The Trend in ENGINEERING

UNIVERSITY OF WASHINGTON COLLEGE OF ENGINEERING NEWSLETTER / **AUTUMN 2019**

Transformation and impact

The start of the school year is an exciting time on campus. Adding to the excitement this fall are more new faces in the College of Engineering, further innovative research advancements, and increased opportunities in engineering education thanks to the state's investment initiated last spring.

We are delighted to welcome the new Frank & Julie Jungers Dean of Engineering, Dr. Nancy Allbritton, who will begin her tenure on November 1. Dr. Allbritton is a nationally recognized leader, and you can get to know her better via the story on pages 4-5. Also joining us this year are 13 new faculty members, who you can meet at engr.uw.edu/newfac2019. And we are thrilled to welcome nearly 830 first-year engineering students in our second Direct to College cohort.

Our cover story exemplifies the high-impact research our faculty and students are leading. Researchers from the College of Engineering, College of the Environment and School of Public Health are working with locals in Cambodia to understand how changes to the Mekong River will impact fish and rice production in the region. This work has the potential to inform future hydropower projects worldwide.

On the subject of change, you may notice *The Trend* itself has gone through a bit of a transformation. Many thanks to the alumni who participated in our newsletter focus groups last spring. We're excited to roll out changes in this issue based on their recommendations, such as a new events section and more pages highlighting research. We hope you enjoy these additions and welcome your feedback.

Gregory Miller, PhD
Interim Dean of Engineering

Thank you, Olympia

The Washington Legislature has made a significant, forward-looking investment in the future

The spring 2019 legislative session ended with great support for the College of Engineering. Legislators created a dedicated revenue source through an increase in the Business and Occupation Tax on certain professional businesses and services. Through this new revenue source, funding was granted to expand engineering enrollment and support STARS, our highly impactful academic program that is increasing access and diversity among our undergraduates. Legislators also voted to invest in the design of a new engineering facility — a greatly needed step in our campaign to build a new interdisciplinary teaching and research building.

The state funding is a positive investment in the region's future, and the College thanks the members of the House and Senate, as well as Governor Jay Inslee, for their hard work and vision. We also thank those businesses, such as Microsoft and Amazon, that supported tax legislation actively during the session.

Magdalena Balazinska to serve as the Allen School's new director

This January, we welcome Professor Magdalena Balazinska as Director of the Paul G. Allen School of Computer Science & Engineering. A respected scholar, Balazinska brings leadership experience that will serve the school well as it continues to grow in size and stature. As director of the eScience Institute and Associate Vice Provost for Data Science, she has developed cross-campus partnerships to advance data-intensive discovery and established herself as an outstanding leader.

A professor of computer science and engineering who joined the UW faculty in 2006, Balazinska holds a PhD from the Massachusetts Institute of Technology. Her research interests are in the field of database management systems. At the UW, she has spearheaded the establishment of educational programs at all levels for students in the burgeoning field of data science. She has a broad vision of the societal impact of the field of computer science and will build upon the strong foundation of the school to advance that vision.

François Baneyx named director of UW CoMotion

François Baneyx, the Charles W.H. Matthaei Professor of Chemical Engineering, has been named the new director of UW CoMotion and Interim Vice Provost of Innovation.

CoMotion is the UW's collaborative innovation hub dedicated to expanding the economic and societal impact of the UW community. Baneyx will draw from several years of leadership and innovation experience. Currently he directs the Center for the Science of Synthesis Across Scales, a multi-institution Energy Frontier Research Center funded by the U.S. Department of Energy. He has previously served as site director of the National Nanotechnology Infrastructure Network, director of the Center for Nanotechnology and chair of the Department of Chemical Engineering. A researcher whose work lies at the confluence of engineering, biology and nanotechnology, Baneyx is also the co-founder of Proteios, a UW spinoff.

Kristi Morgansen appointed as Aeronautics & Astronautics chair

Professor Kristi Morgansen was named chair of the William E. Boeing Department of Aeronautics & Astronautics in May. She served as the interim chair since September and as Associate Chair for Academics since 2015.

Morgansen's research focuses on nonlinear systems where sensing and actuation are integrated, stability in switched systems with delay, and incorporation of operational constraints such as communication delays in control of multi-vehicle systems. Applications include both traditional autonomous vehicle systems, such as fixed-wing aircraft and underwater gliders, as well as novel systems — including bio-inspired underwater propulsion, bio-inspired agile flight, human decision-making and neural engineering.

W MATERIALS SCIENCE & ENGINEERING 125 YEARS

Materials Science & Engineering celebrates 125 years

Join us in wishing a happy anniversary to MSE! Alumni and friends gathered on Sept. 13, 2019, to reflect on the 125-year journey from "College of Mines" to "Mineral Engineering" to the Department of Materials Science & Engineering (MSE) as it's known today.

Meet NANCY ALLBRITTON

By Chelsea Yates

ON NOVEMBER 1, DR. NANCY ALLBRITTON WILL JOIN US AS THE NEW FRANK & JULIE JUNGERS DEAN OF THE COLLEGE OF ENGINEERING. A FACULTY MEMBER, RESEARCHER AND CHAIR OF THE JOINT DEPARTMENT OF BIOMEDICAL ENGINEERING AT THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL (UNC) AND NORTH CAROLINA (NC) STATE UNIVERSITY, ALLBRITTON BRINGS AN IMPRESSIVE RECORD OF LEADERSHIP, TEACHING, RESEARCH AND INNOVATION TO THE UW.

Allbritton joined UNC in 2007 after 13 years on the faculty at the University of California, Irvine. In 2009, she became chair and expanded the Joint Department of Biomedical Engineering, a single unit that spans UNC and NC State and includes faculty from UNC's School of Medicine and College of Arts & Sciences and NC State's College of Engineering. She has received excellence in teaching awards and has advised 42 graduate students and trained 33 postdoctoral fellows.

Allbritton's research has been funded by more than $60 million in grants. She develops technologies and platforms for biomedical research and clinical care, including the study and analysis of single cells for the treatment of diseases such as cancer, macular degeneration and HIV. She has co-founded four startup companies and holds 43 patents that have led to 15 commercial products.

After earning her doctorate in medical physics/medical engineering from the Massachusetts Institute of Technology, Allbritton completed a postdoctoral fellowship at Stanford University. She holds a medical degree from Johns Hopkins University and her bachelor's degree in physics from Louisiana State University.

The Trend's Chelsea Yates recently spoke with Allbritton about her background, career highlights and vision for engineering research and education at the UW.

How did you become interested in engineering?

I think I was born an engineer, even though it was years before I learned what engineers do, or that engineering was something I could do. As a child, I liked to design and build things. My grandfather and I would take apart and reassemble TVs and build bookshelves together. I designed quite a few rabbit hutches on my own. I've always enjoyed the challenge of solving problems — understanding, designing, building and testing solutions.

After years of teaching and research, what drew you to administration?

I'm driven by the question, How can I do more? Having a positive impact has always been core to my teaching and research, and I felt I could have much broader impact as an administrative leader.

What are characteristics that every leader should possess?

The ability to articulate and execute a clear vision, but more than anything, an effective leader puts others first and empowers them to succeed. Strong leaders are honest and trustworthy, they listen, and they work to develop a rich community of problem-solvers.

What attracted you to the UW? What opportunities most excite you here?

I see the UW as a fantastic, forward-looking institution — it's internationally known with numerous awards and accolades, values collaboration, research and innovation, and has a real commitment to diversity.

There also seems to be strong industry and state support for engineering in Washington that will enrich student experiences and faculty research. And cross-campus collaboration is a strength that I'm looking forward to broadening, in particular with Arts & Sciences, the Foster School of Business and UW Medicine.

Finally, how do we make engineering education scalable and affordable? There's great opportunity for the UW to become an international leader in transforming engineering education.

Tell us more about the opportunities and challenges facing engineering education, as you see them.

Making engineering accessible for people of all backgrounds is one of the biggest. High school education varies greatly, and so how can we ensure that all creative, bright minds know that engineering is an option. We also need to increase public understanding of engineering, and what engineers do. In terms of teaching and curriculum, we need to embed social responsibility, professional skills development and hands-on, real-world learning opportunities into engineering education at all levels.

We can also think more broadly about how to de-silo traditional engineering disciplines and teach engineering students to become cross-disciplinary engineers.

You've led large cross-disciplinary initiatives. What are the keys to effective partnership?

Collaboration requires diverse teams that represent diverse viewpoints — of disciplines, backgrounds and experiences. It's not enough that diversity is represented; it also must be respected. The most successful collaborations understand and embrace this.

What are some of your personal career highlights?

Seeing my students succeed and grow into leaders. I'm also very proud of the Biomedical Engineering department I've led for the last ten years. It now grants dual degrees across two universities and I feel confident it will continue to soar. As a researcher and innovator, I love identifying unmet problems in biomedical research and developing solutions. One of the best feelings is visiting someone's lab and seeing tech I've designed in use — especially when they have no idea that I developed it.

At the UW, you'll hold an appointment in Bioengineering. Tell us about your plans to continue your research.

I'm planning a scaled-down version of my current lab's work with deeper concentration in single-cell enzymatic assays and organ-on-a-chip technology. The latter will be our core focus; we're developing a large intestine-on-a-chip for better drug screening and disease modeling.

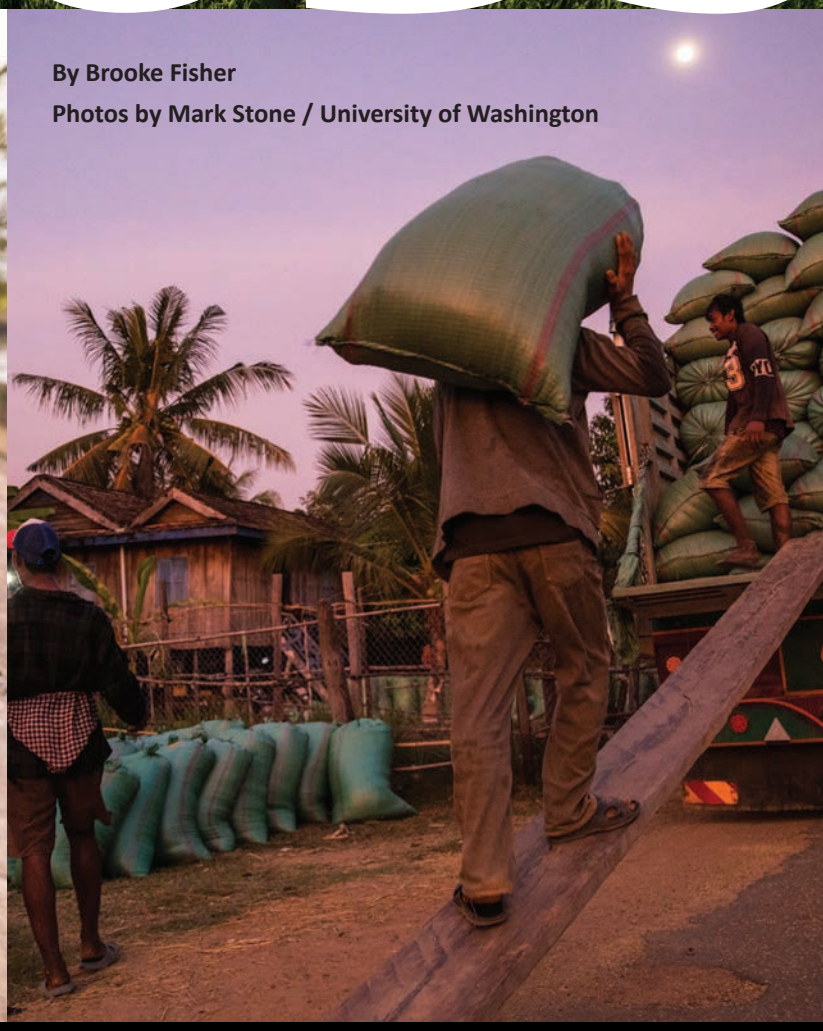
What are your thoughts on balancing the College's teaching and research missions?

Both are fundamental. Universities are economic and innovation engines; we have an obligation to develop impactful research, create new technologies and solve society's greatest problems. Similarly, we're preparing future generations of engineers, innovators and leaders. Society has given us these responsibilities, and we need to do both exceptionally well.

Join us in welcoming Dr. Allbritton to the UW Engineering community!

FUELED BY FLOODS

By Brooke Fisher
Photos by Mark Stone / University of Washington



UW RESEARCHERS ARE RACING TO DETERMINE HOW HYDROPOWER DEMAND WILL IMPACT THE SUPPLIES OF RICE AND FISH ALONG THE MEKONG RIVER – AND THE COMMUNITIES WHO RELY ON THEM.

As the outside light fades on the outskirts of Phnom Penh, the flame of a small cookstove grows brighter. With help from her daughters, Sen Mary is cooking rice and freshly caught fish for the Math family's dinner. While local food is plentiful for now, drastic change may be on the horizon.

"When I was 12, I caught a lot of fish, but now there are not as many. There may be no more fish in the future, depending on the current situation," says Sen Mary's son-in-law, Nan Sab Yi, who works as a fisherman to support the family. "We depend on fish and the river. If we don't have that, we have nothing."

The Tonle Sap, which fuels both fish and rice production, is on the brink of radical transformation. A freshwater lake with an attached river, the Tonle Sap winds through the eastern part of Phnom Penh. The largest lake in Southeast Asia, it boasts a large volume of fish and is a tributary of the mighty Mekong River, which crosses five countries before reaching Cambodia.

With a handful of new hydropower dams completed — and more than 135 either under construction or forthcoming — the Mekong's waterways will soon be altered dramatically. For Cambodians, who consume the most freshwater fish in the world and get up to 70 percent of their daily calorie intake from rice, this change may be devastating. Although hydropower development will bring low-cost, renewable electricity to some villages, the majority will be sold to countries up north. While receiving few of the benefits, the rural people of Cambodia will be among the most impacted by dam development.

To discover how changes to the Mekong will impact the future of rice and fish and, ultimately, the Cambodian people, civil and environmental engineering researchers have partnered with the College of the Environment and School of Public Health.

Relying on rice

In the late afternoon, the rice fields of Kampong Thom province glow a bright green. Located on the eastern edge of Tonle Sap Lake, farmers grow rice primarily for export, as the annual floods fuel rice production.

OPPOSITE PAGE - TOP: Farmers grow rice primarily for export, as annual flooding fuels rice production. BOTTOM LEFT: CEE graduate student Yasmine Farhat discusses her research with an official from Cambodia's Ministry of Agriculture. BOTTOM RIGHT: At dusk, workers load rice into a truck in Kampong Thom Province.

"What is often not fully appreciated in the United States is how important rice is in Cambodia," says Yasmine Farhat, a graduate student in civil and environmental engineering (CEE). "Most Cambodians eat rice three times per day."

Rice requires not only a lot of water to grow, but a lot of water at just the right time. To determine how Cambodia's most important crop will be impacted by the introduction of hydropower dams, Farhat and CEE associate professor Rebecca Neumann are investigating the nutritional quality and yield of rice in two of Cambodia's top growing areas, including Kampong Thom province.

"Our hypothesis is that the flooding allows fresh soil to settle onto the rice fields and that brings in nutrients and minerals that the plants need," Neumann says.

To uncover the severity of the impact, the researchers are measuring harmful contaminants and beneficial nutrients. By pinpointing the factors that fuel rice growth and nutrient content, they can make recommendations for water releases that support rice varieties high in minerals and low in contaminants.

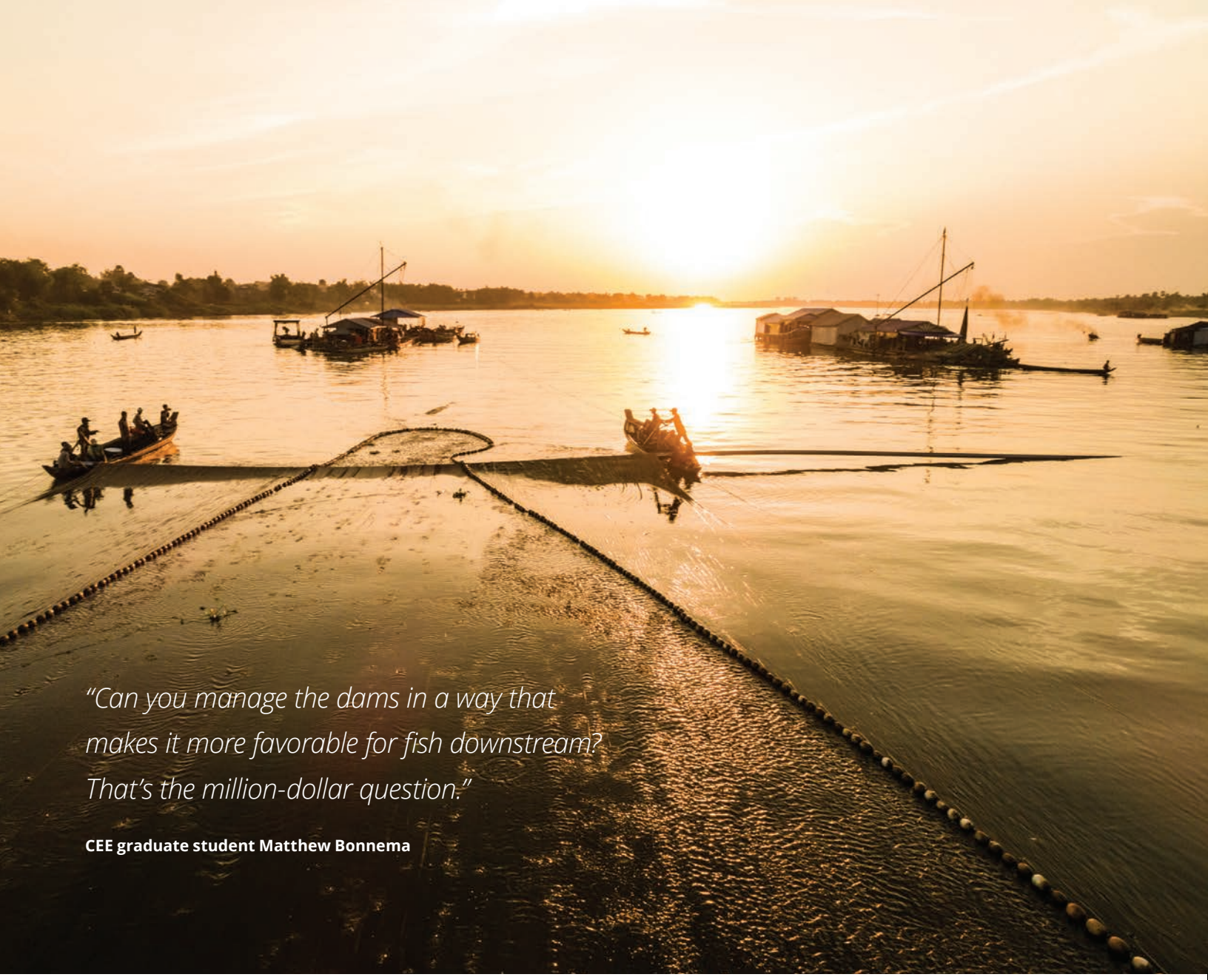
"Once we figure out what key variables are important, we can assess whether those will be impacted by the flood duration and timing and make predictions," Farhat says. "Now is a good time to start studying, before all the dams are built."

Optimal hydropower operations

Dams are nothing new to the Mekong River Basin — it hosts 315 of them across six countries. But many of the planned new dams, in addition to being larger, will have prominent downstream locations along the main river.

Existing dams in the Mekong River Basin provide clues about how future dams may impact the region. To leverage this insight, CEE graduate student Matthew Bonnema, together with faculty members Faisal Hossain and Bart Nijssen, are using satellite data to study 20 existing dams. Evaluating water release and holding patterns will provide insight that the researchers will use to develop recommendations for optimal dam operations that support nutrient-rich and high-yielding fish and rice crops.

"Can you manage the dams in a way that makes it more favorable for fish downstream?" Bonnema asks. "That's the million-dollar question."



"Can you manage the dams in a way that makes it more favorable for fish downstream? That's the million-dollar question."

CEE graduate student Matthew Bonnema

A call for collaboration

New dam construction is largely uncoordinated, placing Cambodia in a precarious position. To complicate matters, the region is also still recovering from the devastation of the Khmer Rouge regime and subsequent civil war.

In lieu of a concerted basin-wide dam management effort among the countries involved, UW researchers anticipate providing recommendations to individual countries to inform the collective operation of hydropower dams. The researchers are optimistic that hydropower operations can be programmed to meet power-generation objectives while satisfying food production.

ABOVE: During peak fishing season, fishermen work around the clock at local fisheries. More than 60 million people in the Mekong River Basin get the majority of their animal protein from freshwater fish.

"It's all about the connection between food, water and energy," Farhat says. "We are trying to understand this interplay, how the changes in water and changes in energy produced by water will impact food security in Cambodia."

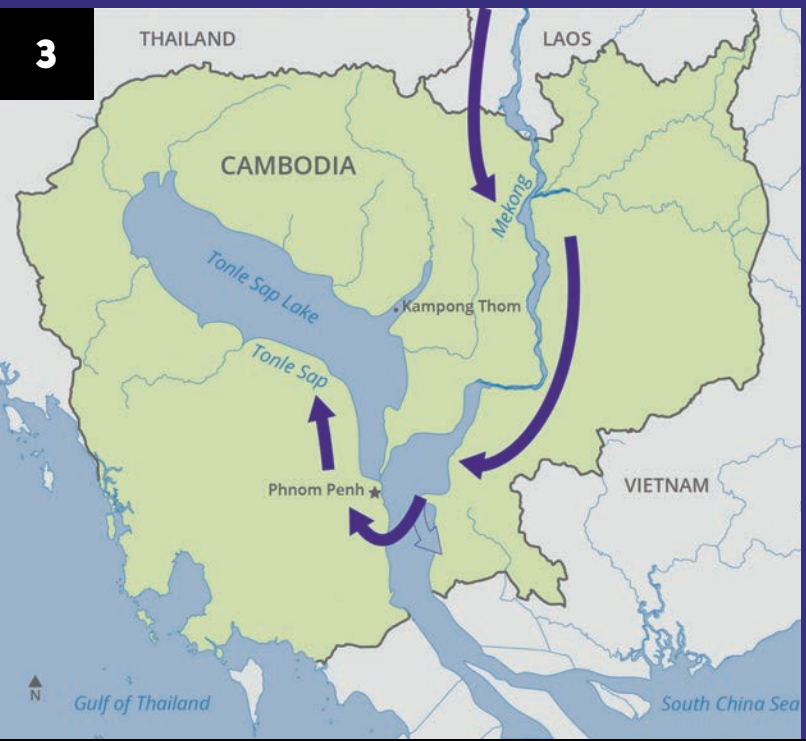
In the coming years, the impact of the researchers' work will be most apparent in the daily ritual of preparing dinner. It remains to be seen whether the Cambodian people — including Sen Mary, Nan Sab Yi and the rest of the Math family — can continue to rely on the same foods that have sustained them for generations.

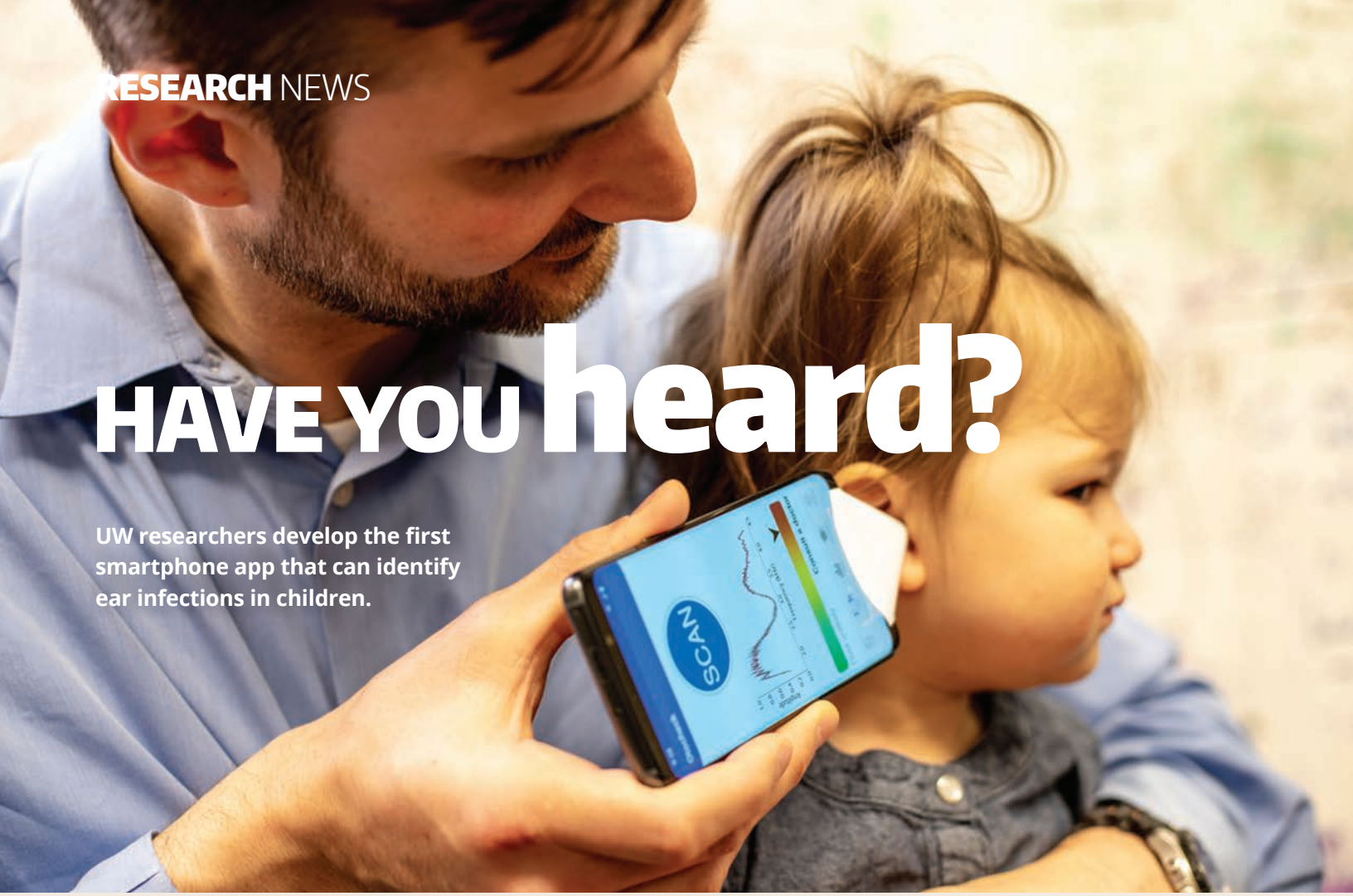
Read more about UW research taking place in Cambodia at environment.uw.edu/mekong

An unusually fertile lake

When the Mekong River floods during the annual monsoon season, water travels up the Tonle Sap River and increases the footprint of the attached lake by up to six times. In addition to more space for fish, the merging of the habitats provides additional nutrients and minerals for fish and rice to grow.

1. Cambodia's dry season runs from October to April, when the dusty northeast monsoon arrives.
2. The southwest monsoon, which blows from May to October, brings water down the Mekong River.
3. The floodwaters reverse the direction of the Tonle Sap River and water fills the Tonle Sap Lake.
4. Fish breed and grow in the flooded lake and migrate downstream when the flood subsides.





HAVE YOU heard?

UW researchers develop the first smartphone app that can identify ear infections in children.

By Sarah McQuate

Ear infections occur when fluid builds up in the middle ear behind the eardrum and is infected, They are the most common reason parents bring their children to a pediatrician, according to the National Institutes of Health. Fluid buildup can be painful and make it hard for children to hear, which can be especially detrimental when they are learning to talk.

Yet this condition can be hard to diagnose because ear infections have vague symptoms: Sometimes children tug on their ears or have fevers, and sometimes there are no symptoms. In addition, young children may not be able to describe where they hurt.

In response, UW researchers have created a new smartphone app that can detect fluid behind the eardrum by simply using a paper funnel and a smartphone's microphone and speaker. The smartphone makes a series of soft audible chirps into the ear through the funnel, which rests on the outer ear to guide sound waves in and out of the ear canal. When the phone chirps, sound waves bounce off the eardrum, travel back through the funnel and are picked up by the smartphone's microphone along with the original chirps. The app then measures how those sound waves have changed: If there's fluid inside, the reflected sound waves interfere with the original sound waves differently.

"Designing an accurate screening tool on something as ubiquitous as a smartphone can be game changing for parents as well as health care providers in resource limited regions," says UW Allen School associate professor Shyam Gollakota, who collaborated with UW School of Medicine researchers on this project. "A key advantage of our technology is that it does not require any additional hardware other than a piece of paper and a software app running on the smartphone."

Being able to do this quick screening at home could help parents decide whether or not they need to take their child to the doctor. And although the app is still being tested and will require FDA clearance before becoming broadly available, the team's early reports suggest that it determines the likelihood of fluid present with a probability of detection of 85% — on par with current, specialized tools and methods available only in doctors' offices. The researchers plan on commercializing this technology through a spinout company, Edus Health, then making the app available to the public.

ABOVE: UW School of Medicine professor Randall Bly uses the app to check his daughter's ear. Photo by Dennis Wise / University of Washington

ADVANCEMENTS in Alzheimer's research

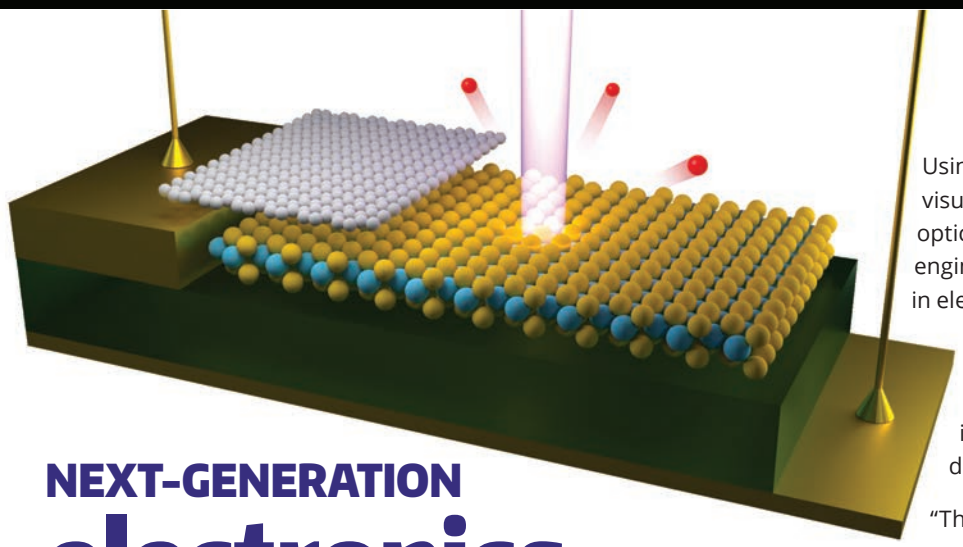
By James Urton

Alzheimer's is a disease of aggregation. Neurons in the human brain make a protein called amyloid beta. On their own, these proteins — called monomers of amyloid beta — perform important tasks for neurons. But in the brains of people with Alzheimer's disease, amyloid beta monomers have abandoned their jobs and joined together. First, they form oligomers — small clumps of up to a dozen proteins — then longer strands and finally large deposits called plaques.

For years, scientists believed that the plaques triggered the cognitive impairments characteristic of Alzheimer's disease. But newer research implicates the smaller aggregates of amyloid beta as the toxic elements of this disease. Now, a team led by UW researchers has developed synthetic peptides that target and inhibit those small, toxic aggregates. Their synthetic peptides — which are designed to fold into a structure known as an alpha sheet — can block amyloid beta aggregation at the early and most toxic stage when oligomers form.

"What we've shown is that we can design and build synthetic alpha sheets with complementary structures to inhibit aggregation and toxicity of amyloid beta, while leaving the biologically active monomers intact," says Valerie Daggett, a UW professor of bioengineering and faculty member in the UW Molecular Engineering & Sciences Institute.

The team's findings add evidence to the growing consensus that amyloid beta oligomers — not plaques — are the toxic agents behind Alzheimer's disease. The results also indicate that synthetic alpha sheets could form the basis of therapeutics to clear toxic oligomers in people.



NEXT-GENERATION electronics

UW and University of Warwick scientists have visualized the electronic structure in a microelectronic device for the first time, opening up opportunities for finely tuned, high-performance electronic devices. The researchers developed a technique to measure the energy and momentum of electrons in operating microelectronic devices made of atomically thin — so-called 2D — materials.

Using this information, the researchers created visual representations of the electrical and optical properties of the materials to guide engineers in maximizing 2D materials' potential in electronic components. Their work could also pave the way for the types of 2D semiconductors that are likely to play a role in the next generation of electronics, in applications such as photovoltaics, mobile devices and quantum computers.

"This powerful technique will open new opportunities to study fundamental phenomena, such as visualization of electrically tunable topological phase transition and doping effects on correlated electronic phases, which are otherwise challenging," says Xiaodong Xu, a UW professor of physics and materials science and engineering and a Clean Energy Institute faculty member.

ABOVE: Electrons ejected by a beam of light focused on a 2D semiconductor are collected and analyzed to determine how the electronic structure in the material changes as a voltage is applied between the electrodes. Image by Nelson Yeung / Nick Hine / Paul Nguyen / David Cobden

Great minds think alike

By Sarah McQuate

Telepathic communication might be one step closer to reality thanks to new UW research. A team of Center for Neurotechnology (CNT) researchers have created a method that allows three people to work together to solve a problem using only their minds.

In BrainNet, three people play a Tetris-like game using a brain-to-brain interface. This is the first demonstration of two things: a brain-to-brain network of more than two people, and a person being able to both receive and send information to others using only their brain.

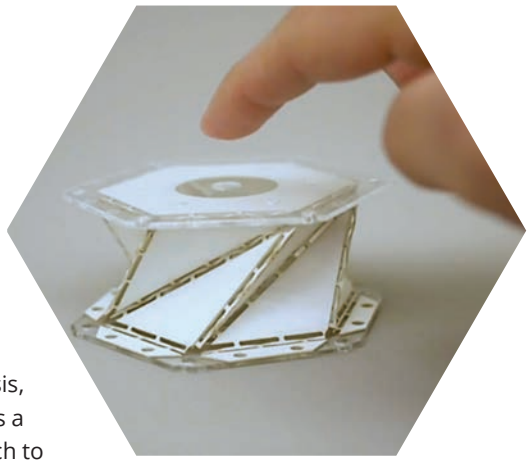
"Humans are social beings who communicate with each other to cooperate and solve problems that none of us can solve on our own," says Rajesh Rao, the CJ and Elizabeth Hwang professor in the UW Allen School and CNT co-director. "We wanted to know if a group of people could collaborate using only their brains. That's how we came up with the idea of BrainNet: where two people help a third person solve a task."

The team hopes that these results pave the way for future brain-to-brain interfaces that allow people to collaborate to solve tough problems that one brain alone couldn't solve. They are also working with a CNT neuroethics team to address the ethics of this kind of brain augmentation research and develop protocols to ensure that people's privacy is respected as the technology improves.

ABOVE: A researcher, left, sends information about a game from her brain over the internet to another researcher, right. He can then manipulate the game with his mind. Photos by Mark Stone / University of Washington

Softening the blow for REUSABLE SPACECRAFT

By Sarah McQuate



Space vehicles like SpaceX's Falcon 9 are designed to be reusable. But this means that, like Olympic gymnasts hoping for a gold medal, they have to stick their landings. Landing is stressful on a rocket's legs because they must handle the force from the impact on the landing pad. One way to combat this is to build legs out of materials that absorb some of the force and soften the blow.

Inspired by the paper folding art of origami, UW researchers have developed a novel solution to help reduce impact forces. The team has created a paper model of a metamaterial that uses folding creases to soften impact forces and instead promote forces that relax stresses in the chain.

"If you were wearing a football helmet made of this material and something hit the helmet, you'd never feel that hit on your head. By the time the energy reaches you, it's no longer pushing. It's pulling," says aeronautics and astronautics associate professor Jinkyu Yang. "Impact is a problem we encounter on a daily basis, and our system provides a completely new approach to reducing its effects."

Currently, their model is made of paper, but next the team plans to make it out of a composite material, ideally one that could be optimized for specific applications.

ABOVE: Inspired by the paper folding art of origami, UW researchers created a paper model of a metamaterial that uses folding creases to soften impact forces. Photo by Kiyomi Taguchi / University of Washington

COMBATTING misinformation

By Jackson Holtz

This autumn, the new UW Center for an Informed Public will open, thanks to a $5 million investment from the John S. and James L. Knight Foundation and $600,000 award from the William and Flora Hewlett Foundation. The new center will combat what researchers call the "misinformation epidemic" by building upon the university's ability to better understand how and why fake news, misinformation and disinformation are created.

The UW Center is one of five institutions receiving major investments from the Knight Foundation nationally and is the only recipient in the Western United States.

The five principal investigators at the Center are a "who's who" in this field of research, widely recognized for their respective expertise: Jevin West, Emma Spiro and Chris Coward of the UW Information School, Ryan Calo of the School of Law, and Kate Starbird of the College of Engineering. A Human Centered Design & Engineering (HCDE) associate professor, Starbird directs the Emerging Capacities of Mass Participation (emCOMP) Lab where her team researches how information and disinformation — false content deliberately circulated to confuse and deceive — flows across social media after crisis events.

The Center will be devoted to educational efforts, research, policy and community outreach around misinformation and disinformation campaigns. Additionally, researchers will establish a network of Community Labs in public libraries and other institutions to co-create and assess research-based interventions.

HCDE associate professor Kate Starbird (center) is one of five researchers who will lead research efforts at the UW Center for an Informed Public. Photo by Mark Stone / University of Washington

BREAKTHROUGHS

Making moving photos a reality

People moving in and out of photographs used to be reserved for the world of Harry Potter. But now UW Allen School computer scientists have brought that magic to real life. The researchers have developed an algorithm, Photo Wake-Up, that can take a person from a 2D photo or a work of art and make them run, walk or jump out of the frame. The system also allows users to view the animation in three dimensions using augmented reality tools.

Using AI to diagnose breast cancer

Doctors examine images of breast tissue biopsies to diagnose breast cancer. But the differences between cancerous and benign images can be difficult for the human eye to classify. With partners at the University of California, Los Angeles, UW Allen School and electrical and computer engineering researchers have developed an artificial intelligence system to help pathologists read biopsies more accurately and lead to better detection and diagnosis. Their algorithm helps interpret the images nearly as accurately or better than experienced pathologists, depending on the task.

Art therapy reduces stress

In a pilot study, UW human centered design and engineering and nursing researchers explored art-based mindfulness activities that schools could use to reduce headaches, a common side effect of stress in adolescent girls. After three weeks of twice-weekly mindfulness and art therapy sessions, the girls reported experiencing significantly fewer headaches.

Molecular tethers and chemical "light sabers"

The field of tissue engineering has a problem. To adhere proteins to engineered scaffolds in the lab, researchers modify them using chemistries that kill off more than 90% of their function. A UW chemical engineering and bioengineering team developed a way to keep proteins functional by modifying them with a chemical tether that uses light. The tether can also be cut by laser light, allowing scientists to create protein patterns throughout scaffolds to grow tissues comprising different types of cells.

Read more research news at engr.uw.edu/news

Atari Women

HCDE researchers unearth and celebrate the forgotten histories of women who helped shape the early days of Atari — and the computer gaming industry ever since.

Dona Bailey entered college at age 16 and was introduced to computer programming and statistical analysis through her major, psychology. In her mathematics master's program, she learned SARS and Fortran programming and, after graduating, went to work for General Motors. In 1980, Bailey encountered her first arcade video game, *Space Invaders*. Within three months, she'd quit her job, moved to Sunnyvale, California, and started working as a programmer at Atari, where she was tasked with creating a video game for the company's coin-op division. She set to work on what would become one of Atari's most commercially successful arcade games, *Centipede*.

In the 1970s and early 1980s, women like Bailey were making significant contributions to the growing tech and video game industries. Yet by the mid-1980s, the percentage of tech jobs held by women began to rapidly decline. This was especially true in gaming; by the end of the decade, women represented just 3% of the sector's workforce.

Along with being cut from the work, women's achievements fell into the shadows. In many cases, they were erased entirely from the industry's history. But a team of researchers led by Pernille Bjørn, a computer science professor visiting the UW from the University of Copenhagen, and Human Centered Design & Engineering (HCDE) associate professor Daniela Rosner have been working to change that. Their project, Atari Women, focuses on unearthing and celebrating the stories of women who helped shape Atari's early days and — by extension — the computer gaming industry at large.

Shifting narratives

It's estimated that nearly half of today's gamers are women, yet the computer gaming industry is still heavily dominated by men. So what happened in the 1980s to cause such a dramatic shift?

In one word: marketing.

According to Rosner, one of the most prominent theories has to do with the way personal computers and home gaming consoles like the Atari 2600 were advertised. "As video games moved into the home, who did we see in the commercials? Boys," she says.

A similar message began to appear in popular films. Movies such as *Real Genius*, *TRON*, *Weird Science* and *War Games*, showed boys — not girls — as coding whizzes. "This is when the rise of the 'male genius hacker narrative' really set in, solidifying a new cultural perception: computers and gaming were for boys, not girls," Rosner adds.

As that idea took hold, it not only shaped the future, but it also cast a heavy shadow on the past. The more society regarded tech as men's territory, the more women were eclipsed.

So, to reintroduce them into computer gaming history, Rosner and Bjørn identified and interviewed women who made contributions to Atari games in the 1970s and 80s. Along with programmers, they sought women who worked as designers, artists and manufacturers.

"There's this 'brilliant mind' myth that coding is a solo endeavor, but in reality, tech is much more collaborative," Rosner explains. "What's a video game without the music? You need someone to compose a compelling soundtrack like you need someone to build game cartridges and get them into stores."

By Chelsea Yates

Photos courtesy of Atari Women and Brock Craft

Some of the women interviewed include pioneering software engineers like Carla Meninsky and Suki Lee; musician Patricia Goodson, who created the original music for *Pac-Man Jr.*, *Desert Falcon* and *Food Fight*; and the first e-sport champion Rebecca Heineman.

"When she was 15, Rebecca taught herself how to program by reverse engineering and memorizing the instruction set for Atari 2600," Bjørn says. "At 17 she won the Atari 2600 National Space Invaders Championship in 1980 and later went to work as a game developer. To date she's created more than 275 games."

Creating visibility

Last winter, Rosner and Bjørn led a directed research group for HCDE students to create a digital presence for the Atari Women's stories. Students developed a website, designed project branding by reimagining the Atari logo and worked with the professors to remix the classic game *Pac-Man*. In their version, a woman developer collects binary code to create her own video game while fighting bugs. The music — made by Patricia Goodson — is from *Pac-Man Jr.*, and in the cut scenes Dona Bailey's voice can be heard sharing stories about her experiences at Atari.

During a second directed research group over spring break, students designed interactive works based on the Atari Women's stories.

"We combined a new screen technology — electrochromic display — with traditional materials to create visual artifacts," explains HCDE and art major Khadijah Jordan, whose final project was inspired by Bailey's *Centipede*.

Jordan says that, in addition to boosting her technical and prototyping skills, the experience reinforced the importance of questioning dominant narratives.

"Projects like Atari Women can help spark conversations and encourage people to question underlying assumptions," she says.

Last spring, the team debuted their research at Emerald City Comic Con, where they hosted a panel on representation and technology with women game developers, and at the Living Computer Museum, where audience members interacted with the students' projects. Over the summer they led an edit-a-thon to improve information about the Atari Women on Wikipedia. They've also been receiving invitations from companies such as Microsoft, Google and Sony to give talks and facilitate workshops.

"By recognizing women's contributions, we hope to change broader societal perceptions of who pioneered computer science and engineering fields and who 'belongs' in tech today," says Bjørn. "Our hope is that this work also changes practice, so being invited into tech companies to have these conversations is very promising."

Visit atariwomen.org to read more stories, learn about upcoming events and see if you can help connect the researchers with more Atari Women.

OPPOSITE PAGE - LEFT: In the team's remixed version of Pac-Man, a woman developer collects binary code to create her own video game while fighting bugs. RIGHT: Students design interactive works based on the stories of women who helped shape Atari's early days. THIS PAGE: Framed Atari cartridges autographed by the women who contributed to them.

An ENGINEERING STAR

Ewurama Karikari, '19, shares how the UW STARS program helped her transform her passions for math and robotics into a mechanical engineering mechatronics degree.

Through involvement in UW programs and organizations — STARS, the National Society of Black Engineers, the UW African Student Association and the McNair Scholars — and several internships and research assistantships, Ewurama Karikari has aimed high for herself while also making time to help others.

We recently spoke with Karikari, who graduated in June with a mechanical engineering (ME) bachelor's degree and concentration in mechatronics, about her many UW passions — STARS, math, community-building, Ghanaian dance and robotic systems — and what she hopes to pursue in graduate school this fall at Stanford University.

How did you become interested in UW ME and mechatronics?

I attended high school in Spanaway, Washington. I loved math and my school's robotics club. During my senior year, I was invited to apply to UW's STARS program, which provides Washington students from economically and educationally disadvantaged background extra academic support, mentoring and funding to pursue engineering degrees. Fortunately I was accepted — something I'm still thankful for.

STARS introduces different engineering fields to students and ME seemed like the right fit, especially as I learned more about how math plays a role in device development.

Mechatronics integrates mechanical, electrical and computer engineering. It's helped me focus my dream of working in robotics and has set me up for graduate school where I hope to concentrate more on using controls in robotics systems.

Tell us more about STARS.

STARS students participate in a "redshirt" year their first year at UW during which they develop their study skills and foundational skills in math and science. STARS also provides an amazing community of students, mentors and tutors. During their first year, STARS students share the same schedule and take the same classes. They live in the same residence hall, so it's like having an instant, built-in network. Community is so important when you're in college; no one wants to feel like they're alone, and STARS makes sure they don't. STARS also helped me "see" more people who look like me in engineering — women, people of color, first generation students. That alone was huge.

You served as a calculus tutor for STARS students. What was that like?

STARS helped me develop self-confidence, and I wanted to pass that on. As a calculus tutor I tended to work with about 15 first-year STARS students per workshop. STARS workshops are super helpful; they teach you not just how to crank out answers but how to problem-solve and study. I wanted students to have the confidence that they could get through the math requirements, that they could be engineers.

Tell us about your internships and research lab experience.

For two summers I held internships with Boeing, first on the 737 Product and Technical Integration team and then with the 737 Flight Controls team. As I moved through my ME classes, I was drawn to research. I worked as an assistant in ME Professor Ann Mescher's Polymer Optics Lab, which focuses on fiber optics manufacturing, and last summer as part of the TANMS nanosystems research program at the University of California, Los Angeles. This program, which is focused on developing tiny devices for the bloodstream, exposed me to graduate-level research.

What excites you the most about graduate school?

Getting to do more mechanical engineering research in integrated systems and robotics! I feel fortunate to have been part of the McNair Scholars' Program at the UW. My family moved to the U.S. from Ghana when I was young, and my sister and I are the first in our family to attend college. So higher education is new territory for us. The McNair program preps first-generation, low-income and minority students who want to go to grad school and are interested in academic careers. I presented my research at a McNair conference in Chicago, which was so cool. I can't wait to do more research.

Speaking of Ghana, you were involved in the UW's African Student Association (ASA), right?

Yes, I was a part of the ASA's Ghana dance group and performed each year at Afro Caribbean Night on campus. Being involved in a non-STEM community provided me with an outlet and a way to get to know other African Americans at UW. Like STARS, the ASA helped me find a community where I was free to express myself. It also gave me a space to learn about and establish my identity as a Ghanaian American woman pursuing mechanical engineering.

Any advice for future engineering students?

Speak up for yourself, and ask for whatever you need — resources, information, support, guidance. People at the UW want to help but they don't know what you need, so be open and direct. Make a point to interact with other students; they're often going through the same things that you are, so build community and share those experiences. And talk to your TAs and professors; they have office hours for a reason! If you like research or are thinking about graduate school, look into research assistantships, at the UW and other institutions. They can be a great way to develop hands-on experience and get a taste of other schools and programs.

You can help students like Ewurama pursue engineering by giving to the STARS Program Student Support Fund: washington.edu/giving/stars

OPPOSITE PAGE - TOP: Ewurama Karikari works on her mechatronics capstone project. BOTTOM LEFT: Karikari receives an award from ME professor and chair Per Reinhall at the 2019 ME graduation ceremony. BOTTOM RIGHT: Karikari, left, performs as part of the UW African Student Association's Ghana dance group.

SARP WINS BIG

By Amy Sprague

Photos courtesy of SARP

The UW's student rocketry club clinched the top spot this summer at the 2019 Spaceport America Cup.

The Society for Advanced Rocket Propulsion (SARP), the UW rocketry club, is flying high after being named the Judge's Choice and Overall Winner in the 2019 Spaceport America Cup. The world's largest collegiate rocketry competition, the Spaceport America Cup hosts more than 120 teams each summer in the New Mexico desert outside of Las Cruces. Teams spend the entire academic year building a rocket from scratch for competition.

In addition to its first place overall win, SARP scored first in the 30,000 feet, student-developed hybrid-liquid propulsion category. This year the UW team distinguished itself by creating a hybrid motor, used by only a few teams due to its complex design and operation requirements.

"The hybrid model is more interesting because of the complexity in building it from scratch, and it produces a safer rocket," explains SARP's chief engineer Clifford Jess Grant, who graduated in June with an aeronautics and astronautics (A&A) bachelor's degree. "Advancing this technology is a lot more rewarding, and the hybrid category is the most technically challenging of the competition."

The SARP team was named Judge's Choice and Overall Winner at competition in June.

ABOVE: Team members transport their rocket during the Spaceport America Cup competition in New Mexico.

SARP, which has grown to nearly 150 student members, builds its rockets from past designs, iterating on some subsystems and redesigning others. The team is divided into subteams: structures, avionics, recovery, propulsion, business, and, for the first time this year, payload. While SARP has high representation of A&A students, the team also includes students from other engineering departments and disciplines across campus.

Keep up with the team at sarpuw.com.

EVENTS

The 2019 Engineering Lecture Series explores how engineers and scientists are working across disciplines to manage the quality and quantity of food we eat and grow. Photo by Mark Stone / University of Washington

The following is a sample of upcoming events in the College of Engineering. For more, visit engr.uw.edu/calendar or contact departments directly.

Engineering Lecture Series

THE FUTURE OF FOOD:
Protecting Human and Environmental Health

Lectures begin at 7:30 p.m. in Kane 130
FREE. Register at events.uw.edu/lecture2019

OCT. 23
Human and Ecosystem Health: Arsenic in Food, Water, Plants and Animals

Civil and environmental engineering associate professor Rebecca Neumann, an arsenic expert, is advancing knowledge of how arsenic in local and global settings affects food and water quality, and the health of ecosystems.

NOV. 7
Floods, Fish and People: Challenges and Opportunities in the Mekong River Basin

Aquatic and fishery sciences associate professor Gordon Holtgrieve is working in the Mekong River Basin to address how energy policy, watershed hydrology and ecosystems interact, to mitigate the global effects of hydrologic and climatic change.

UW Converge Taipei

NOV. 9
All day event. Register at uw.edu/alumni/events/converge-taipei
Huskies across the globe head to Taipei for the UW Converge Summit, which this year focuses on artificial intelligence. College of Engineering associate dean of academic affairs and mechanical engineering professor Brian Fabien will present.

Edward Wenk, Jr. Endowed Lecture in Technology & Public Policy

OCT. 29
Civil & Environmental Engineering

3:30 p.m. Alder Auditorium
FREE. Details at ce.washington.edu/news/lecture/wenk
This year's speaker, Laurie Johnson, has nearly 30 years of experience in urban planning and disaster-related consulting and has written extensively about land use and risk, disaster recovery and reconstruction, and the economics of catastrophes.

The Dean W. Lytle Endowed Lecture

DEC. 3
Electrical & Computer Engineering

3:30 p.m. Microsoft Atrium, Allen Center
FREE. Details at ece.uw.edu/lytle-lecture-series
This lecture — ECE's premiere annual event — features internationally renowned researchers in the field of communications, signal processing, control systems and machine learning.

School & Departmental Series

This fall, UW Engineering academic units host recurring lecture and seminar series on topics related to their fields. Events are FREE; alumni are welcome.

Aeronautics & Astronautics Chair's Distinguished Seminar Series –
NOV. 18 & DEC. 2, 4:00 P.M.
in the Husky Union Building (HUB). Details at aa.uw.edu/chairseminar

Allen School (Computer Science & Engineering) Distinguished Lecture Series –
OCT. 29, NOV. 14 & DEC. 5, 3:30 P.M.
in the Gates Center Amazon Auditorium. Details at bit.ly/UWAllenLectures

Materials Science & Engineering –
weekly on Mondays during Autumn Quarter, 3:30 p.m. in Johnson 075.
Details at mse.uw.edu/events/mse520

Mechanical Engineering –
weekly on Tuesdays during Autumn Quarter, 3:30 p.m. in Mechanical Engineering Building 238. Details at me.uw.edu/news/seminar/520seminar

Save the date

JAN. 15, 2020
Engineering Exploration Night

Alumni and students connect to discuss engineering careers and fields. Students meet with a diverse group of industry professionals in a "speed date" format. Each year, we seek engineering alumni from all disciplines.

Interested in participating? Email Caitlin Karbula at caitlk2@uw.edu

APR. 23-24, 2020
Engineering Discovery Days

Engineering students and faculty share their work with students, teachers, families and the community. Geared toward students in grades 4-8, both days feature hands-on activities that demonstrate the exciting work of engineers.

Registration opens in January. Details at engr.uw.edu/about/k12/discoverydays

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