producing down-force and increasing speed. "There were a lot of calculations and 34-hour simulations running on the school virtual lab software," said Noah Beattie, team exhaust captain. "So that was the big thing for this year, along with making the car lighter."

To counter the expenses that go with building a new car, Warrior Racing relies heavily on resources from sponsors as well as alumni. In 2015, Warrior Racing Legacy was founded for alumni to provide financial help, lend design expertise or even help with construction.

BASF lecture series brings world renowned chemical engineers to campus

Five members of the U.S. National Academy of Engineering comprise the second annual BASF Distinguished Lecture Series, a joint effort between BASF and the Department of Chemical Engineering and Materials Science.

Each speaker's visit to Wayne State is intended to stimulate idea-focused conversations about such topics as membrane technology, chemical process and control, polymers and rheology, performance materials and connected plants, and catalysis.

Norman Li, M.S. '57, founder and president of NL Chemical Technology, Inc., and Tom Edgar, professor of chemical engineering at the University of Texas at Austin and director of the UT Austin Energy Institute, opened the series in September. Chris Macosko, professor emeritus of chemical engineering and materials science at the University of Minnesota, and Gavin Towler, vice president and chief technology officer at Honeywell, will be in Detroit in October. Enrique Iglesia, professor of chemical engineering at the University of California at Berkeley, concludes the series in March 2020.

This partnership between Wayne State and BASF — the largest chemical producer in the world, with a footprint in more than 80 countries — was initiated to create another channel that connects students with professional leaders and enhances interaction among industry experts.

The Wayne State University College of Engineering is pleased to announce the addition of eight outstanding scholars, including two new department chairs, to its faculty.

MECHANICAL ENGINEERING

Gilou Agbaglah completed a trio of two-year postdoctoral fellowships at the University of Michigan, Cornell University and the University of Ottawa after earning his Ph.D. in mechanical engineering from Pierre and Marie Curie University in Paris, France in 2012. He also holds an M.S. in mechanical engineering from the university as well as a B.S. and M.S. in mathematics from the University of Lome in Togo, where he was valedictorian. Agbaglah's research interests include computational fluid dynamics, numerical and CFD simulations, surface tension and multiphase flow.

BIOMEDICAL ENGINEERING *(Chair)*

Cynthia Bir was a biomedical engineering faculty member at Wayne State from 2000-14 before joining the University of Southern California as a professor in the Division of Trauma at the Keck School of Medicine. Bir is an internationally-renowned expert in human injury tolerances, with particular research interests in sports injury biomechanics, ballistic impacts, blast injury and forensic biomechanics. Several organizations have relied on her expertise, such as the National Football League Engineering Committee and the LCG9 Blue Trauma Group for NATO. Bir was also lead scientist for ESPN's Sport Science and National Geographic's Fight Science. She has generated over $11 million in external funding and published nearly 70 journal articles. Bir has a B.S. in nursing from Nazareth College, an M.S. in bioengineering from the University of Michigan, and an M.S. in mechanical engineering as well as a Ph.D. in biomedical engineering from Wayne State University. She was inducted as a fellow into the American Institute for Medical and Biological Engineering and into the Wayne State University College of Engineering Hall of Fame.

COMPUTER SCIENCE

Zheng Dong completed his doctoral work in 2019 at the University of Texas at Dallas, focusing his work on developing efficient real-time scheduling algorithms and timing validation techniques to enhance the computing capability of cyber-physical systems (CPS) powered by homogeneous or heterogeneous multicore platforms. Dong has developed several scheduling techniques to analyze CPS in different scenarios, such as data analytics-driven CPS, Internet of Things, wireless sensor networks and mobile edge computing. Before joining UT Dallas, Dong received his master's in software engineering from University of Science and Technology of China in 2011 and his bachelor's in computer science and technology from Wuhan University in 2008.

CIVIL AND ENVIRONMENTAL ENGINEERING

Yaoxian Huang completed his Ph.D. in environmental engineering at Michigan Technological University in 2014 and subsequently worked as a postdoctoral fellow at the National Oceanic and Atmospheric Administration, a postdoctoral associate at Yale University and, most recently, a postdoctoral fellow at the University of Michigan's Department of Climate and Space Sciences and Engineering. Huang's research interests include atmospheric chemistry and climate modeling; greenhouse gas quantification and attribution; impacts of anthropogenic emissions on air quality, climate and health; aerosol-cloud-radiation interaction; impacts of climate change on air quality; and satellite remote sensing. He also holds a B.S. and M.S. in environmental engineering from East China University of Science and Technology.

MECHANICAL ENGINEERING

Mahbubul Islam spent the last two years working as a postdoctoral research assistant at the School of Materials Engineering at Purdue University, where he investigated the physics and chemistry of high-energy materials at extreme conditions of pressure and temperature. He earned his Ph.D. from the Department of Mechanical and Nuclear Engineering at Penn State University. In his doctoral research, Islam developed an explicit electron version of the ReaxFF reactive force field method and worked on the development of a lithium-sulfur force field and molecular dynamics simulations of Li-S battery cathode materials, anode-electrolyte interfacial chemistries, and hydrogen embrittlement in structural iron. He holds a bachelor's and master's in mechanical engineering from the Bangladesh University of Engineering and Technology.

INDUSTRIAL AND SYSTEMS ENGINEERING

Sara Masoud earned her doctorate in systems and industrial engineering as well as a master's in statistics from the University of Arizona in May 2019. Masoud has worked on a diverse collection of projects sponsored by NSF and USDA that involve data analytics, simulation, and optimization of large-scale systems. Her other research interests include distributed and hybrid modeling paradigms, machine learning algorithms, and computationally feasible analysis of massive datasets. Her dissertation focused on designing and developing a decision support tool for agro-industrial production systems with an emphasis on manual labor performance. Masoud also holds a bachelor's in industrial engineering from Sharif University of Technology.

ELECTRICAL AND COMPUTER ENGINEERING

Masoud Nazari spent four years as an assistant professor of electrical engineering at California State University, Long Beach. His background is in computational methods for cyber-physical systems with a focus on the theory and application of Internet of Things (IoT) and data analytics in smart buildings, smart grids and autonomous systems. Nazari is the primary investigator of a $2.5 million California Energy Commission project to develop an innovative building energy management system. He received a dual Ph.D. in electrical and computer engineering, and engineering and public policy, from Carnegie Mellon University in 2012, and was a postdoctoral fellow from 2013 to 2015 at the Georgia Institute of Technology. He also holds master's degrees from Carnegie Melon and the Sharif University of Technology in Tehran, Iran.

CIVIL AND ENVIRONMENTAL ENGINEERING *(Chair)*

Bill Shuster comes to Wayne State from the U.S. Environmental Protection Agency, where since 2002 he served as a senior research hydrologist. Shuster has conducted groundbreaking field research in a nationwide assessment of urban soils for their suitability in development of engineered green infrastructures, developing the science around improved demolition practices, researching how cities can leverage urban landscapes and soils toward stormwater and wastewater management objectives, and applications of sustainability science to urban hydrology. He secured over $6 million in funding from sources such as the U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Department of Agriculture and the Natural Resources Conservation Service. His research led to over 70 journal publications and over 100 abstract and presentations. Shuster earned his B.S. in physics from the University of Michigan and his Ph.D. in environmental science from The Ohio State University.

3,493 Total Enrollment

LEVEL

Undergraduate **2,498**
71.5%
Graduate **995**
28.5%

FULL/PART TIME

Full Time **2,371** — 67.9%
Part Time **1,122** — 32.1%

GENDER

Female **886** — 25.5%
Male **2,604** — 74.5%

RESIDENCY AND LEVEL

In-State Undergraduate	2,371 STUDENTS
In-State Graduate	127 STUDENTS
Out-of-State Undergraduate	510 STUDENTS
Out-of-State Graduate	485 STUDENTS

CLASS LEVEL

FRESHMAN	554
SOPHOMORE	381
JUNIOR	556
SENIOR	1,017
MASTER'S	698
DOCTORATE	297

DIVERSITY AND INCLUSION

- Female student enrollment up **80%** since 2012
- Hispanic student enrollment up **167%** since 2012
- African-American female student enrollment up **39%** since 2014

FACULTY AND STAFF

Full-Time Staff → **71**
Full-Time Faculty → **135**

Since 2012:

- **77%** of new faculty have funded research
- **21%** of new faculty are women
- **41%** received CAREER awards
- **20%** are Fellows of professional societies

DEGREES AWARDED

IN 2018-19

Bachelor's	431
Master's	413
Ph.D.	44
Certificate	5

TOP 100 GRADUATE PROGRAMS

(U.S. News and World Report)

- Biomedical Engineering
- Chemical Engineering and Materials Science
- Computer Science
- Industrial and Systems Engineering

COUNTRIES REPRESENTED BY CURRENT STUDENTS	47
LIVING ALUMNI	29,429
STUDENT ORGANIZATIONS AND TEAMS	20

RESEARCH EXPENDITURES *2018 fiscal year* **$19,019,000**

By Source

National Institutes of Health	$1,141,000
National Science Foundation	$3,384,000
Department of Energy	$465,000
Department of Defense	$1,551,000
All other fed/state/local agencies, private industry, etc.	$12,478,000

**All figures represent fall 2019 unless otherwise indicated*

WAYNE STATE UNIVERSITY

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