# *The* TREND *in Engineering*

THE UNIVERSITY OF WASHINGTON COLLEGE OF ENGINEERING NEWSLETTER SPRING 2016

## Engineering student success through STARS

*Pages 4-5*

## FROM THE DEAN

Spring quarter is a busy time for our students and faculty. For the graduating class of 2016, this quarter is the culmination of a rigorous journey. Our seniors are wrapping up their capstone design projects, and many students are participating in—and winning—annual innovation competitions. Our Career Center @ Engineering is overflowing with students pursuing professional opportunities and internships. Educating engineers is our highest priority, and we continue to grow our ability to meet the increasing needs of our community.

Since our last publication, a Reuters ranking was released that rated the University of Washington as the most innovative public university in the world—and fourth overall, behind only Stanford, MIT and Harvard. Our engineering faculty power the engine of UW innovation. Over the last five years engineering faculty were responsible for over half of the innovations reported, patents filed and start-ups produced.

Our five-year strategic plan for the College underscores our commitment to provide our students with a world-class engineering education. One of our goals is to increase diversity, inclusion and access to foster excellence. This issue's feature story exemplifies that goal and shows the life-changing impact of our diversity and access programs.

We continue to invest in key facilities. A $37 million renovation of the Washington Nanofabrication Facility is now underway. Construction continues on the Nanoengineering & Sciences building that is scheduled to open in 2017. And we aim to break ground next year on the construction of a new building for computer science and engineering.

This quarter is filled with many events including the annual Diamond Awards dinner and, of course, commencement.

Mike Bragg
*Frank & Julie Jungers Dean of Engineering*

## Honors & Awards

*Several faculty and alumni have received honors and awards this year. We highlight a few below.*

**National Academy of Engineering welcomes UW professor, alumni**
Tom Anderson, '89 MS, '91 PhD, professor of computer science and engineering, has been elected to the National Academy of Engineering. Also elected are civil engineering alumnus Jon Magnusson, '75 BS, and computer science alumnus Albert Greenberg, '81 MS, '83 PhD.

**Rajesh Rao receives Guggenheim fellowship**
Rajesh Rao, director of the Center for Sensorimotor Neural Engineering and professor of computer science and engineering, has been awarded a 2016 Guggenheim fellowship for his project, The Computational Brain: Understanding and Interfacing with Neuronal Networks.

**Professors win Presidential Early Career Award for Scientists and Engineers**
Shwetak Patel, the Washington Research Foundation Entrepreneurship Endowed Professor in computer science and engineering and electrical engineering, and Luke Zettlemoyer, associate professor of computer science and engineering, have received the 2016 Presidential Early Career Award for Scientists and Engineers.

**Suzie Pun named a 2015 National Academy of Inventors Fellow**
In December, bioengineering professor Suzie Pun was named a 2015 National Academy of Inventors Fellow. Her research focuses on developing bioinspired materials for medical applications.

**Five faculty listed among 'world's most influential scientific minds' by Thomson Reuters**
Thomson Reuters has selected five engineering faculty members for their list of highly cited scientific researchers: Guozhong Cao, Alex Jen and Miqin Zhang, professors of materials science and engineering; Samson Jenekhe, professor of chemical engineering; and William Noble, professor of genome sciences and adjunct professor of computer science and engineering.

**Three faculty honored with UW's 2016 Awards of Excellence**
The UW's Awards of Excellence recognize individuals for achievements in teaching, mentoring, public service and staff support. Cole DeForest, assistant professor of chemical engineering, and Wendy Thomas, associate professor of bioengineering, have received Distinguished Teaching Awards. Joe Mahoney, professor of civil and environmental engineering, is the recipient of the Distinguished Contributions to Lifelong Learning Award.

## UW center receives $16M to work on first implantable device to reanimate paralyzed limbs

In the next decade, people who have suffered a spinal cord injury or stroke could have their mobility improved or even restored through a radically new technology: implantable devices that can send signals between regions of the brain or nervous system that have been disconnected due to injury.

That's the mission driving the Center for Sensorimotor Neural Engineering (CSNE), a UW-led effort that includes researchers from the Massachusetts Institute of Technology, San Diego State University and other partners.

To support development of this much-needed technology, the National Science Foundation recently renewed the center's funding. It has awarded $16 million over the next four years to support research on implantable devices that promote brain plasticity and reanimate paralyzed limbs.

"There's a huge unmet need, especially with an aging population of baby boomers, for developing the next generation of medical devices for helping people with progressive or traumatic neurological conditions such as stroke and spinal cord injury," said CSNE director and UW professor of computer science and engineering Rajesh Rao.

The goal is to achieve proof-of-concept demonstrations in humans within the next five years, Rao said. This will lay the groundwork for eventual clinical devices approved by the Food and Drug Administration, in collaboration with the center's industry partners.

## Engineering student teams win big at 2016 UW Innovation Challenges!

Engineering students swept the eighth annual Alaska Airlines Environmental Innovation Challenge (EIC) and placed highly in the inaugural Health Innovation Challenge (HIC). Held in March, these events provided interdisciplinary student teams the opportunity to solve pressing issues affecting the environment and in healthcare.

Teams pitched their innovations, demonstrated their prototypes and fielded questions. They were judged on four criteria: the problem they set out to solve, their pitch, the prototype demonstration and their ability to articulate the potential for impact.

At the EIC, UW teams won first, second and third place, as well as the clean energy prize. They included students from civil and environmental engineering, mechanical engineering and chemical engineering:

- First place: AgriC, a technology that produces chitin-based biodegradable plastics for agricultural mulch and also functions as a fertilizer after decomposing.
- Second place and clean energy prize: Ionic Windows, which provides low-cost, high-performance membranes for grid-scale energy storage technologies.
- Third place: ETA1, a device that converts wasted heat energy from car engines into electrical energy which, in turn, increases fuel economy.

UW teams led by bioengineering and computer science and engineering students won second and third place at the HIC:

- Second place: miPS Labs, which allows individuals to preserve their youngest cells today to repair and regenerate their bodies in the future.
- Third place: Multimodal Health, a project using advanced data science and engaging software to quantify rehab, extending advanced treatment from the clinic to the home.

Learn more at foster.uw.edu/buerk.

The Washington STate Academic RedShirt (STARS) program is making waves college-wide by setting students up for boundless opportunities in engineering. And it's only in its third year. What's next?

# Engineering Student Success through STARS

By Chelsea Yates

When asked why he decided to study engineering, Jorge Gomez* answers in one word: dams. As a kid growing up in Tri-Cities, Washington, he'd go camping along the Columbia River, and he became fascinated with the way dams worked. When he discovered that engineers brought together nature and technology to produce energy through dams, Gomez decided he wanted to be an engineer. The UW had a strong engineering school, so he set his sights on becoming a Husky.

He was both excited and anxious. The first in his family to attend college, Gomez wanted to set a positive example for his younger siblings, but he didn't want to be apart from them. His parents, though supportive of his education, depended heavily on him at home. "I'm not going to lie, I initially feared coming to the UW because I would have to leave my family," he says. Additionally, he didn't know who to ask for advice on transitioning to college life. He'd received decent grades in high school but he worried that he wasn't academically prepared to compete with other engineering students.

"Luckily I found STARS," says Gomez, who is finishing his first year. "If it weren't for STARS, I probably wouldn't still be a student here."

Gomez is one of 75 students enrolled at the UW through STARS, a program designed to increase the number of students from economically- and educationally-disadvantaged backgrounds who graduate with UW engineering degrees by providing a strong foundation through extra academic support, mentoring and funding.

Historically, fewer than half of the students who enter the UW intending to study engineering complete engineering degrees. The success rate is nearly 20% lower for students from low-income and underserved communities. Often, these students have difficulty gaining admission to engineering departments due to inadequate high school preparation.

Even students who earn A's in high school aren't necessarily prepared for the difficulty of college-level classes. Many become discouraged and turn away from engineering.

## Access: A social justice issue

"It is a social justice issue that economically and educationally-disadvantaged students be given every opportunity to pursue high-value UW degrees, such as those offered by the College of Engineering," says Eve Riskin, the College's associate dean for diversity and access. In collaboration with colleagues at the UW and Washington State University, Riskin secured a grant from the National Science Foundation in 2013 to implement STARS, originally modeled after University of Colorado-Boulder's Engineering GoldShirt Program.

One of several access programs offered by the College, STARS focuses on building academic skills, providing students with a supportive community and educating them about the different types of engineering paths to find the right fit.

## An academic "redshirt year"

To think in terms of college athletics, STARS offers participating students a "redshirt year:" students spend five years at the UW, using the first year to develop the skills they'll need to succeed in engineering.

At the UW, 32 incoming freshmen are invited to participate annually. Entry into the program isn't based solely on academic performance, as STARS program director Sonya Cunningham explains, "It's not just about how smart you are but how hard you're willing to work." Students must tackle a workload drastically different than high school.

First-year STARS student Donavan Erickson* can attest to this: "Nothing in high school prepared me for the amount of time and energy that it takes to do well at the UW, and I'm so thankful for the foundation in these areas that STARS is giving me."

In many underserved high schools, classes like calculus, chemistry and physics may not be offered, and when they are, they're not usually at the same level of rigor as similar courses taught elsewhere. As a result, students may do well but aren't prepared. Cunningham explains, "Students who scored high by memorizing facts and formulas still need to develop different skills to be successful—namely problem-solving and critical thinking."

Students develop study skills through regular meetings with STARS advisers, participation in study groups and by spending time at the UW's Engineering Academic Center. They take classes together as a cohort and look to each other for support. STARS students are required to live on-campus their first two years and are placed in the same residence halls.

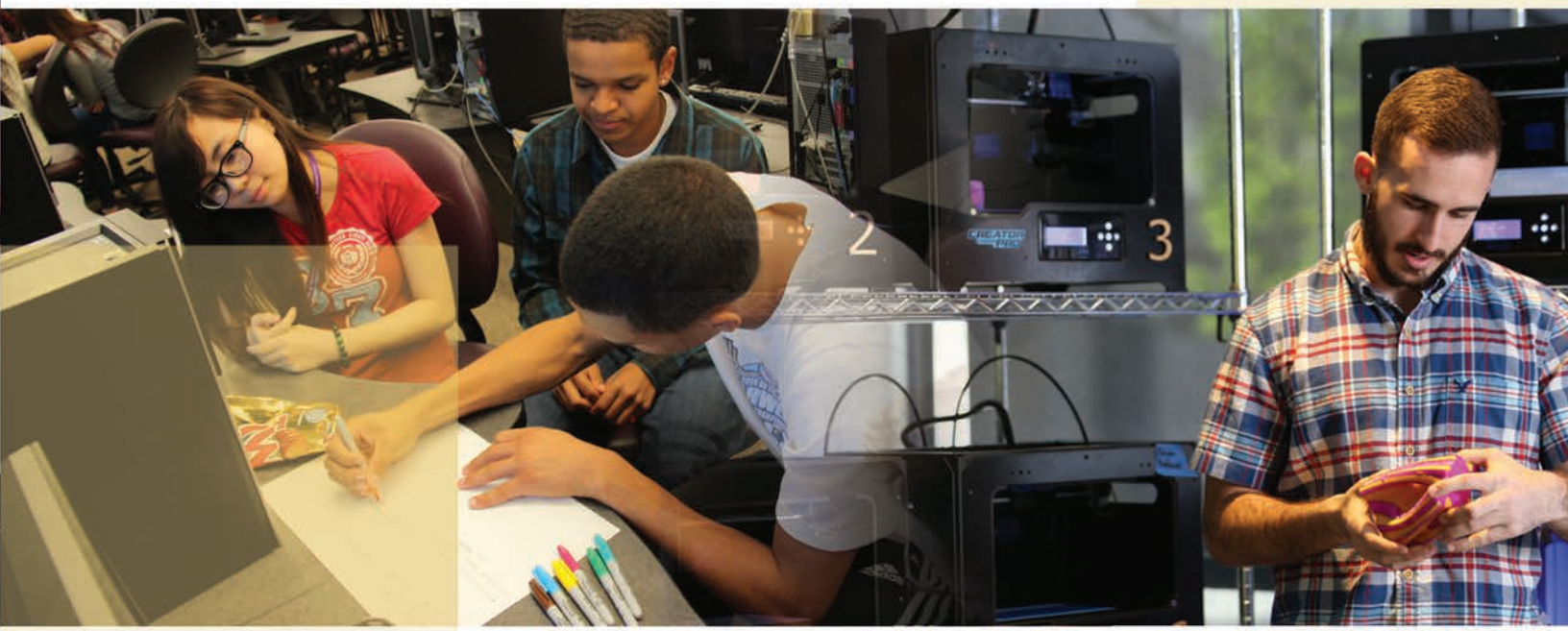
"STARS makes a large, intimidating place like the UW seem small, accessible and encouraging," says Gomez.

For Erickson, the STARS community makes all the difference. "I'm closer to my peers, closer to campus resources like the engineering, math and writing centers, and I have a network of people that I can ask when I need help," he explains.

## Together, undaunted

Only in its third year, STARS is reporting positive impact in terms of student retention and performance. Overall, STARS students have achieved higher GPAs and performed better in their math and science courses relative to students who were eligible for STARS but didn't participate. And 83% have been retained in engineering to their sophomore year, compared to just 53% eligible but non-participating students. STARS students are also significantly more familiar with student resources on campus, such as academic help desks, centers and faculty office hours.

The program's impact is rippling through the College. Since STARS began, enrollment of under-represented minority students has increased by 93.5% while overall enrollment in the College has increased by 30.5%. Classrooms are more diverse, Riskin says, which means students of all backgrounds are better prepared to enter an increasingly diverse work environment.



For Cunningham, one of the most exciting aspects of STARS is continually observing how well students do when expectations are set high. "We see it with each new cohort—with guidance, structure and support, students will rise to the challenges set before them," she says.

STARS students who have fulfilled program requirements by the end of their first year are guaranteed a spot in one of the UW's engineering programs. Both Gomez and Erickson hope to pursue electrical engineering and feel they are much better positioned to succeed in it than they would have been without STARS.

"When I came to the UW, I was one person, and now, thanks to STARS, I'm a very different person—more focused, conscious, engaged and prepared," Erickson says.

Learn more at engr.uw.edu/current/stars

**Featured on the front cover are students Donavan Erickson and Jorge Gomez.*

## Engineering student team heads to SpaceX for hyperloop competition

Imagine traveling from San Francisco to Los Angeles in under 30 minutes at transonic speed. Sound unreal? A team of engineering students known as UWashington Hyperloop has been working to actualize this process, and they've received an award for their work from Elon Musk's "hyperloop" design competition.

A ground transportation theory developed by Musk, hyperloop would allow people to travel at hypersonic speed via pods inside vacuum tubes. Musk recently invited engineering and design students across the country to work through the idea. More than 100 teams—including the UW's—accepted the challenge.

At a ceremony held in January at Texas A&M University, the UW team—which includes students from several engineering departments—received the Safety Subsystem Technical Excellence Award.

Musk made a surprise appearance at the awards ceremony, during which he expressed his amazement at the interest and talent in the competition. Civil engineering senior Malachi Williams asked Musk if he would sign the UW team's trophies, which Musk did.

"I knew I just had to ask him to sign our award," said Williams, who has recently accepted a summer internship with Tesla. He hopes he'll have a chance to let Musk know in-person how much the experience meant to the UW team.


UWashington Hyperloop will continue to refine the project until the next leg of the competition, where they will be invited to test a prototype hyperloop pod on a one-mile track at SpaceX headquarters in Hawthorne, California this summer.

"I'm most looking forward to being a part of something so new," said senior electrical engineering major Anthony Grigore. "If this form of transportation gets traction in industry, we can say we were part of the movement to introduce it to the world."

Learn more at hyperloop.io

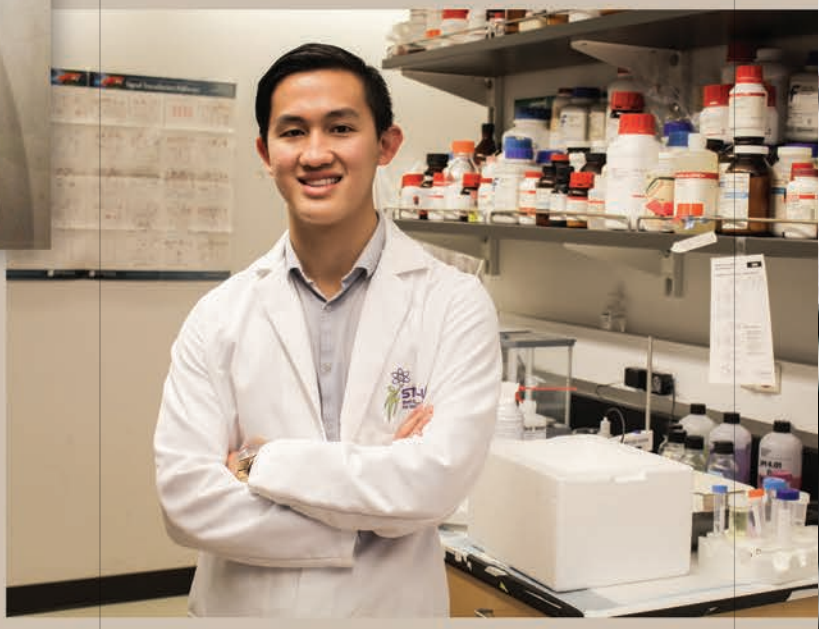
## Bioengineering student receives UW Freshman Medal

Bioengineering sophomore Caleb Perez has received the UW Freshman Medal for academic achievement from UW President Ana Mari Cauce. This medal is awarded annually to the UW sophomore having the highest scholastic standing for the first year of his or her course.

Perez's interest in bioengineering was inspired by his family's history of health challenges. "We are no strangers to the impact of medicine, both its miracles and shortcomings," he explained. He was particularly motivated by his grandfather, who suffered from acute heart disease.

"A heart transplant gave him the gift of eight additional years," Perez said. But he later died after developing an untreatable infection caused by a minor fall. By pursuing a career in bioengineering, Perez hopes to overcome health care challenges such as those experienced by his grandfather and other family members.

In addition to his studies, Perez works in a lab under the direction of Ying Zheng, assistant professor of bioengineering, and participates in Bioengineers Without Borders, a student group that develops low-cost, sustainable medical technologies while providing engineering design experience and professional development.



# RESEARCH

## New pen-sized microscope could ID cancer cells in doctor's offices and operating rooms

UW mechanical engineers are developing a miniature microscope that will allow doctors and dentists to distinguish between healthy and cancerous cells in an office setting. This new technology, which is being advanced in collaboration with Memorial Sloan Kettering Cancer Center, Stanford University and the Barrow Neurological Institute, will also give surgeons the ability to "see" at a cellular level in the operating room and determine where to stop cutting.

"Surgeons don't have a very good way of knowing when they're done cutting out a tumor," said Jonathan Liu, UW assistant professor of mechanical engineering and one of the principal investigators. "They're using their sense of sight, their sense of touch, pre-operative images of the brain — and often it's pretty subjective.

"Being able to zoom and see at the cellular level during the surgery would help them to accurately differentiate between tumor and normal tissues and improve patient outcomes," said Liu.

The handheld microscope, roughly the size of a pen, combines technologies in a novel way to deliver high-quality images at faster speeds than existing devices. Researchers expect to begin testing it as a cancer-screening tool in clinical settings next year.

## Family technology rules: What kids expect of parents

A new study from UW human centered design and engineering researchers is among the first to survey kids about technology rules they would set for their parents.

The technology rules kids wished their parents would follow fell into seven general categories:

- Be present: Children felt there should be no technology at all in certain situations, such as when a child is trying to talk to a parent
- Child autonomy: Parents should allow children to make their own decisions about technology use without interference
- Moderate use: Parents should use technology in moderation and in balance with other activities
- Supervise children: Parents should establish and enforce technology-related rules for children's own protection
- Not while driving: Parents shouldn't text while driving or sitting at a traffic light
- No hypocrisy: Parents should practice what they preach, such as staying off the Internet at mealtimes
- No oversharing: Parents shouldn't share information online about their children without explicit permission.

## UW engineers achieve Wi-Fi at 10,000 times lower power

The upside of Wi-Fi is that it's everywhere—invisibly connecting laptops to printers, allowing smartphones to make calls or stream movies without cell service, and letting online gamers battle it out.

The downside is that using Wi-Fi consumes a significant amount of energy, draining the batteries on all those connected devices.

A team of UW computer scientists and engineers has demonstrated that it's possible to generate Wi-Fi transmissions using 10,000 times less power than conventional methods. This new "Passive Wi-Fi" system transmits Wi-Fi signals at bit rates of up to 11 megabits per second that can be decoded on any of the billions of devices with Wi-Fi connectivity, but it does so by turning existing signals in the air into power sources for battery-free devices.

In addition to saving battery life on today's devices, wireless communication that uses almost no power will help enable an "Internet of Things" reality where household devices and wearable sensors can communicate using Wi-Fi without worrying about power.

Shyam Gollakota, assistant professor in computer science and engineering and one of the technology's lead developers, was named to CNN Money's list of top five innovators changing the world. It has also been heralded as one of the 10 breakthrough technologies of 2016 by MIT Technology Review and is being commercialized through a spin-off company, Jeeva Wireless.

Learn more at passivewifi.cs.washington.edu.

COLLEGE OF ENGINEERING
UNIVERSITY of WASHINGTON

371 Loew Hall, Box 352180
Seattle, Washington 98195-2180

**Michael B. Bragg, PhD**
*Frank & Julie Jungers Dean of Engineering*
**Judy Mahoney**
*Associate Dean of Advancement*
**Heather Hoeksema**
*Senior Director of Communications*
**Chelsea Yates**
*Assistant Director of Publications*
**Jennifer Langston**
*Science Writer*
**Mary Macenka**
*Graphic Design*

*Send address corrections or comments to:*
*trenduw@uw.edu attn: Editor*

Read more news at **www.engr.uw.edu/news**
Follow us at **www.facebook.com/UWEngineering**
Find us on **Twitter @uwengineering**


**Diamond Awards** Eleventh Annual Dinner Friday, May 20, 2016, 6-9 PM **wəɬəb?altxʷ** – Intellectual House, UW Campus

Please join the College of Engineering as we honor six engineers with Diamond Awards for their outstanding achievements.

**Frank Jungers,** *'47 BS Mechanical Engineering*
*Dean's Award*

During his 31-year career at Arabian-American Oil Company (Aramco), Frank Jungers was an influential figure at critical moments in the development of the Middle East oil industry. Since retiring, he has served on the boards of several Fortune 100 companies.

**Michael Garrison,** *'99 PhD Bioengineering*
*Distinguished Achievement in Industry*

Michael Garrison has helped to improve care, prevent infection and enable cost-effective drug delivery globally by overseeing the development and commercialization of critical medical devices and products.

**Louis Scharf,** *'64 BS, '66 MS, '69 PhD Electrical Engineering*
*Distinguished Achievement in Academia*

Louis Scharf's 45-year research and teaching career has been dedicated to statistical signal processing, one of the essential elements of contemporary digital technology. A foremost authority in his field, Scharf is a Life Fellow of IEEE and has held appointments at universities worldwide.

**Peter Janicki,** *'89 MS Mechanical Engineering*
*Entrepreneurial Excellence*

Peter Janicki's pioneering work in composite tooling has transformed the aerospace, wind energy and transportation industries. In partnership with the Gates Foundation, he developed the Omni Processor, a revolutionary device to redefine water sanitation.

**Ron Crockett,** *'61 BS Mechanical Engineering*
*Distinguished Service*

As the founder of multiple successful companies, Ron Crockett is known for his business acumen, but some of his most remarkable contributions are in service to higher education. Crockett attended the UW with scholarship support and has been committed to helping students succeed.

**Benjamin Hindman,** *'07 BS Computer Science & Engineering*
*Early Career*

If you've used Yelp to look up restaurants or watched a movie on Netflix, you can thank Ben Hindman for the software that provides such content with ease and reliability. As the co-creator of Mesos technology and founder of Mesosphere, Inc., he improved the efficiency of data systems and sparked an innovative new technology industry.

**Learn more about the honorees and the dinner at engr.uw.edu/da**