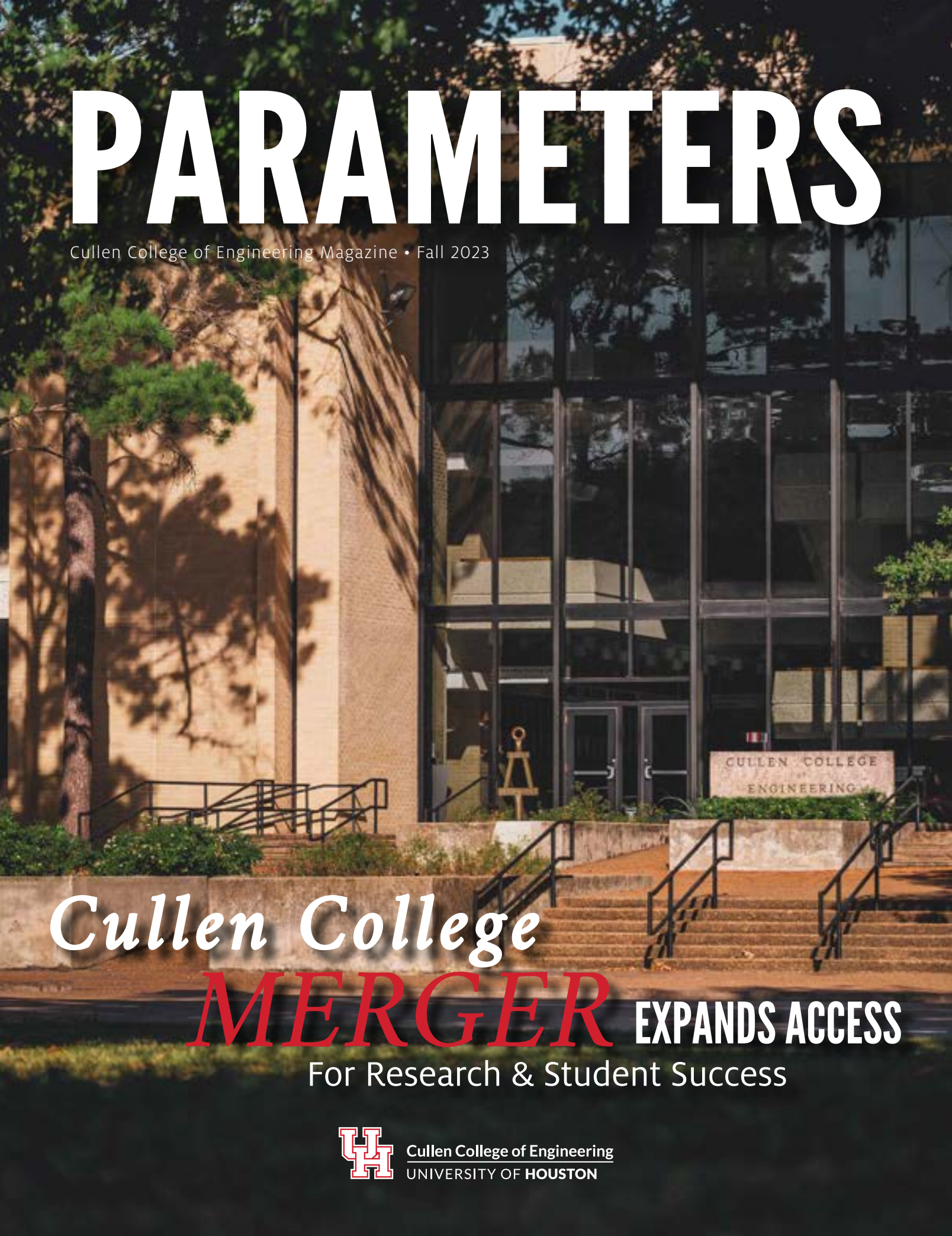
PARAMETERS

Cullen College of Engineering Magazine • Fall 2023



Cullen College MERGER EXPANDS ACCESS

For Research & Student Success

Cullen College of Engineering
UNIVERSITY OF HOUSTON

CHANGE

CHANGE NEEDS A SPARK.

ENGINEERED FOR
WHAT'S NEXT.

PARAMETERS Fall 2023 I www.egr.uh.edu

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PARAMETERS

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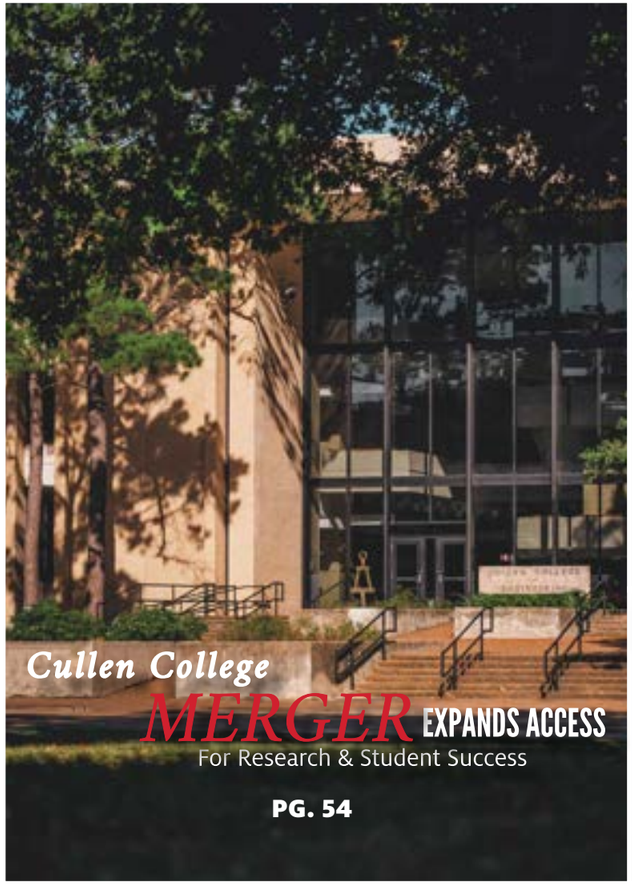


IN EVERY ISSUE

Cullen College of Engineering
UNIVERSITY OF HOUSTON

UHEngineering | @uhengineering | @uhengineering | UHCullenCollege | University of Houston Cullen College of Engineering

DEAN'S LETTER

What an exciting time this is for the Cullen College of Engineering. Since our founding, the college has transformed tremendously over the years. Both our student body and faculty populations have experienced explosive growth, all while maintaining our high standards and commitment to excellence. And at this time, we are poised for even greater growth and opportunities for our students.

Earlier this year, our college went through its greatest and most significant transformation in its 80-year history. The UH System Board of Regents approved the merger of the Cullen College of Engineering and the College of Technology. The new Technology Division will stand alongside our seven engineering departments, offering programs in construction management, engineering technology, human development and consumer sciences, and information science technology. This significant transformation has elevated the Cullen College to becoming the third-largest engineering college in Texas and the second-largest college at the University of Houston.

Our newly expanded college will be able to offer even more opportunities to our students and faculty, stemming from a significant expansion of study avenues, opening new career pathways, expanding our research enterprise and filling gaps previously found on both sides. The student body will now be able to complete their studies at both the Katy and Sugar Land instructional sites, allowing for more flexibility in navigating incredibly demanding degree plans while being closer to valued industry partners across the Greater Houston Area. Our faculty will also have increased opportunities for collaborative research directly impacting the local industry and beyond.

When I think about the years to come for our expanded college, I'm excited about how bright our future will be. We will be a vibrant institution with a curriculum that will rival any curriculum of any engineering college in the country, our research enterprise will grow to tremendous heights, and we will be able to meet the evolving workforce needs of our city, state and nation. I invite you to read on and to see how, together, we are powering the minds that are powering a new possible, in order to be engineered for what's next.

Warm regards,

Joseph W. Tedesco

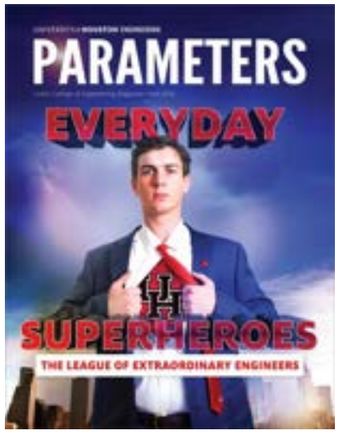
Joseph W. Tedesco, Ph.D., P.E.
Elizabeth D. Rockwell Dean and Professor

ENGINEERING SNAPSHOTS

PARAMETERS ON THE FIVES

BY STEPHEN GREENWELL

A look back at past **PARAMETERS** stories and interview subjects, and what those Cougars are up to now...



FIVE YEARS BACK...

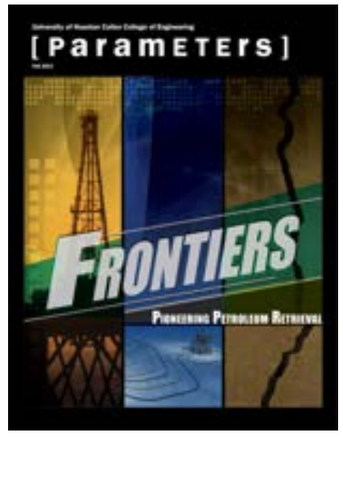
Serrae Reed, a Spring 2018 graduate of the Mechanical Engineering Department, was preparing for her first semester of her doctoral studies at Yale. The Klein High School product earned a Ford Foundation Predoctoral Fellowship while at UH, which provided funding for her first three years at Yale. She is now Serrae Reed-Lingenfelter, Ph.D., after earning her degree in May 2023 and marrying fellow Cougar alum **Isaac Lingenfelter** (Mechanical Engineering, '18) in 2021. Isaac also just finished his master's in Biomedical Engineering from the University of Connecticut in May 2023. This Fall, Serrae will join Apple as a Display Module Engineer and Isaac will begin as a Life Science Consultant for Deloitte.

"I am so grateful for the experiences I had at UH – from serving as a Bonner Leader to conducting undergraduate research with the Houston Scholars Program," Serrae said. "The teaching, mentorship and community I found during my time at UH sparked my love for learning and problem solving, and provided me with the tools I needed to succeed in graduate school. Go Coogs!"

Left to Right: Serrae Reed-Lingenfelter in 2018, Serrae and her Husband Isaac Lingenfelter

TEN YEARS BACK...

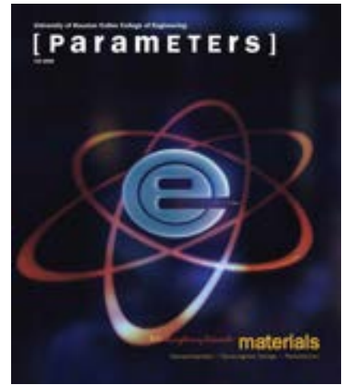
To keep pace with the world's need for skilled engineers in the fields of health and energy, **Dean Joseph W. Tedesco** announced the College's latest major building project, the Multidisciplinary Research and Engineering Building. Groundbreaking for the $51 million project occurred in 2014, and the building opened in 2017. In October 2018, the building was renamed the **Durga D. and Sushila Agrawal Engineering Research Building** in recognition of a gift from the family. Durga (M.S. '69, Ph.D. '74) is the founder of Piping Technology & Products, Inc. After arriving in Houston from India in 1968 with a bachelor's degree in mechanical engineering, he earned a master's degree and Ph.D. in industrial engineering from Cullen. "My message to the students is to always be optimistic. One can achieve any goal with hard work, persistence and determination... As alumni, we must keep the torch of knowledge, excellence and innovation growing and glowing."



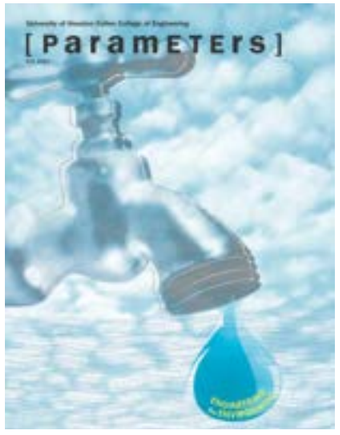
Pictured: Interior of the Durga D. and Sushila Agrawal Engineering Research Building, Outside of the building

FIFTEEN YEARS BACK...

Thanks to support from industry partners, the College was preparing to elevate Petroleum Engineering into its own department. Devon Energy and Marathon Oil pledged a combined $1.6 million to support the program, which was launched in Fall 2009. Now, the Petroleum Engineering Department is ranked ninth in the nation, according to the 2023 graduate school rankings from U.S. News & World Report.



Left to Right: Petroleum research students, ConocoPhillips Petroleum Engineering Building



TWENTY YEARS BACK...

The Engineering Career Center launched in September 2003, with director **Vita Como** serving as the lead for the project. Como retired in May 2015, after 24 years of service for the university. A photo gallery from her retirement is available online, and the event was covered by the Houston Chronicle. The center, now led by director **Janice Quiroz-Perez**, has grown substantially since 2003. The most recent Career Fair in Spring 2023 featured 135 participating companies, more than 465 industry representatives and more than 1,200 students.

Left to right: Vita Como. Vita and Janice Quiroz-Perez at crawfish boil in 2008. Vita at her retirement party in 2015.

IN THE MEDIA **SPOTLIGHT**

HOUSTON CHRONICLE HIGHLIGHTS
UH RESEARCHER'S GLACIER RESEARCH

The Houston Chronicle featured a story on **Pietro Milillo's** findings about the record-high rate that the world's glaciers are melting. These findings have a direct bearing on how scientist will understand future sea level and climate risks. Milillo, who serves as an assistant professor in the Civil and Environmental Engineering at the University of Houston's Cullen College of Engineering, is focused on improving the understanding of the Earth's environment using remote sensing instruments.

READ ONLINE AT:
www.houstonchronicle.com/news/houston-texas/education/article/UHglacierresearch-17604326.php

HOUSTON PUBLIC MEDIA SPOTLIGHTS **NEW UH ENERGY TRANSITION INSTITUTE DIRECTOR**

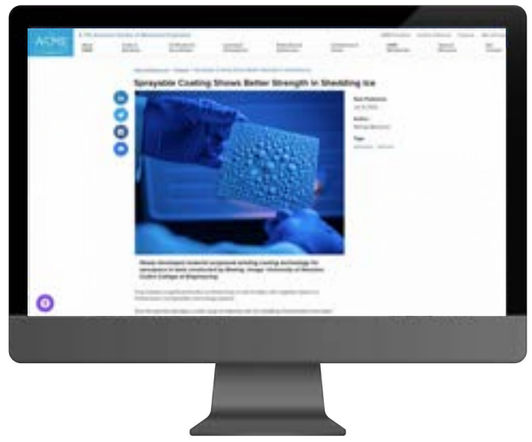
Houston Public Media recently spotlighted **Joseph Powell**, the new director of the UH Energy Transition Institute. Powell is a former chief scientist for Shell and member of the National Academy of Engineering (NAE). In addition to leading the institute, Powell serves as a faculty member in the Department of Chemical & Biomolecular Engineering at the UH Cullen College of Engineering. Powell envisions that the institute will have several important roles – serving as a bridge between different stakeholders; connecting UH faculty experts and students to industry; and bringing these groups together to work on mutually beneficial solutions toward a net-zero future more efficiently.

READ MORE ONLINE AT:
www.houstonpublicmedia.org/articles/shows/uh-moment/2023/01/11/441149/uh-moment-joe-powell-named-director-of-uh-energy-transition-institute/

SPRAYABLE COATING TECHNOLOGY
FEATURED ON ASME.COM

Hadi Ghasemi's newly developed, sprayable ice-shedding material is 100 times stronger than any others, and as a result, was featured on ASME.com. The material has been tested by Boeing under erosive rain conditions at 385 miles per hour and has outperformed current state-of-the-art aerospace coating technologies. This fundamental concept paves the way for innovations in materials for aerospace, wind energy and other industrial and commercial applications where icing is an issue.

VIEW ONLINE AT:
www.asme.org/topics-resources/content/sprayable-coating-shows-better-strength-in-shedding-ice



AZO OPTICS HIGHLIGHTS **NEW RIM METHOD PAVING THE WAY** FOR NEXT-GEN BATTERIES

Xiaonan Shan and a team of UH researchers have achieved real-time visualization of solid electrolyte interphase (SEI) dynamics for the first time. This provides key insight into the rational design of interphases, a battery component that has been the least understood and most challenging barrier to developing electrolytes for future batteries.

READ MORE ONLINE AT:
www.azooptics.com/News.aspx?newsID=28195

DRONELIFE.COM HIGHLIGHTS PROFESSOR'S **NEW SWARM RESEARCH**

Dronelife.com recently spotlighted **Aaron Becker**, associate professor of electrical and computer engineering at the University of Houston. The majority of Becker's current research focuses on refining algorithms enabling the coordinated control of drone swarms based on the behavior of flocks of birds and schools of fish.

VIEW ONLINE AT:
www.dronelife.com/2023/06/07/intelligent-drone-swarms-could-mimic-bird-flocks-new-research-from-university-of-houston/

View Cullen College videos online at youtube.com/UHCullenCollege YouTube

UH ENGINEERING **BY THE NUMBERS**

9,893 total students

2,074 graduate students + **7,819** undergraduate students

80% of UH engineering undergraduates are employed within six months of graduation.

75% six-year graduation rate

TOP 20 TO 25% nationally for all public schools

27 NSF CAREER AWARDS
received since 2010

NEWEST AWARDEES:

Jerrod Henderson
Assistant Professor of
Chemical and Biomolecular Engineering

Konrad Krakowiak
Assistant Professor of
Civil and Environmental Engineering

Harish Krishnamoorthy
Assistant Professor of
Electrical and Computer Engineering

DEGREES AWARDED IN 2021-22 ACADEMIC YEAR

569 B.S.
212 M.S.
101 Ph.D.
=
882 TOTAL

$34M in research expenditures

29 research centers, institutes and consortiums

120+ active laboratories

17 National Academy of Engineering Members

1) Dan Luss; 2) Jerome Schultz; 3) James M. Symons; 4) Benton F. Baugh; 5) Charles D. Cutler; 6) John H. Lienhard; 7) Christine A. Ehlig-Economides; 8) Kaspar Willam; 9) Jamal J. Azar; 10) S.M. Farouq Ali; 11) Andrea Prosperetti; 12) Kaushik Rajashekara; 13) Ganesh Thakur; 14) Birol Dindoruk; 15) Hao Huang; 16) Pradeep Sharma; 17) Joseph Powell

THE RANKINGS ARE IN!

The University of Houston's Cullen College of Engineering has improved two spots, to **69th** overall of U.S. Engineering schools, in the latest yearly rankings by the U.S. News & World Report.

In addition to the overall improvement of the college, the Petroleum Engineering Department solidified its position nationally, moving to ninth overall from 10th place.

"I'm thrilled that the College has improved in the latest U.S. News and World Report rankings, but our drive to improve is not over yet," said Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College. "Our goal is to be named a Top 50 institution, and this is merely a step on that journey. I am proud of our faculty, staff and students, and I know we can achieve even more in the future."

Each department of the college, and its ranking:

- ***Biomedical Engineering* — #88**
- ***Chemical Engineering* — #34**
- ***Civil Engineering* — #64**
- ***Electrical Engineering* — #85**
- ***Environmental Engineering* — #64**
- ***Industrial Engineering* — #50**
- ***Materials Engineering* — #91**
- ***Mechanical Engineering* — #71**
- ***Petroleum Engineering* — #9**

As of Fall 2022, the Cullen College of Engineering had an undergraduate enrollment of 3,266, an increase from the previous year. Master's degree enrollment is 1,044, and 558 students are pursuing a doctoral degree. The College awarded 569 undergraduate degrees, 212 Master's degrees and 101 doctorates in FY 2022.

The University of Houston is a Carnegie-designated Tier One public research university recognized by The Princeton Review as one of the nation's best colleges for undergraduate education. UH serves the globally competitive Houston and Gulf Coast Region by providing world-class faculty, project-based learning, high impact research and strategic industry partnerships. Located in the nation's fourth-largest city, UH serves more than 45,000 students in the most ethnically and culturally diverse region in the country.

$1 MILLION GIFT FROM *BRIJ AND SUNITA AGRAWAL* to Upgrade UH Technology Lab in Sugar Land

BY CHRIS STIPES

Brij and Sunita Agrawal

Prominent entrepreneur and University of Houston Distinguished Alumnus **Brij Agrawal** and his wife, Sunita, have pledged $1 million to fund manufacturing laboratory equipment at the UH College of Technology building in Sugar Land. In recognition of the Agrawals' generosity, the building's ground floor auditorium will be named the Brij and Sunita Agrawal Auditorium.

Agrawal graduated from UH's Cullen College of Engineering in 1988 with a degree in mechanical engineering, and quickly made a name for himself as the founder of numerous successful companies in manufacturing, fabrication and fast-casual restaurants. He is the Chief Executive Officer and President of VKC Group, which operates more than 150 restaurants in Texas, Colorado and New Mexico.

Born in Lakhanpur, India, Agrawal moved to Houston at 17 and attended night school at UH while working full-time. He credits his experience at UH for providing him the foundation to launch and sustain a successful career, and hopes his family's investment will do the same for students in the Fort Bend County area. The Agrawals are longtime Sugar Land residents. "I would not have graduated from college if it wasn't for the UH System. That is why I am so passionate about supporting UH. I live in Sugar Land and that makes me more attached to the UH at Sugar Land campus. I am thrilled to know the impact this gift will have on the students and faculty in terms of access to state-of-the-art equipment in a modern academic building and campus in Sugar Land," said Agrawal.

The gift will fund the purchase of the latest 3D printers, machine tools and measuring test equipment, and the creation of an advanced manufacturing design center focused on small and medium scale industry. Advanced manufacturing, or the use of innovative technologies to create new and existing products, is a key goal for the Advanced Technology and Innovation Center at UH at Sugar Land, an instructional site of the University of Houston.

The center is leading efforts in Fort Bend County – a region experiencing extensive tech business growth – to increase investment, economic development and workforce creation.

"I am grateful to Brij and Sunita Agrawal whose generosity will enhance the educational experience for our students and researchers to help create the next generation of technology innovators," said **Renu Khator**, University of Houston president. "Having access to state-of-the-art lab equipment is critical to building the skills necessary to excel in today's rapidly developing technology workforce."

The gift's total impact could reach $3.5 million after matching gifts from the George Foundation, which will match $1 million, and the Texas Research Incentive Program (TRIP).

The Agrawals have been loyal supporters of the University for decades, also offering financial support for the construction of the first building at UH at Sugar Land. In addition, they established a Presidential Endowment to fund scholarships for UH engineering students. Agrawal received the distinguished alumnus award from Cullen College in 2007.

"UH at Sugar Land continues to expand its already impressive presence in Fort Bend County and the continued support from families like the Agrawals is critical to keep the momentum going," said **Eloise Brice**, vice president for University advancement.

The ground floor auditorium in the Cullen College's Technology Division building in Sugar Land will be named the Brij and Sunita Agrawal Auditorium.

> *"I am thrilled to know the impact this gift will have on the students and faculty in terms of access to state-of-the-art equipment in a modern academic building and campus in Sugar Land."*
>
> - BRIJ AGRAWAL

Konrad Krakowiak

Harish Krishnamoorthy

Jerrod Henderson

NSF CAREER AWARDS ARE GRANTED TO HIGHLY PROMISING JUNIOR FACULTY MEMBERS WHO EXEMPLIFY THE ROLE OF TEACHER-SCHOLARS THROUGH

"outstanding research, excellent education and the integration of education and research."

Stereochemical Biomimicry for Sustainability Research

BY STEPHEN GREENWELL

Konrad Krakowiak, assistant professor in the Civil and Environmental Engineering Department at the University of Houston's Cullen College of Engineering, is quick to defer when he's offered praise for his research. For him, any success he might have is due to the students he has working with him, and the foundation of the critical thought process he got from his academic mentors.

His latest "great achievement," as he calls it, is earning a National Science Foundation CAREER award for his proposal, "Stereochemical Biomimicry for Sustainability." The $698,187 in funding is the second significant NSF grant for Krakowiak, after earning $203,151 for similar research in 2018.

"I achieved this goal because of the hard work of my students," he said. "If I didn't work with my students and if my students didn't do this quality of work, I would be missing certain pieces of the puzzle. It's so rewarding, not only for my hard work, but most importantly for my students for the work that they did. This achievement wouldn't be possible without the support and hard work and intellect of my students."

The main focus of Krakowiak's research group is implementing practical modifications for construction materials by examining and improving them on the molecular scale. Globally, estimates on the amount of concrete used each year vary from 4 billion tons on the low end, to as high as 30 billion tons.

Enhancing the State of Health and Performance of Electronics

BY RASHDA KHAN

Harish Krishnamoorthy, assistant professor of Electrical and Computer Engineering at the University of Houston Cullen College of Engineering, received a Faculty Early Career Development (CAREER) Award from the National Science Foundation earlier this year.

The CAREER awards will provide Krishnamoorthy $500,015 to continue his research on high-density power conversion for grid interface of energy systems, machine learning-based methods for improving the quality and reliability of power electronics, advanced electronics and control for mission-critical applications.

One of the critical challenges facing existing converter installations is the difficulty in assessing their health, predicting system behavior, and adapting their performance in real-time without disrupting operations. To address this, Krishnamoorthy and his research team will be working on what is referred to as 'Edge Intelligence,' a seamless integration of data-driven prognostic health management with power converters onboard.

The need for additional computing resources has also been a significant barrier, making it seemingly impractical in applications with a large number of power converters, such as data centers and solar PV farms.

However, the introduction of the SHaPE-MaP framework will enable edge intelligence, revolutionizing power converter hardware and control systems.

"The SHaPE-MaP framework holds vast implications for large-scale converter applications, potentially saving hundreds of millions, if not billions, of dollars," Krishnamoorthy said. "System operators will benefit from improved decision-making regarding maintenance or repairs, while the supply chain team will gain better logistics estimation and inventory management."

Centering the Engineering Identity of Black Men to Enhance Representation and Degree Completion

BY STEPHEN GREENWELL

Jerrod Henderson, an assistant professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, is the Cullen College of Engineering's latest recipient of a National Science Foundation CAREER award.

Henderson seeks to strengthen the future of the U.S. engineering workforce by enabling and encouraging the participation of all citizens in the engineering enterprise, particularly Black men. According to the American Society for Engineering Education Engineering & Engineering Technology by the Numbers 2020 Report, Black men represented only 2.8 percent of those who earned engineering bachelor's degrees.

"I'm happy to share that I've been awarded the NSF CAREER Award," Henderson said. "Thank you to all Henderson Research Group members past and present, my collaborators and my mentors for all of your support. I'm especially grateful to my undergraduate research student **Jared Davis** and postdoc **Le Shorn Benjamin**, who helped collect and analyze the preliminary data for this project."

The research is funded for $563,407 through 2028. Henderson joined UH in 2016 as an instructional associate professor, and became the director of PROMES in 2017, a position he held until 2022. Henderson is also the co-founder of the St. Elmo Brady Academy. He was hired as a tenure-track assistant professor in 2021.

SINCE 2010, THE CULLEN COLLEGE HAS RECEIVED

27

NSF CAREER AWARDS

Megan Robertson (ChBE)
Jiming Bao (ECE)
Jacinta Conrad (ChBE)
Jeffrey Rimer (ChBE)
Debora Rodrigues (CEE)
Lars Grabow (ChBE)
Wei-Chuan Shih (ECE)
Gila Stein (ChBE)
Haleh Ardebili (ME)
Zhu Han (ECE)
Stanko Brankovic (ECE)
Bora Gencturk (CEE)
Cunjiang Yu (ME)
Aaron Becker (ECE)
Zheng Chen (ME)
Jeremy Palmer (ChBE)
Sheereen Majd (BME)
Rose Faghih (ECE)
David Mayerich (ECE)
Mehmet Orman (ChBE)
Kyung Jae Lee (PE)
Shailendra Joshi (ME)
Devin Shaffer (CEE)
Jinsook Roh (BME)
Harish Krishnamoorthy (ECE)
Konrad Krakowiak (CEE)
Jerrod Henderson (ChBE)

The Culmination of an

ART - SCIENCE

Performance-Research Study

BY LAURIE FICKMAN

Furthering ongoing studies at the University of Houston on the effect of creativity on the brain, Vangeline Theater/New York Butoh Institute held a free public showing of "The Slowest Wave/Butoh and The Brain," the culmination of an art-science performance-research study.

This showing was offered as part of a new study investigating brain dynamics of dancers through the use of electroencephalography (EEG) to record the participants' brain waves while they are performing Butoh, a postmodern dance style that originated in Japan. The study is a collaboration between the New York-based Vangeline Theater dance company, the Laboratory for Noninvasive Brain-Machine Interface Systems, IUCRC BRAIN Center, The Rockefeller University, and the Neurobiology of Social Communication Lab (funded by the City University of New York, Rockefeller University and New York University).

Jose Luis Contreras-Vidal

Jose Luis Contreras-Vidal is the Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Electrical and Computer Engineering and director of the NSF Industry–University Cooperative Research Centers for Building Reliable Advances and Innovations in Neurotechnology (IUCRC BRAIN) at the University of Houston. He has pioneered noninvasive brain-machine interfaces to exoskeletons and prosthetics to restore motor function in individuals with disabilities. His work at the nexus of art and science is opening new windows to study the neural basis of human creativity in children and adults while informing neuroaesthetics, neural interfaces and the power of the arts (dance, music, visual art) as a modulator of brain activity.

In collaboration with Contreras-Vidal, neuroscientists Sadye Paez, New York University's Center for Ballet and the Arts and Constantina Theofanopoulou, Hunter College, City University of New York and composer Ray Sweeten, Vangeline choreographed a 60-minute ensemble Butoh piece, which is uniquely informed by the protocol established for a scientific pilot study researching the impact of Butoh on brain activity during Butoh dancing. For the groundbreaking art-science study, dancers' brain activity will be recorded at the University of Houston with real-time visualization of the dancers' neural activity. Results will then be disseminated in scientific journals.

Vangeline and Sweeten have built on a 20-year history of creative collaboration with a soundscape that is informed by techniques of brainwave entrainment (techniques that affect consciousness through sound). "The Slowest Wave" investigates through the use of scalp EEG how brain waves during Butoh dancing compare to those emitted during other conscious or unconscious motor behaviors, such as speaking or meditating. Moreover, the study will elucidate the functional neural networks of the dancers and the neural synchrony within and between them.

This project is meant to foster connections and understanding between dancers, artists, scientists, engineers and audiences from around the world.

"The Slowest Wave" is supported in part by an award from the National Endowment for the Arts, as well as the NSF IUCRC BRAIN Center at the University of Houston, and by public funds from the New York City Department of Cultural Affairs in partnership with the City Council, and the New York State Council on the Arts with the support of the Governor and the New York State Legislature.

Researchers Turn To The POWER OF NATIVE AQUATIC PLANTS To Clean Coastal Waters

BY SALLY STRONG

The research team led by University of Houston's **Venkatesh Balan**, associate professor of biotechnology in the Technology Division at the Cullen College of Engineering, studies the abilities of these water-loving flora to uptake concentrations of chemicals and heavy metals that unfortunately end up in places where they should not be. Eventually, the researchers also hope to find helpful uses of the system's byproducts.

"But first, we must identify which species are best at removing what we don't want – the chemicals and metals in our coastal water," Balan said.

The Managing Urban Runoff project is funded over three years with a $1.5 million grant from the U.S. Environmental Protection Agency, with $624,000 allocated for UH-based research. It is a collaboration of Balan and UH colleagues **Xiaonan Shan**, assistant professor of electrical and computer engineering, and **Weihang Zhu**, professor of engineering technology; Ram Ray and Gururaj Neelgund of Prairie View A&M University (PVAMU); and Sandeep Kumar of Old Dominion University in Virginia.

This polluted-water problem stems from a case of too much of a good thing. Heavy rainstorms often wash chemical fertilizers and soil amendments away from the farmlands, lawns and household gardens where they had been helpful in appropriate amounts. Eventually, the runoff accumulates along the Gulf Coast, including in the PVAMU watershed where the team is at work.

"In the process called eutrophication, the chemical fertilizers and soil amendments feed the algae in watersheds. The result is heavy concentrations of excess nutrients such as nitrogen and phosphorus and metal salts such as copper sulfate. That combination feeds cyanobacteria, which produces algal bloom that yields toxins harmful to humans, fish, marine mammals and birds," Balan said.

Removing these substances from stormwater is necessary for maintaining ecological balance and keeping communities healthy.

Other methods of cleaning the water are available, including aeration, sprayable clay suspensions, chemical and biological additives, and ultrasonic technology. But they are rarely adopted because of high costs.

Around the world, aquatic plants have long been on the job of reducing nitrogen, phosphorus, heavy metals and fine suspended particles within stormwater runoff, vastly improving the quality of water in the process.

To maximize the natural benefits, selected species of floating aquatic plants typically are nurtured by implanting hydroponically grown native grasses or wetland plants on durable synthetic mats. The plant tissue above the synthetic mat stores excess nutrients. The roots beneath release oxygen and provide a surface to support microorganism growth.

Even in deep or fluctuating waters, this configuration can treat a wide range of wastewater and help restore a healthy population of fish and other wildlife inhabitants.

While the floating aquatic plants currently have no commercial value once harvested, the team is seeking ways to transform the harvested plants into biochar, which has potential to increase organic carbon in soil and other agricultural amendments.

On the study site, from left to right, are principal investigator Vankatesh Balan, University of Houston; Ram Ray, Prairie View A&M University; Weihang Zhu, UH; and Gururaj Neelgund, Prairie View A&M. Not pictured are researchers Xiaonan Shan, UH, and Sandeep Kumar, Old Dominion University.

ENVIRONMENT

Researchers Study How Underserved Farmers Can IMPROVE CROP AND IMPACT CLIMATE CHANGE

BY DENNIS SPELLMAN

University of Houston researchers are developing a program to teach small-scale, underserved and limited resources (SULR) farmers how to improve their crop production by reducing greenhouse gas emissions and increasing carbon removal.

The work is supported by a nearly $5 million grant from the US Department of Agriculture (USDA) Natural Resources Conservation Service. Researchers will partner with colleagues from Prairie View A&M University, Texas A&M University and Michigan Aerospace Corp. to study how best to implement a Climate-Smart Sustainability Certificate program for SULR farmers. UH research projects will receive almost $700,000.

"These farmers are the most disadvantaged in the current agricultural system and most vulnerable to the negative impacts of climate change," said **Abdul Latif Khan**, assistant professor in the Technology Division at the Cullen College of Engineering.

The study will allow the USDA to track the success of Climate-Smart farming practices. The team will quantify the benefits and costs of growing specialty crops under precision technology-assisted climate-smart practices and compare them with conventional production practices. In addition, the study will provide information on sustainable farming practices. Included in the study will be research done by **Xiaonan Shan**, assistant professor in the Electrical and Computer Engineering Department at the Cullen College of Engineering.

"Climate changes hinder the desired natural plant productivity and threaten food security," said **Venkatesh Balan**, associate professor in the Technology Division at the Cullen College of Engineering.

Through this project, the researchers from partnering institutions will collect data on three central Climate Smart interventions that sequesters carbon dioxide – silicon, algae and rock powder. In addition, SULR farmers will learn practices like adding rock dust to the soil to speed up the chemical reactions that sequester carbon.

The project will also focus on existing practices that protect the soil from erosion, pests, weeds and diseases, while increasing soil fertility and reducing greenhouse gas emissions. When the harvest is over, crop cover will be grown to protect the soil from erosion. In addition, farmers will employ new water management practices and reduce soil tilling.

"We will measure, monitor, report and verify the carbon and greenhouse gas reduction benefits," added Xiaonan Shan, assistant professor of electrical engineering at the Cullen College of Engineering.

The team will share results with farmers to provide data-driven evidence in support of adopting climate-smart practices.

The team believes farmers will embrace Climate-Smart sustainability practices when they see the increased crop production that results from their efforts.

Pictured left to right: Abdul Latif Khan, Xiaonan Shan, Venkatesh Balan

Collaborative Study Examines **Benefits** *of*

GEOTHERMAL ENERGY IN TEXAS

BY RASHDA KHAN

Experts Offer Insight for Future Development & Decarbonization

Researchers from five Texas universities, the University Land Office and the International Energy Agency jointly published a landmark study evaluating the potential of geothermal – the naturally occurring renewable energy harnessed from the heat emanating from the earth's core – as an abundant clean energy source in Texas and its potential to scale globally over the coming decades.

The 15-chapter study, "*The Future of Geothermal in Texas: The Coming Century of Growth & Prosperity in the Lone Star State*," includes analyses of the location and quality of Texas geothermal resources, evaluations of technology developments, the role of the oil and gas industry in achieving growth and scale, as well as environmental, regulatory, economic, and legal issues pertinent to the growth of the geothermal industry, both in Texas and globally.

Most importantly, it provides a scientific basis for informed decision-making as entities begin to consider the increased development of geothermal in Texas.

Collaborators include researchers from multiple research institutions across the state, including the University of Houston, the University of Texas at Austin, Southern Methodist University, Rice University, and Texas A&M University. The report is funded and supported by the Cynthia and George Mitchell Foundation, the Educational Foundation of America, and Project InnerSpace.

Current geothermal energy production is limited to places where, by chance, the right conditions – heat, permeability and the presence of substantial amounts of water – naturally occur near the surface. But geothermal resources are literally everywhere beneath the surface, and research shows that new technologies and techniques can be leveraged to harvest this energy source anywhere in the world.

Texas and geothermal energy are a natural fit said **Birol Dindoruk**, the American Association of Drilling Engineers Endowed Professor in Petroleum, Chemical and Biomolecular Engineering at the University of Houston and one of the lead authors of the report.

"We have multiple opportunities that is direct function of the coherent ecosystem exists in Texas. We have been doing many of these drilling and extraction operations already in the oil industry and as well as through the existing geothermal businesses, which is not new," said Dindoruk, who contributed to the first three chapters of the report that cover various concepts with unique applications in Texas. "Existing wells and other add on wells especially at geothermal sweet spots will generate opportunities in various ways – from diminishing costs to reducing emissions."

According to the report, numerous geothermal startups have launched in Texas in recent years. Buoyed by oil and gas investments and primarily led by oil and gas industry veterans, these companies are moving quickly to demonstrate entirely new scalable geothermal concepts.

"Nabors views the geothermal opportunity as a possibility to repeat the scale and impact of unconventionals, but for decarbonized energy. Our investments, both internal and in our portfolio of start-ups, represent our commitment to innovating the future of energy while staying committed to our core competencies," noted Siggi Meissner, President, Energy Transition and Industrial Automation at Nabors Industries.

The increasing engagement of oil and gas entities in geothermal is both reflected in and explained by outcomes of the study. Authors report that oil and gas technology and knowledge transfer into geothermal is projected to deliver 20 to 43 percent in cost savings to geothermal, using existing technologies in use in the oil and gas industry today, and that nearly 70 percent of oil and gas entities engaged with the study reported that there are no geothermal related technical challenges that the oil and gas industry cannot solve.

"As an energy technology company, Baker Hughes has supported the geothermal sector for more than 40 years, providing technology and expertise for some of the world's most innovative projects. Baker Hughes continues its strategic focus on new energy frontiers, including geothermal -- launching into the next 40 years and beyond," said Ajit Menon, Baker Hughes Vice President for Geothermal.

Researchers in the study calculated multiple growth scenarios for geothermal development, both globally and in Texas, placed in the context of the scale of the oil and gas industry. They concluded that drilling 1.4 million wells globally between 2030 and 2050 could meet 77 percent of the world's projected electricity demand, while enabling Texas to decarbonize 100 percent of its grid.

"The outcomes of this study are big - but so is the oil and gas industry - and the role of the industry is what has been the missing link in prior assessments about geothermal and its potential to scale," noted Jamie Beard, Principal Investigator and Editor of the study. "To achieve the outcomes reported, we would need an Apollo-style mobilization of effort globally, but that is what climate change requires of us. We've done Apollo before - let's do it again."

Environmental and climate groups are increasingly engaging with geothermal as a potentially high-impact and fast path to global decarbonization. Clean Air Task Force, for example, launched a team focused on a type of deep geothermal called SuperHot Rock in 2022. "For too long, geothermal has been underestimated as a critical climate solution, noted Philip Ball, Chief of Geothermal Innovation at Clean Air Task Force. "Advanced, scalable geothermal concepts, like those discussed in this Report, can play a critical role in decarbonizing the global energy system and providing abundant carbon-free energy virtually everywhere in the world. It's time environmental groups recognize the opportunity geothermal presents and put themselves in a position to seize it."

Geothermal sits in a rare political and social space in an increasingly polarized political and policy climate, where environmental and climate impact groups and oil and gas entities can get together and support the same cause.

"This geothermal study presents a rare opportunity in polarized debates about the future of energy where renewable energy proponents and the oil and gas industry can support the same cause," said David Monsma of the Austin-based Cynthia and George Mitchell Foundation, a study funder. "It presents an overdue energy policy pathway toward increasing firm clean electricity that should bring everyone to the table."

NEW EXTREME SENSORS

BY RASHDA KHAN

Extreme environments in several critical industries – aerospace, energy, transportation and defense – require sensors to measure and monitor numerous factors under harsh conditions to ensure human safety and integrity of mechanical systems.

In the petrochemical industry, for example, pipeline pressures must be monitored at climates ranging from hot desert heat to near arctic cold. Various nuclear reactors operate at a range of 300-1000 degrees Celsius, while deep geothermal wells hold temperatures up to 600 degrees Celsius.

Now a team of University of Houston researchers has developed a new sensor that was proven to work in temperatures as high as 900 degrees Celsius or 1,650 degrees Fahrenheit, which is the temperature mafic volcanic lava, the hottest type of lava on Earth, erupts.

"Highly sensitive, reliable and durable sensors that can tolerate such extreme environments are necessary for the efficiency, maintenance and integrity of these applications," said **Jae-Hyun Ryou**, associate professor of mechanical engineering at UH and corresponding author of a study published in the journal Advanced Functional Materials.

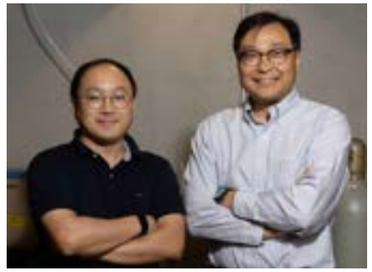
Making It Work

The UH research team previously developed III-N piezoelectric pressure sensor using single-crystalline Gallium Nitride, or GaN thin films for harsh-environment applications. However, the sensitivity of the sensor decreases at temperatures higher than 350 degrees Celsius, which is higher than those of conventional transducers made of lead zirconate titanate (PZT), but only marginally.

The team believed the decrease in sensitivity was due to the bandgap – the minimum energy required to excite an electron and supply electrical conductivity – not being wide enough. To test the hypothesis, they developed a sensor with aluminum nitride or AlN.

"The hypothesis was proven by the sensor operating at about 1000 degrees Celsius, which is the highest operation temperature among the piezoelectric sensors," said **Nam-In Kim**, first author of the article and a post-doctoral student working with the Ryou group.

Below: Nam-In Kim and Jae-Hyun Ryou



While both AlN and GaN have unique and excellent properties that are suitable for use in sensors for extreme environments, the researchers were excited to find that AlN offered a wider bandgap and an even higher temperature range. However, the team had to deal with technical challenges involving the synthesis and fabrication of the high-quality, flexible thin film AlN.

"I have always been interested in making devices using different materials, and I love to characterize various materials. Working in the Ryou group, especially on piezoelectric devices and III-N materials, I was able to use the knowledge I learned in my studies," said Kim, who earned his Ph.D. in materials science and engineering from UH in 2022. His award-winning dissertation was on flexible piezoelectric sensors for personal health care and extreme environments.

Close-up photo of the new piezoelectric sensor developed by University of Houston researchers. It can potentially work in extreme environments.

"It was very interesting to see the process leading to the actual results and we solved the technical challenges during the development and demonstration of the sensor," he added.

What's Next?

Now that the researchers have successfully demonstrated the potential of the high-temperature piezoelectric sensors with AlN, they will test it further in real-world harsh conditions.

"Our plan is to use the sensor in several harsh scenarios. For example, in nuclear plants for neutron exposure and hydrogen storage to test under high pressure," Ryou said. "AlN sensors can operate in neutron-exposed atmospheres and at very high-pressure ranges thanks to its stable material properties."

The flexibility of the sensor offers additional advantages that will make it useful for future applications in the form of wearable sensors in personal health care monitoring products and for use in precise-sensing soft robotics.

The researchers look forward to their sensor being commercially viable at some point in the future. "It's hard to put a specific date on when that might be, but I think it's our job as engineers to make it happen as soon as possible," Kim said.

ENVIRONMENT

ASSESSING THE HUMAN HEALTH RISK OF ENVIRONMENTAL CHEMICAL MIXTURES

BY STEPHEN GREENWELL

Debora Rodrigues

Xinli Liu

The U.S. Environmental Protection Agency announced Wednesday $7.7 million in research grant funding to improve risk assessment of chemical mixtures in the environment, which includes $749,926 for research by **Debora Rodrigues**, Ezekiel Cullen Professor of Civil and Environmental Engineering and her co-PI, **Dr. Xinli Liu**, associate professor of Pharmaceutics.

Rodrigues' research is one of 11 proposals funded by the EPA. Other institutions include Georgia Tech, Purdue, Texas A&M and the University of North Carolina.

"Protecting public health is an essential part of EPA's mission," said Chris Frey, Assistant Administrator of EPA's Office of Research and Development. "The research announced today will advance the science for evaluating mixtures of chemicals and their toxicity so we can better understand the human health impacts, and ultimately, better protect public health."

The research, "Oral toxicity assessment of PAH mixtures using an in vitro 3D cell culture bioreactor mimicking the in vivo intestinal tract environment," runs through August 2023.

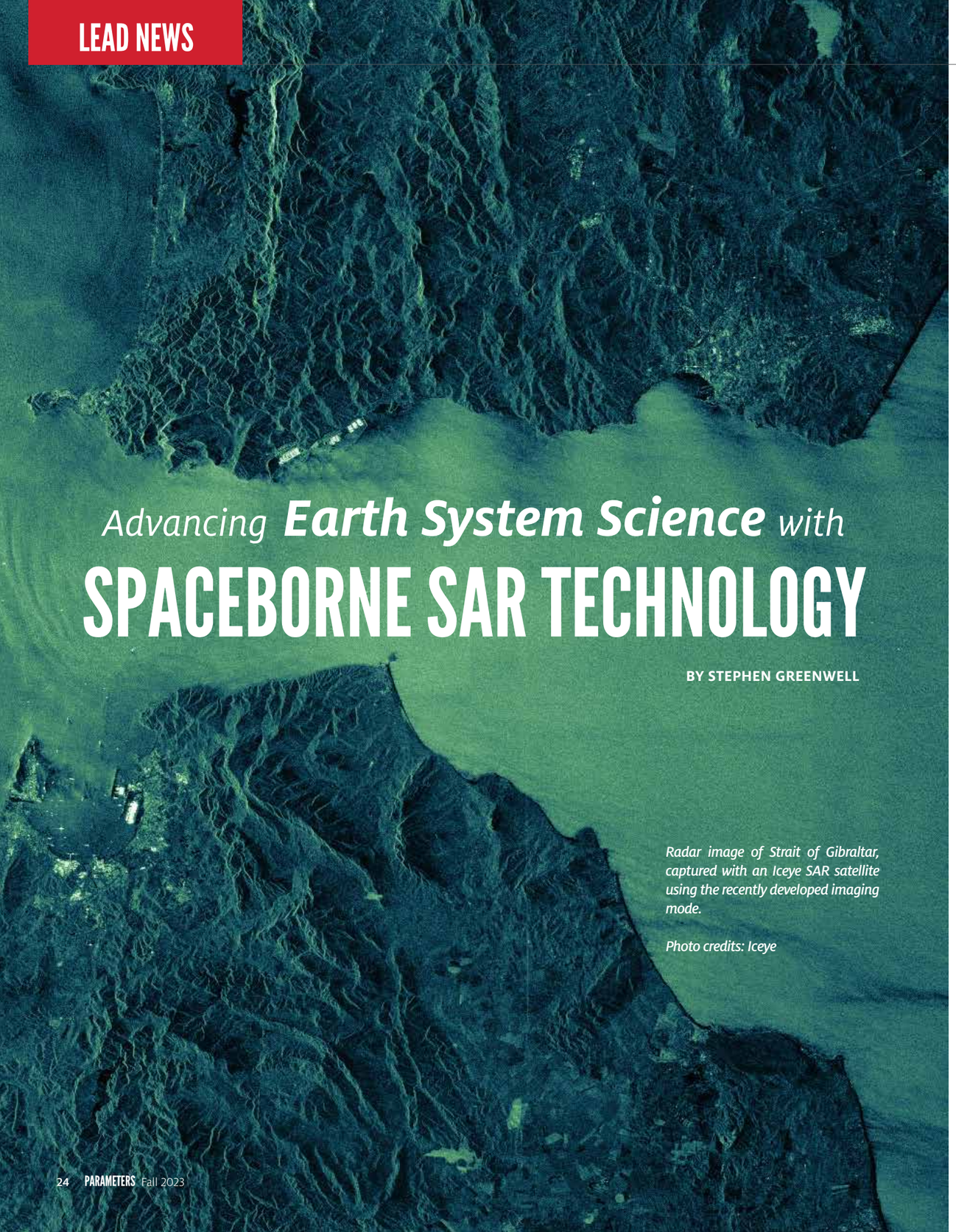
According to a research description provided by Rodrigues, "Polycyclic aromatic hydrocarbons (PAHs) ubiquitous presence in the environment is a severe public health concern as many of them are known to be carcinogenic to humans. PAHs can enter the human body either through inhalation or consumption of contaminated food. The latter represents the most common mechanism of PAHs intake (2-500 ng/day) but has not received much attention. Current approaches to understanding the toxicology of environmental contaminants usually require in vivo experimentations with different animals. Still, they do not necessarily translate to actual human responses, can be expensive, laborious, and is of low throughput, especially for a large class of toxicants such as PAHs. To address this limitation, the objective of this study is to design and engineer an in vitro 3-Dimensional (3D) cell culture integrated into a flow-cell bioreactor to conduct the toxicological assessment of environmental PAH mixtures that can be found in food."

The objective of the work will be "incorporating 3D cell culturing techniques in a bioreactor with a controlled temperature, growth conditions, and flow of nutrient media will induce growth and alter cell behavior like an in vivo intestinal tract environment, providing an efficient and realistic model to understand PAH mixtures health risk." Dr. Liu's group will assist in validating this new approach in animal model.

This is the first EPA grant awarded to the University of Houston since 2007, and only the eighth since 1996. Earlier this year, Rodrigues was chosen as an NSF program director, and through 2018 she has earned more than $5.5 million in grant funding from major organizations.

Advancing ***Earth System Science*** *with* SPACEBORNE SAR TECHNOLOGY

BY STEPHEN GREENWELL



Radar image of Strait of Gibraltar, captured with an Iceye SAR satellite using the recently developed imaging mode.

Photo credits: Iceye

Pietro Milillo, an assistant professor in the Civil and Environmental Engineering Department at the University of Houston's Cullen College of Engineering, has secured a $200,000 grant from NASA funding for assessing NASA's Commercial Smallsat Data Acquisition (CSDA) Program.

The goal of the project is to assemble study teams for evaluating the potential impact spaceborne synthetic aperture radar (SAR) constellations may have in encouraging and enabling efficient approaches to advancing Earth System Science and applications development for societal benefit.

SAR is a cutting-edge technology that uses radar signals to create high-resolution images of the earth's surface. Unlike traditional optical systems that record light reflected by our planet Earth, SAR emits microwave radiations and uses advanced signal processing techniques to combine multiple radar reflections into a single, highly detailed image. SAR has a wide range of applications, from mapping and surveying to military reconnaissance and disaster response.

The CSDA Program was established to identify, evaluate and acquire data from commercial sources that support NASA's Earth science research and application goals. Specifically, the two proposals will evaluate Capella Space and Iceye high-resolution data for Coastal Monitoring and Sustainable Water Management Practices.

It will also further assess whether the added value of the new private constellation of SAR sensors including Capella and Iceye are leading to an unprecedented observational capability and advances in Earth Science and natural hazards response.

“Our first goal is document Capella Space and Iceye synthetic aperture radar data quality for coastal monitoring and sustainable water management practices” said Milillo, who is also a visiting scientist at the German Aerospace Center in Munich. “The synergistic use of synthetic aperture radar constellations proved to be the key for recent fundamental discoveries in climate change, should this data prove to be up to standard they will be able to be used routinely by the scientific community and provide a new level of detail in space and time never seen before”

In addition to Milillo, the study team will also include associate professor **Hyongki Lee**, another member of the Civil & Environmental Engineering Department and a co-investigator at the University of Houston.

Lee will be supporting the project by assessing the Capella and Iceye dataset over the selected reservoirs in Vietnam where in-situ observations are available from a stakeholder. This will provide valuable insights into the accuracy and reliability of the satellite data, as well as its potential applications in water resources management. Lee's expertise in remote sensing and water resources management will be a valuable asset to the project, and his contributions will be instrumental in achieving the study's objectives.

“SAR data has been useful in capturing reservoir states from space, and I am excited to look into the new high-resolution Capella and Iceye images and evaluate how then can contribute to obtained reservoir extents more accurately and more frequently. I envision the data can be eventually used for better water resources management with its unprecedented resolution in space and time,” Lee said.

The team will investigate the Capella and Iceyes commercial satellite's inclined orbit capabilities of acquiring SAR images close in time to the TanDEM-X (TDX) acquisitions in order to characterize shoreline uncertainties and improved estimates of daily reservoir operations in Vietnam.

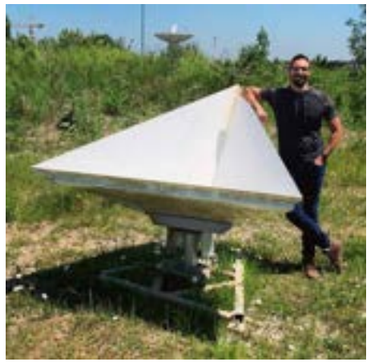
“In order to assess the quality standards of these commercial constellations we will have to assess satellites performances using ground based instruments such as transponders and corner reflectors used for calibration,” Milillo said.

The study will also have international collaborators, including the Italian National Research Center (CNR-IREA), which will provide support with calibration test sites in Italy. Also collaborating is the Ministry of Natural Resources and Environment of Vietnam, together with the National Center for Water Resilience Planning and Investigation, which will provide reservoir ground-based measurements.

The project will yield critical new knowledge about the relative capacity of satellite-based SAR to document spatiotemporal variability in coastal areas with the resolution and scale required for coastal flood prediction and risk assessment along the Pacific Coast, where flood hazards are dominated by high tides and waves.

The project will also focus on the Greater Mekong, which includes six neighboring countries in China, Myanmar, Laos, Cambodia, Thailand and Vietnam. The area is among the most affected regions by climate changes, and sees exponential growth of reservoir storage capacity.

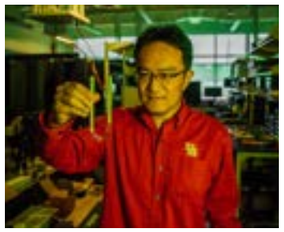
Advanced analysis techniques will be used in the projected, including short-repeat pass SAR platforms for observing, interpreting, and modeling coastal areas and reservoir states. This will reduce uncertainties in coastal flood hazard assessment and decision-making for more sustainable water resources management.

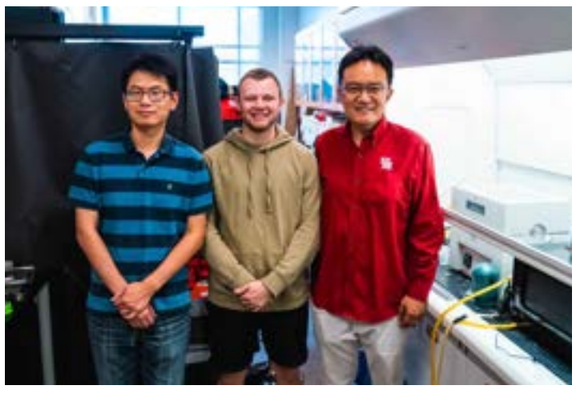


Pietro calibrating and advancing Earth Science applications for societal benefits using Capella and Iceye data.

Minimizing **Carbon F👣tprint** *By Converting* METHANE TO HYDROGEN

BY STEPHEN GREENWELL





Jiefu Chen, Xionan Shan and their research student conducting research.

A pair of professors from the Cullen College of Engineering are partnering with a colleague from Howard University to spur clean energy development via the use electromagnetic energy assisted hydrogen generation from fossil fuels.

Currently, about 96 percent of global hydrogen production is obtained from hydrocarbon (e.g. by coal gasification, oil/naphtha reforming, and steam reforming of methane), and the methane reforming takes 48 percent of the total hydrogen production in the world. It is extremely important to find an efficient way to convert the methane to hydrogen with the minimized carbon foot print.

Associate professor **Jiefu Chen** and assistant professor **Xiaonan Shan**, both of the Electrical and Computer Engineering Department, are the leads on the project for the University of Houston to find a more efficient way to convert the hydrocarbon, such as methane, to hydrogen using the microwave plasma.

In this project, they will design and simulate the catalyst structure, geometry, and materials to control the localized micro-plasma generation and therefore improve the microwave heating efficiency and boost the methane pyrolysis conversion rate and selectivity.

The principal investigator is Su Yan, an Assistant Professor in the Department of Electrical Engineering and Computer Science at Howard University. The total funding for the project is about $400,000, with the UH portion of the grant totaling about $190,000.

Shan said the research would be ongoing for several years.

“Basically, in this proposal, we are studying the possibility of using electromagnetic waves (microwaves) to enhance the hydrogen generation from fossil fuel,” he said. “We are mostly focused on using a computational tool to study that. Currently, we are reaching out to oil companies in Houston to seek extra funding to experimentally demonstrate it.”

As part of the grant, there is funding to hire one minority or underrepresented graduate student researcher. Shan said that student had not yet been identified yet.

ENERGY

XU Receives NSF Grant For HEAT TRANSFER RESEARCH

BY STEPHEN GREENWELL

Ben Xu

A new faculty member in the Mechanical Engineering Department at the University of Houston's Cullen College of Engineering has received a six-figure grant from the National Science Foundation for collaborative research into oscillating flow and heat transfer in porous media.

Ben Xu, an assistant professor and Presidential Frontier Faculty Fellow, received the award in March for his proposal, “Collaborative Research: Multi-scale study of oscillating flow and multiphase heat transfer in porous media.” As the leading PI in this collaborative campaign, the $171,734 grant will cover research at UH through August 2025.

“This is my first standard NSF grant, and it will expand my research in multiphase transport phenomenon in advanced energy systems. This project will provide an insight in the fundamental understanding of multiphase transport process in porous media under oscillating flow conditions, and the findings will greatly improve the design of porous structures in a variety of energy applications, including thermal storage in concentrated solar power plants, carbon retention in rock structures, fuel cells, and hydrogen production,” Xu said.

According to the grant's abstract, several state-of-the-art energy technologies central to energy generation and storage require complicated flow and heat transfer through porous media, yet these flow and heat transfer mechanisms are not well understood when combining with multiphase and oscillating process. The proposed research attempts to experimentally study oscillating and multiphase flows in porous media, and then develop a numerical approach that can be used to gain further insight into the fundamental behavior, thereby improving energy efficiency, and lowering both economic costs and environmental impacts.

“This research will combine experimental and numerical techniques to describe the effects of the physical porous structure, the flow/heat transfer boundary layer and the variations in wettability from materials and manufacturing process,” the proposal states. “Naturally-occurring and engineered porous media will be scanned, analyzed and cataloged in a database, and an experimental platform will also be designed and developed to study in situ oscillating and multiphase transport phenomena inside porous media using the Neutron Imaging Facility at Oak Ridge National Lab.”

“The experimental work will be coupled with numerical simulations through parallel development of a multiphase discrete Boltzmann method model and a hybrid discrete/lattice Boltzmann method model that captures kinetic behaviors and multi-scale interactions.” Xu said.

Xu started at the University of Houston in January 2023. He has three doctoral students – **Shuqi Zhou**, **Mathew Farias** and **Lichang Zhu** – but his lab has more openings for researchers. Farias also recently published a paper on the Journal of Manufacturing Processes. For more information on openings and Xu's lab, visit the Multiphase Transport Lab (MTL).

Charging The Future With MODERN AQUEOUS BATTERIES

BY RASHDA KHAN

Yan Yao

Yanliang "Leonard" Liang

Lithium-ion batteries, which today power everything from the smartphones we carry in our pockets to the electric vehicles we drive, are projected to capture 80 percent of the rechargeable battery market in the coming years.

There's good reason for their popularity – lithium-ion batteries offer better battery capacity, efficiency and longevity than others in the current marketplace. However, they are still quite expensive and can catch fire or explode in extreme conditions.

Two top battery experts at the University of Houston contend that the gold-standard lithium-ion battery is about to get some competition. They are betting on humble aqueous batteries – with water-based electrolytes – generally regarded as safe, reliable and affordable.

"The idea is to develop advanced aqueous batteries that can combine better safety and higher voltage," said **Yan Yao**, Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Electrical and Computer Engineering and principal investigator at the Texas Center for Superconductivity at the University of Houston. Yao has been leading research on energy storage materials and devices for about a decade now. His team is on a mission to create better, safer and less expensive batteries.

Yao, and **Yanliang "Leonard" Liang**, research assistant professor of electrical and computer engineering, were recently invited by *Nature Reviews Materials*, a high-impact academic journal, to review the evolution of rechargeable aqueous batteries. "Designing modern aqueous batteries" highlights key breakthroughs over the last decade and provides guidance and direction for new research.

"Our review is extensive in scope because we wanted to paint a big picture on the landscape of aqueous batteries," Liang said. "If we don't understand the overall picture, we can't know where the next opportunity will be."

Where are aqueous batteries now and where do they need to be?

The big push toward electrification in almost every aspect of life, the growing demand for consumer electronics and electric vehicles and the need for adequate storage for renewable energy are driving the demand for batteries higher and higher.

Commercial aqueous batteries that exist today lack the energy density and lasting power needed to be seriously considered for large-scale application such as transportation and grid storage.

However, Liang and Yao stress that innovations involving materials and chemistries, coupled with other research advances have created new opportunities for a modern, more advanced form of aqueous batteries.

Rechargeable aqueous batteries offer many advantages – abundant and low-cost raw materials; minimal requirements for manufacturing environments; non-inflammable; simple fabrication and high power, which determines how long it takes to fully charge and accelerate from 0 to 60 mph.

They have their drawbacks, too – narrow thermodynamic electrochemical stability window, faulty operations that could lead to explosions and, of course, low energy density.

According to the authors, there are modern versions made with innovative materials that are in the early stages of commercialization which are key developments in the transition to the next big battery research breakthrough.

The goal is to create an advanced aqueous battery that can deliver the best of both worlds. "This new water-based battery will deliver better safety and higher voltage," Yao said.

Designing the breakthrough aqueous battery

Designing the new and improved version of the aqueous battery that will revolutionize the battery market is no easy task. It requires knowledge of the most basic intricacies and new technologies to create the ideal version – from mixing and matching ion selective membranes and coatings to lean water electrolytes, to new types of electrode reactions and modular cell design.

According to the researchers, the goal is to widen the window of electrochemical stability, allowing battery chemistry to work across wider voltage ranges and produce more energy, leading to new opportunities.

"How we integrate the different components will have a profound impact in this field," Liang said. "We must mix and match and try new combinations. Sometimes it will result in improvement in one area but compromises in another. We have to be realistic and keep trying to make it better and better."

It's all about coming up with smart combinations that will deliver the twin targets of high energy and high safety.

Liang, whose research interest spans everything from solid state and aqueous batteries to multivalent metal batteries, as well as lithium and sodium batteries, is hopeful that the ideal is achievable thanks to modern tools and new discoveries. "One day, you will have an aqueous battery that has the same voltage as the lithium-ion battery, but it will be safer because it is water-based," he said.

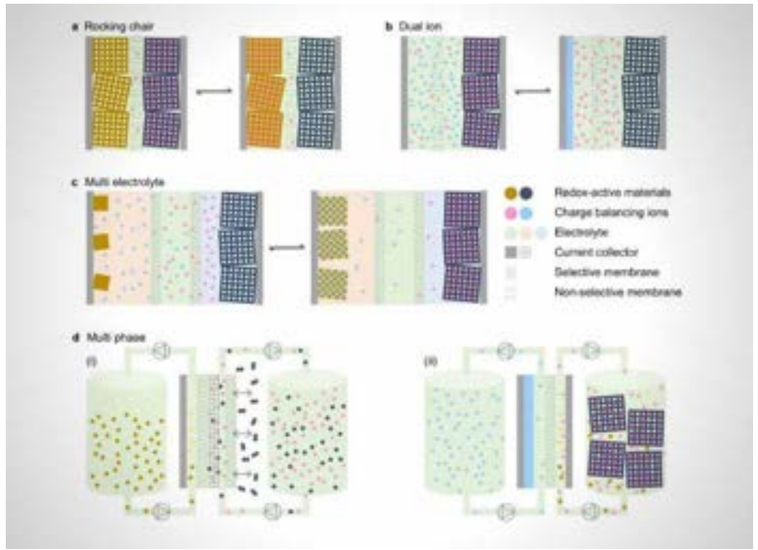
However, researchers will have to continue pursuing improvements to turn the hope into the reality of an advanced commercially viable aqueous battery. There is excellent incentive to spur researchers on – not only will the aqueous batteries of the future offer more energy and safety, but they will also make battery disposal easier on the environment because of the materials used.

Yao and Liang recently launched a startup called LiBeyond to scale up and further develop innovative battery technologies originally developed at UH. They envision possible applications in electric vehicles and other areas of transportation to help power entire fleets and grid-scale storage.

> "The possibilities these modern aqueous batteries will offer are endless."
>
> - YAN YAO

"This will be especially important when grid reliability is key, such as during situations like hurricanes, winter storms and other emergencies," Yao said. He added that wearable technologies would also benefit from this development.

"One of the key features of aqueous batteries is safety, which is vital in wearable technologies because you 'wear' them directly on the body," he said. "The possibilities these modern aqueous batteries will offer [once developed] are endless."



The key to advancing aqueous battery development is mixing and matching components for numerous combinations of reactions and phases.

UH EXPERTS **OFFER ADVICE TO DEAL** WITH TEXAS ENERGY CHALLENGES

BY RASHDA KHAN

Texas is bracing for an energy strain and high prices as summer heats up.

The first official day of summer in Texas brought a stark reminder of the challenges ahead with temperatures in the triple digits and the Electric Reliability Council of Texas (ERCOT) calling for the public to voluntarily conserve energy. Many Texans are concerned about the stability of the state's power grid.

With above-average temperatures predicted and the mercury already surpassing 100 degrees in June, electricity demand is expected to skyrocket while supply remains tight.

Earlier this month, ERCOT utilized the new ERCOT Contingency Reserve Service (ECRS) mechanism, allowing it to pay generators to step out of the daily market and be on standby. When electricity demand rises and supply is tight, ERCOT pays these generators extra to pitch in. Ed Hirs, Energy Fellow and globally recognized energy markets expert at the University of Houston, said consumers will end up paying much higher prices for electricity, partly because of ECRS.

"Consumers will have paid more than $1 billion more than necessary since June 16...this will show up on bills when contracts get renewed," Hirs said. "The net effect of the ECRS is that no new generators are being built, and the wholesale price of electricity is jumping."

Hirs, who forecast the ERCOT's 2021 winter storm grid failure in 2013 due to the flawed market design that was mandated by Texas state laws and regulations, added "the ECRS was just an immaterial reconfiguration of the existing portfolio of generators."

More context and details are available in Hirs' Victoria Advocate guest column.

Here are some more insights and advice from several UH energy experts on how best to conserve electricity and alleviate the strain this summer:

Xingpeng Li, an assistant professor of electrical and computer engineering, highlighted Conservation Voltage Reduction (CVR) programs used by many utilities as a key strategy for energy conservation.

"Reducing voltage, by a reasonable small amount, can save electricity," Li said. CVR, a long-practiced cost-effective measure, involves controlling distribution voltage levels and delivering electricity at lower voltages within the acceptable range, as defined by the American National Standards Institute 1995.

Li also suggested a simple, yet effective, measure individuals can take to reduce energy consumption related to tanked water heaters. He advised turning off these heaters when they are not in use during peak hours, as they continue to consume electricity to maintain water temperature, even when idle.

Harish Krishnamoorthy, assistant professor of electrical and computer engineering and associate director of the Power Electronics, Micro-grids and Subsea Electric Systems Center (PEMSEC) at UH, outlined three simple steps he personally follows:

1. Turn on the fan(s) and set the power-hungry AC's temperature higher (78 degrees Fahrenheit and above).

2. Increase the temperature set points of the refrigerator (many refrigerators allow for independently setting the temperature of the freezer and remaining sections).

3. Do not do laundry during the peak hours.

Charles McConnell, director of the Center for Carbon Management and Energy Sustainability, expressed a need to encourage a "balanced approach for all forms of energy for reliability. Let's not forget that reliability requires investment in dispatchable, baseload, 24/7 electricity supply and a market that promotes it."

Texas, he added, needed a balanced long-term strategy to address its energy challenges.

"I, for one, can't subscribe to a sustainable strategy that requires consumers to turn their thermostats up. That's not a strategy. That is, in my view, a desperate attempt to try to get through situations that are difficult," McConnell shared in a recent ABC 13 interview.

McConnell, a former assistant secretary of energy at the U.S. Department of Energy, urged more conversations among officials about the best ways to keep up with energy demands long-term and find the best energy solutions for the good of the public.

ENERGY

ENERGY INDUSTRY APPS IMPROVE EFFICIENCY

BY RASHDA KHAN

Birol Dindoruk, the American Association of Drilling Engineers Endowed Professor in petroleum, chemical and biomolecular engineering at UH; **Mohamed Soliman**, chairman of the UH Department of Petroleum Engineering; and **Utkarsh Sinha**, who earned a master's degree in petroleum engineering from UH in 2018, have developed a series of digital applications to make energy industry processes more efficient. Three innovative online calculators, the most recent being the UH Hydrocarbon Gas Minimum Miscibility Pressure (MMP) Calculator, are available to industry professionals free of charge.

With the industry's focus shifting toward carbon capture, utilization and storage (CCUS) and a net-zero economy, gas injection could play a vital role. MMP is the key property that determines the feasibility coupled with the efficiency of a gas injection project, one of the most effective methods for enhanced oil recovery. In addition, it will provide a calibration point for carbon dioxide sequestration projects when hydrocarbons are present. The new calculators for hydrocarbon MMP, carbon dioxide MMP, and viscosity, can help engineers in the field save time, resources and funds with by enabling faster screenings and calculations.

"These apps provide a quick, robust method to provide the MMP value during gas injection with easily available inputs in hand and with a significantly higher accuracy than any of the incumbent methods used in the industry," Sinha said.

Given the fast-paced energy industry and recognizing that engineers and technical personnel don't necessarily have the luxury to test and implement ideas shared in academic papers, the research team was determined to bring these tools to "the fingertips of the users," added Dindoruk.

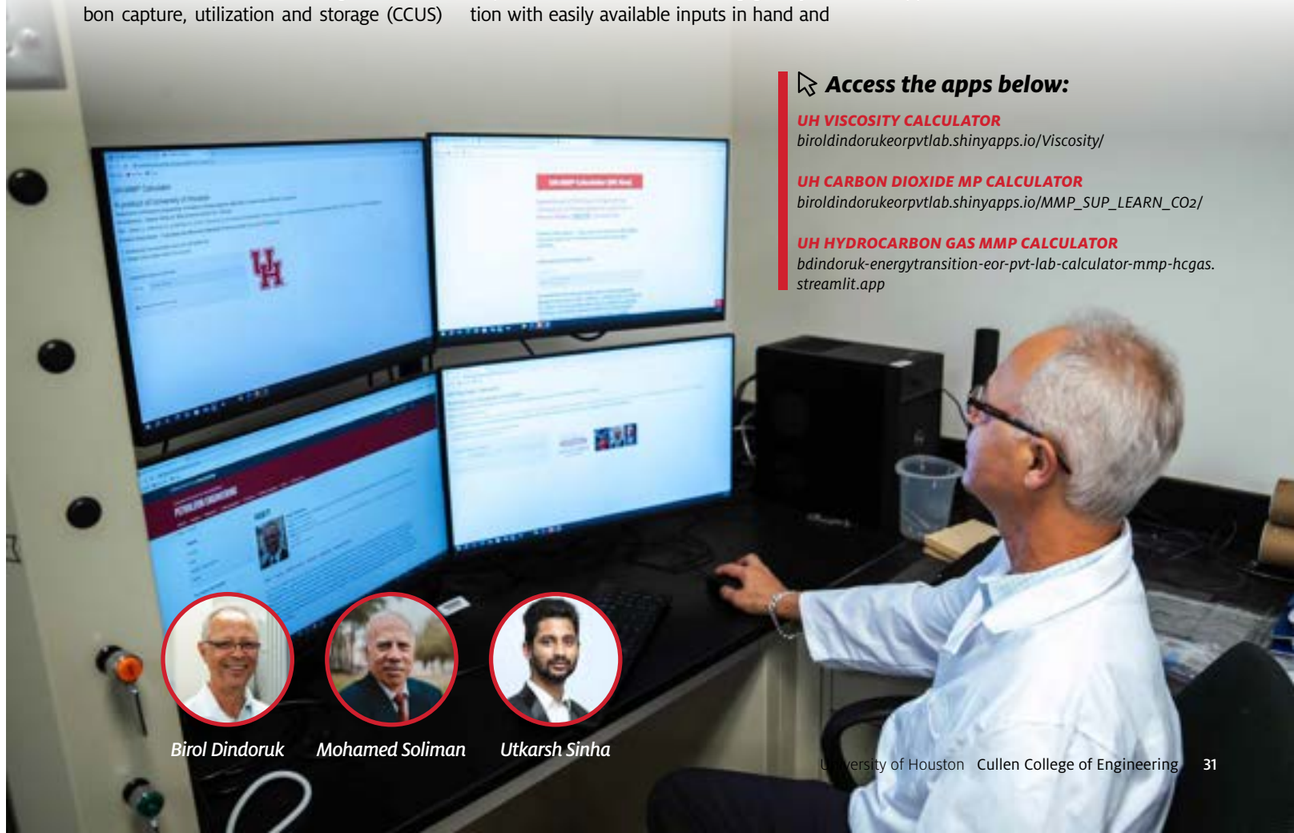
By making the apps freely available, the researchers hope to learn from users' feedback to make improvements, and even develop new applications.

Access the apps below:

UH VISCOSITY CALCULATOR
biroldindorukeorpvtlab.shinyapps.io/Viscosity/

UH CARBON DIOXIDE MP CALCULATOR
biroldindorukeorpvtlab.shinyapps.io/MMP_SUP_LEARN_CO2/

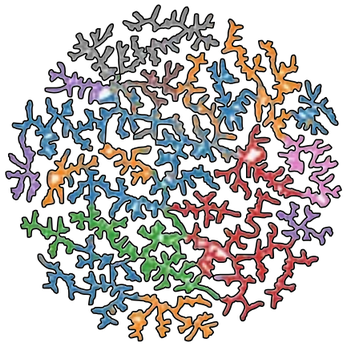
UH HYDROCARBON GAS MMP CALCULATOR
bdindoruk-energytransition-eor-pvt-lab-calculator-mmp-hcgas.streamlit.app



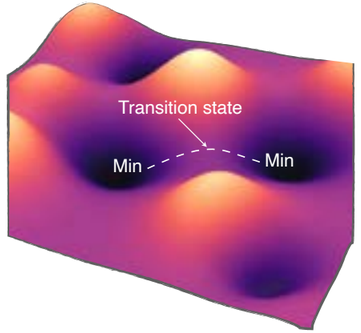
Birol Dindoruk *Mohamed Soliman* *Utkarsh Sinha*

Addressing **Renewable Energy Challenges** With Computers

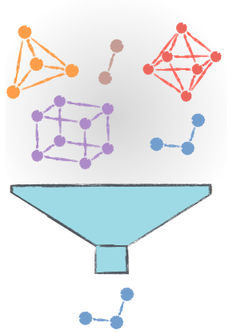
BY STEPHEN GREENWELL



Machine Learning Reactions



Atomistic Molecular Simulations



Materials Screening

For **Mingjian Wen**, a new assistant professor and Presidential Frontier Faculty Fellow in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the Cullen College of Engineering, the interplay of materials and computational techniques is what drives his research and intellectual curiosity.

"I use modern computational techniques, such as machine learning and high-performance computing, to find new molecules and materials for energy and healthcare applications," he said, pointing to lithium-ion batteries as an example of an item that could be improved.

"Lithium-ion batteries have enabled the widespread use of smart phones and electric cars. But most of us have to recharge our phones every day, and our electric cars can drive for only about 300 miles on a single charge. Both are limited by the amount of energy a battery can store. One branch of my research is to find new materials that can significantly improve battery performance. This is a very challenging task given the complexity of a battery. We tackle this with computational approaches by utilizing machine learning models and molecular simulations to search for candidates. The candidate materials are later tested and verified by experimental collaborators."

While lithium-ion batteries are one example, this sort of cross-pollination between materials and computers can be applied to other areas as well.

"The techniques underlying my research, such as machine learning, atomistic molecular simulation and high-performance computing, can be easily transferred to understand other materials," he said. "I am expanding my research to investigate nanoporous materials and drug molecules, hoping it can help to address current energy and healthcare challenges."

Wen earned his doctorate in Aerospace Engineering and Mechanics at the University of Minnesota, Twin Cities. He earned his B.S. in Chemical Process Machinery Engineering from Tianjin University, China. Before coming to UH, he worked as a postdoctoral researcher at the Lawrence Berkeley National Laboratory in the Energy Storage and Distributed Resources Division.

Wen spoke highly of his two mentors from Minnesota and Berkeley when it came to developing his own interest in research and academia.

"I first developed my interest in academia while I was a graduate student working with Prof. Ellad Tadmor at the University of Minnesota," he said. "The most significant influence Prof. Tadmor had on me was his research appetite for addressing problems that would benefit an entire research community. The OpenKIM Project I worked on in my PhD strives to make classical molecular simulations of materials reliable, reproducible and accessible, and we've developed a set of computational tools and web apps for this," he said. "I am very glad to see that it has been benefiting many researchers who perform molecular simulations to understand and design materials."

Wen also identified his postdoctoral research advisor as being important to his development.

"After obtaining my Ph.D., I joined Prof. Kristin Persson's group as a postdoc at Lawrence Berkeley National Lab to continue my training on materials discovery and developing open scientific infrastructure. Managing the Materials Project, the world's leading materials genome project, Kristin's group offers open access to computed information and analysis tools of materials to inspire and design novel ones. Kristin has created an unrivaled research atmosphere in her group. People in the group are very kind to each other and are always willing to help. I very much enjoyed all kinds of conversations, both inside and outside academic settings, with graduate students, postdocs, staff members and Kristin herself. This is the type of research group I am envisioning for my own, and I am working toward it from day one."

Wen joined the faculty in September 2022, after seeing a posting on Twitter by **Lars Grabow**, Dan Luss Professor of Chemical and Biomolecular Engineering, about the job opening in the Fall of 2021 and applying for the job. He added that he had known a couple of other professors working on materials research here at UH for quite some time, like **Jakoah Brgoch** in Chemistry and **Pradeep Sharma** in Mechanical Engineering.

"The hiring area – Applied Data Science, Artificial Intelligence and High-Performance Computing – was what I had been working on and hoped to continue with in my career. It is a perfect match for me," Wen said.

Wen was hired via UH's Presidential Frontier Faculty program, which is focused on hiring a large cohort of convergence research faculty to respond to federal priorities and societal challenges.

"Dr. Wen is an outstanding young scholar in the field of Computational Materials Science whose research interests are aligned with the UH strategic plan in the area of Energy Transition to more sustainable and environmentally-friendly technologies. My colleagues and I are delighted that he joined our Department," said **T.J. (Lakis) Mountziaris**, Ph.D., William A. Brookshire Professor and Department Chair.

"With my expertise in data science and AI, I see great potential to work together with my peer new hires and existing faculty members," Wen said. "I am very grateful to the generous startup support of the program, which jumpstarts my independent research by providing enough personnel and computing resources."

Wen noted that he did speak with and know some of his colleagues before joining the Cullen College of Engineering, and this also made the position attractive.

"I had various conversations with faculty members from UH, and I genuinely felt very welcomed here. My UH colleagues are very supportive and more than willing to help young faculty members to prosper," he said.

> "I am very glad to see that it has been benefiting many researchers who perform molecular simulations to understand and design materials."
>
> - MINGIJAN WEN

DOLPHIN RESEARCH *LEADS TO NEW METHOD TO POSSIBLY* IMPROVE PHARMACEUTICALS

BY LAURIE FICKMAN

Controlling Crystal Growth Has Implications for Array of Medicines

Yes, dolphins get kidney stones, too. And how did we find this out? You can thank the Navy.

In fact, move over Navy SEAL – the bottlenose dolphin is another marine mammal working hard defending our shores. With their highly evolved ability to detect objects, the dolphins have been helping the U.S. Navy find underwater mines for decades as part of the U.S. Navy Marine Mammal Program.

As part of that program, the Navy takes good care of its dolphin friends, funding research on such matters as dolphin kidney stones. That has led to implications for human treatments, according to a UH researcher.

In the body, crystals – made of things such as calcium or a collection of urine – form masses that can cause pain and serious health conditions. **Jeffrey Rimer**, Abraham E. Dukler Professor of Chemical Engineering at the Cullen College of Engineering, is known globally for his seminal breakthroughs using innovative methods to control crystals to help treat malaria and kidney stones. He is reporting a new method to control the growth of ammonium urate crystals, the substance known to cause kidney stones in dolphins.

Rimer has been riding the wave of dolphin research for a while, previously reporting on crystals associated with dolphin kidney stones made of ammonium urate, rarely found in humans. Now he's leading an international team of researchers from Tianjin University China, Stockholm University Sweden, University of Pittsburgh, University of Strathclyde, Glasgow Scotland, Texas A&M University, Purdue University, Instituto Politecnico Nacional Mexico and The Molecular Foundry at Lawrence Berkeley National Laboratory.

On behalf of the team, Rimer has published new work in *Nature Communications* on their discovery of a method to control the crystal growth of ammonium urate by manipulating isomers of urate called tautomers. The findings may not only help dolphins but may also have implications for the pharmaceutical industry.

"We found that a small fraction of urate existing as a minor tautomer can control the rate at which crystals grow to the point they can completely block crystallization," Rimer said. "It was the most unexpected and remarkable thing to find that as you increase the concentration of urate, all of a sudden the rate of crystallization drops to almost zero and crystals do not grow in that region."

> "That is critical for pharmaceuticals because when you put medicine into your body, their effectiveness is related to how fast they dissolve.
>
> - JEFFREY RIMER

Rimer thinks it may be possible to mimic those results by diet control to get the concentration in the kidney in that range, so then the possibility exists that crystal growth would be inhibited, and medicine would be unnecessary.

That goes for dolphins and humans, alike, but more on that in future research.

Examining urate crystals, Rimer also found that tautomers get incorporated into crystals as defects, and that is where the findings have implications for pharmaceuticals.

Among the top 200 drugs, there are 33 (including allopurinol, used to treat kidney stones) that are tautomers. These medications impact millions worldwide, prescribed for HIV, epilepsy, COVID-19, schizophrenia and cancer (skin, lung and pancreatic).

"When we produced crystals with very few defects, they dissolved much slower whereas crystals with a higher percentage of defects dissolve faster," said Rimer. "That is critical for pharmaceuticals because when you put medicine into your body, their effectiveness is related to how fast they dissolve," said Rimer.

"We are asking the question about these 33 pharmaceuticals – do companies really know the extent to which they develop defects? The same question can be posed for nature where tautomers may impact unique properties in species that are vital to their intended function like optical properties in fish or color change in chameleons," he said.

With Rimer's continued research, these questions may soon be answered.

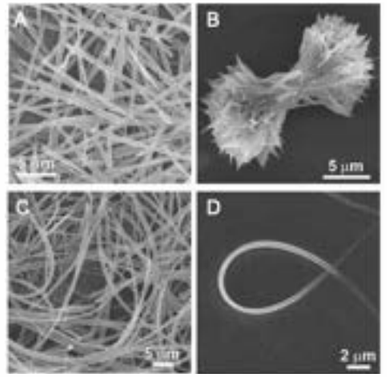
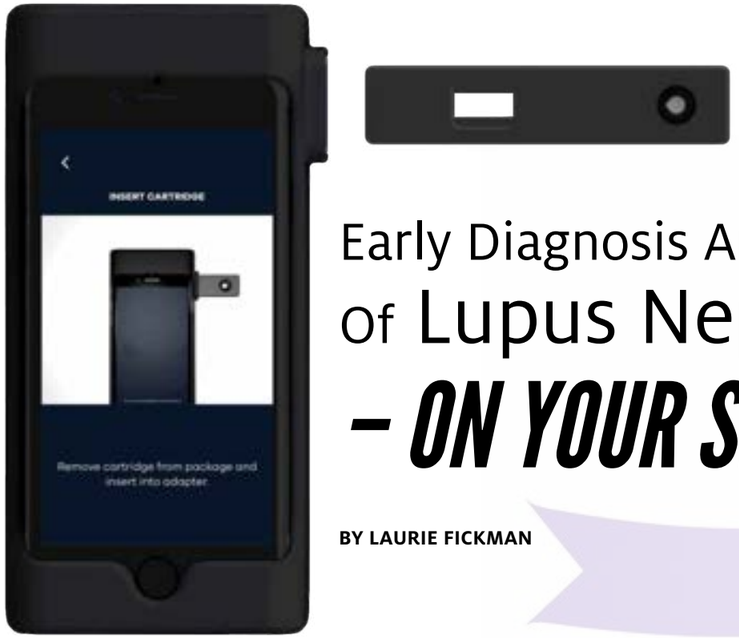


Figure. (A) Crystals of ammonium urate prepared in the absence of growth modifiers. (B - D) Crystals prepared under conditions where the concentration of minor tautomer (urate isomer), which functions as a crystal growth modifier, is present in high quantity. The minor tautomer results in the formation of defects (B) leading to intergrowths as well as incorporated defects within the crystal that leads to natural bending (C and D).

Jeffrey Rimer



Images from www.cliphealth.com

Early Diagnosis And Monitoring of Lupus Nephritis – ON YOUR SMARTPHONE

BY LAURIE FICKMAN

A team of researchers at the University of Houston is reporting the success of their new method for the early diagnosis and monitoring of lupus nephritis – at home. If you've taken an at-home COVID-19 or pregnancy test, then you've taken what is scientifically called a lateral flow assay (LFA) test, a diagnostic tool widely used because of its rapid results, low cost and ease of operation. The team applied that same technology to assessing lupus nephritis, or inflammation of the kidneys, one of the most severe complications for patients with systemic lupus erythematosus (SLE, or lupus).

The home test – with results read on a smartphone – is meant to eventually replace the gold standard for diagnosis of active lupus nephritis, an invasive kidney biopsy, with its attendant morbidity which cannot be serially repeated. The test assesses the levels of a protein-coding gene known as ALCAM.

"Urinary ALCAM (uALCAM) has shown high diagnostic accuracy for renal pathology activity in active lupus nephritis," reports **Chandra Mohan**, Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering, and one of the nation's leading lupus researchers, in Frontiers in Immunology. "The LFA tests for both non-normalized and normalized uALCAM exhibited excellent accuracies in distinguishing active lupus nephritis from healthy controls."

This test had 86 percent accuracy for distinguishing active lupus nephritis from all other lupus patients.

Utilizing the ALCAM biomarkers discovered by Mohan, **Richard Willson**, Huffington-Woestemeyer Professor of chemical and biomolecular engineering and professor of biochemical and biophysical sciences, created the smartphone-based app and test kit based on the technology underlying home pregnancy tests.

"Periodic monitoring of uALCAM using this easy-to-use LFA test by the patient at home could potentially accelerate early detection of renal involvement or disease flares in lupus patients, and hence reduce morbidity and mortality," said Willson.

According to the Centers for Disease Control and Prevention, about 204,295 Americans have systemic lupus erythematosus, an autoimmune disease leading to chronic inflammation in multiple organs, including the kidneys. Nephritis flares are hard to recognize because their symptoms often masquerade as something else. A sufferer might think they have a cold or the flu or are just tired.

"A point-of-care testing platform's importance rests on its potential to empower patients to monitor their health status with convenience, thus allowing for early diagnosis and monitoring of disease progression. The LFA represents the most widely used rapid diagnostic POC testing platform," said Mohan.

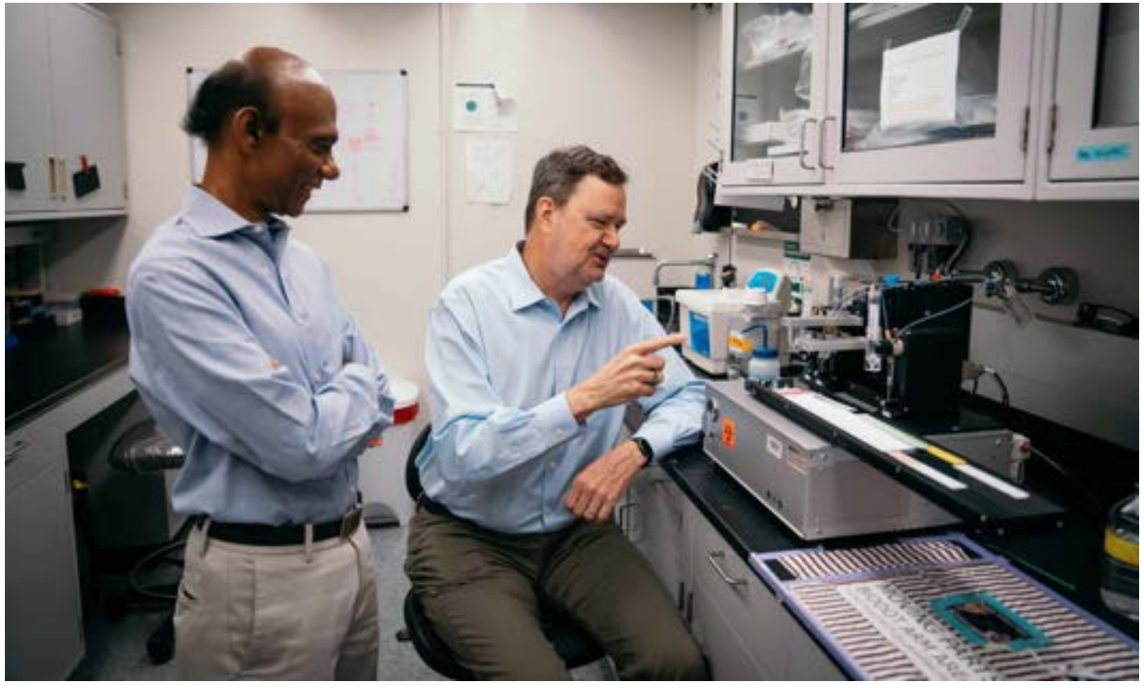
In this work, the team used nanophosphor-based lateral flow immunoassays to demonstrate promise in facilitating home-based smartphone-enabled monitoring of disease activity in LN. These studies were carried out by biomedical graduate student **Rongwei Lei**, with clinical support from Dr. Michelle Petri, John Hopkins University School of Medicine. Other contributors from the University of Houston include **Binh Vu** and **Katerina Kourentzi**, William A. Brookshire Department of Chemical and Biomolecular Engineering; Sanam Soomro and Suma Nadimpalli, biomedical engineering; Adheesha N. Danthanarayana and Jakoah Brgoch, Department of Chemistry.

"This may allow the proactive institution of therapeutics and even preventive strategies in LN, while minimizing treatment-related side effects," said Mohan.

Lupus test strip

> This may allow the proactive institution of therapeutics and even preventive strategies in LN, while minimizing treatment-related side effects
>
> - CHANDRA MOHAN

Chandra Mohan and Richard Willson demonstrating how the machine works.



Enhancing At-Home COVID Tests With

GLOW-IN-THE-DARK MATERIALS

BY LAURIE FICKMAN

Researchers at the University of Houston are using glow-in-the-dark materials to enhance and improve rapid COVID-19 home tests. If you've taken an at-home COVID-19 or pregnancy test, then you've taken what is scientifically called a lateral flow assay (LFA) test, a diagnostic tool widely used because of its rapid results, low cost and ease of operation. When you read test results, you see colored lines.

"We are making those lines glow-in-the-dark so that they are more detectable, so the sensitivity of the test is better," said **Richard Willson**, Huffington-Woestemeyer professor of Chemical and biomolecular engineering and professor of biochemical and biophysical sciences, who previously created a COVID smartphone-based app and test kit based on the technology underlying home pregnancy tests.

The first idea for glow-in-the-dark technology sprang from a star pasted on the ceiling of Willson's young daughter's bedroom. One night while he was putting her to sleep, he peered at the glow-in-the-dark star and his mind began to wander, applying its principles to science. Within days Willson and his team of students and postdocs was creating a test with glowing nanoparticles made of phosphors, which would make the particles even more detectable and the tests more accurate. Two of the students became the founders of Luminostics (now called Clip Health), a spinoff from the Willson lab).

Now in the Willson lab, the next generation is developing.

"In this new development, there are two tricks. First, we use enzymes, proteins that catalyze reactions, to drive reactions that emit light, like a firefly. Second, we attached those light-emitting enzymes onto harmless virus particles, along with antibodies that bind to COVID proteins," reports Willson in the Royal Society of Chemistry's journal *Analyst*.

COVID test results screen

Richard Willson

The reason these steps are useful is that one antibody on a virus can bind to one COVID target on the test strip and bring along with it many light-emitting enzymes. So, the team gets more light for each target, thus needing fewer targets to see the light, making the test more sensitive.

And while you might be able to read the results with your eye in a very dark room, the Willson team created a little plastic box to exclude light and let a smartphone camera do the reading.

"This is more reproducible and probably more sensitive, and with smartphones you can communicate the results to databases and things like that," said the paper's corresponding author **Katerina Kourentzi**, University of Houston research associate professor of chemical and biomolecular engineering. **Jacinta Conrad**, Frank M. Tiller Associate Professor of Chemical and Biomolecular Engineering, also from the William A. Brookshire Department of Chemical and Biomolecular Engineering at the University of Houston Cullen College of Engineering, is on team. Others from UH include the first author of the paper **Maede Chabi, Binh Vu, Kristen Brosamer, Maxwell Smith** and **Dimple Chavan**.

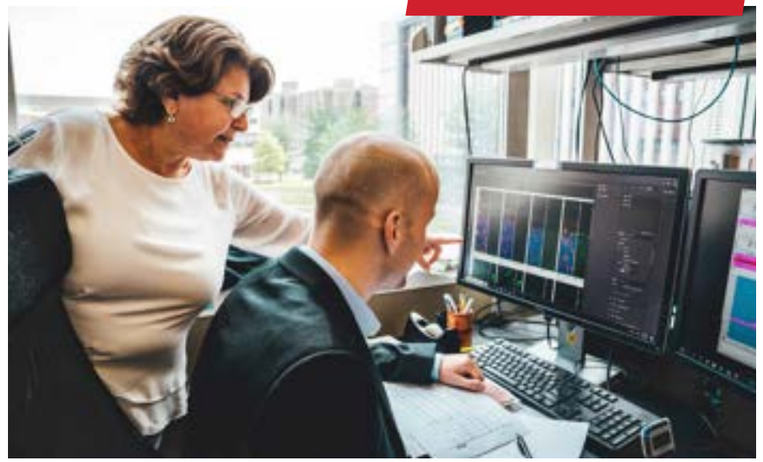
Willson adds the sensitivity is really excellent, better than essentially any commercial tests, making the technology useful in an array of medical arenas.

"This technology can be used for detecting all kinds of other things, including flu and HIV, but also Ebola and biodefense agents, and maybe toxins and environmental contaminants and pesticides in food," said Willson.

So truly, the sky – and stars – are the limit.

NAASH AWARDED GRANT TO EXPAND GENE THERAPY FOR RARE BLINDNESS DISEASE

BY LAURIE FICKMAN



Muna Naash and research student looking over collected data

A University of Houston researcher is expanding a method of gene therapy with the hopes it will restore vision loss in Usher Syndrome Type 2A (USH2A), a rare genetic disease.

The National Eye Institute has awarded **Muna Naash**, John S. Dunn Endowed Professor of biomedical engineering, $1.6 million to support her work.

Usher Syndrome Type 2A, caused by mutations of the USH2A gene, can include hearing loss from birth and progressive loss of vision, prompting retinitis pigmentosa (RP). RP affects the retina, the eye's light-sensitive layer, leading to a breakdown of cells in the retina which causes blindness. Currently no treatment exists for USH2A.

"Our goal is to advance our current intravitreal gene therapy platform consisting of DNA nanoparticles/hyaluronic acid nanospheres to deliver large genes in order to develop safe and effective therapies for visual loss in Usher Syndrome Type 2A," Naash said. Gene therapy is the introduction of a normal gene into cells to correct genetic disorders. Intravitreal treatment consists of injections directly into the vitreal chamber of the eye.

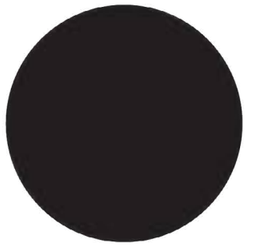
"Developing an effective treatment for USH2A has been challenging due to its large coding sequence (15.8 kb) that has precluded its delivery using standard approaches and the presence of multiple isoforms with functions that are not fully understood," said Naash, who will also evaluate the long-term efficacy of the best therapeutic platform for future translation to the clinic.

To rescue vision loss, Naash's non-viral therapy targets the mutation in usherin, the protein product that causes Usher Syndrome Type 2A. Naash has already cloned two usherin isoforms to be tested with her innovative platform to safely advance gene therapy for USH2A.

"Understanding which isoforms of usherin are expressed in the retina and the cochlea and what role they play (in contrast to mutant pathogenic forms) is essential in developing an effective gene therapy construct," Naash said.

The work will provide a solid foundation for understanding the function of each usherin isoform and developing an effective gene therapy platform to treat USH2A associated visual defects, she said.

Pictured below: An example of someone with Usher Syndrome vision over time.



KULKARNI Excited And Grateful To Receive The BRITE PIVOT AWARD

BY STEPHEN GREENWELL

Yashashree Kulkarni, Bill D. Cook Professor of Mechanical Engineering, has earned the prestigious BRITE award for about $410,000 from the National Science Foundation, as well as another $266,000 grant for collaborative research.

The BRITE award is for Kulkarni's research proposal, "An Integrated Theory of Continuum and Statistical Mechanics of Active Soft Matter." The second grant is for her collaborative research, "Interface Enabled Plasticity In High-Strength Co-Based Intermetallics."

These two grants span Kulkarni's research in the role of mechanics in materials science to biology. The BRITE award focuses on biological membranes.

Biological membranes are interfaces that separate cells and their internal organelles from their environment. These membranes play a crucial role in processes such as response of cells to mechanical stimuli, transmission of messages through electrochemical signals, or exchange of nutrients.

To date, most mechanics-based studies have focused entirely on treating biological membranes as "passive" (or "dead") since they are believed to fluctuate due to thermal vibrations of molecules only. However, there is growing consensus that membranes are actually "active" and are able to harness energy from external sources to execute specific functions when and where they need to.

According to the NSF, the BRITE (Boosting Research Ideas for Transformative and Equitable Advances in Engineering) award is designed to enable and create opportunities for experienced researchers – tenured or equivalent – to forge new directions or to enter new fields by capitalizing or branching out of their established domains, or to revitalize research after a hiatus, or to explore ambitious, bold, and expansive research ideas that cover wide intellectual spaces. There are four distinct funding tracks: Synergy, Pivot, Relaunch and Fellow. Each track provides dedicated time and resources to the PI.

"I am really excited and grateful to receive this BRITE Pivot award to support my group's research in understanding the mechanics of active membranes to gain insights into their role in critical biological phenomena, and possibly pave the way to better understand, control, and perhaps mimic active biological matter for biotechnology and healthcare applications," Kulkarni said.

The second grant focuses on intermetallics, with their remarkable properties of high mechanical strength and high melting temperatures. They are excellent candidates for next-generation structural applications that can transform national defense systems and industries like aerospace, automotive and energy.

Yashashree Kulkarni

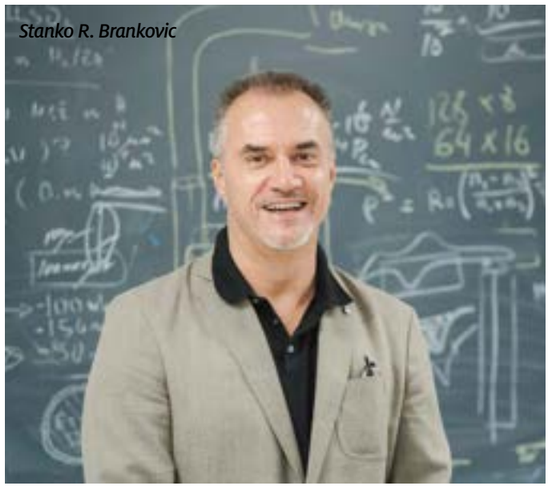
However, conventional intermetallics are very brittle at room temperature, which adversely impacts their potential as structural materials. Kulkarni will be conducting this research with Xinghang Zhang, Professor of Materials Engineering at Purdue University's School of Materials Engineering.

Kulkarni and Zhang aim to understand the mechanical behavior of nanocrystalline intermetallics with a novel core/shell architecture that endows them with simultaneous high strength and unprecedented deformability at room temperature.

"Dr. Zhang is designing cobalt-based microstructures with novel grain boundaries, and we are performing simulations on million-atom samples on supercomputers to understand the deformation mechanisms from the scale of atoms," Kulkarni said. "As engineers, we want to see how these novel interfaces lead to high strength and deformability in intermetallics to open up avenues for designing novel materials for structural needs."

BRANKOVIC EARNS $300K GRANT For Ferromagnetic Alloy Research

BY STEPHEN GREENWELL



Stanko R. Brankovic

Stanko R. Brankovic, professor in the Electrical and Computer Engineering at the Cullen College of Engineering, has received a $300,000 grant to continue his research into creating a new magnetic alloys with superior properties for induction application.

This work is of essential importance for future microchip design, which is expected to consist of up to a trillion resistors by 2030. For this reason, an optimum power supply to the chip structure will be a key problem to solve. Design of new magnetic alloys providing a highly efficient induction process of the on-chip thin film inductors is essential. The future voltage regulators and inductor structures are expected to perform without significant losses in the > 0. 5 GHz frequency range.

The grant comes from the Semiconductor Research Corporation, which previously funded research by Brankovic. In 2019, Brankovic received a three-year, $240,000 grant to explore synthesizing magnetic materials using an electrochemical process. **Francisco C. Robles Hernández**, now a professor for Mechanical Engineering Technology at UH's College of Technology, served as co-PI for that grant.

In his latest research proposal, "Electrodeposition of High Moment-High Resistivity CoFeX (X=P, O) Alloys for Inductor Application," Brankovich notes that he is building on the earlier project.

"[We've] demonstrated theoretical foundation and practical approach for electrochemical synthesis of FeCo ferromagnetic films incorporating resistive Fe2O3 phase," he wrote. "Facile control over magnetic moment, coercivity, oxygen content and resistance of these materials were established as a function of solution and electrodeposition process design. Using this approach, recent PI's work demonstrates a high resistivity of CoNiFeX (X=P and/or O) films with soft magnetic properties and high moment (1.8 – 2 T). Extending this work to a CoFe alloys in the composition range of 50:50 at percentage will ensure their moment above 2 T and soft magnetic properties (Hc < 10 Oe) while further improving their resistivity (> 1000 mWcm) by incorporation of P and O as electron scattering impurities."

Brankovic outlaid a three-year plan for the current research grant.

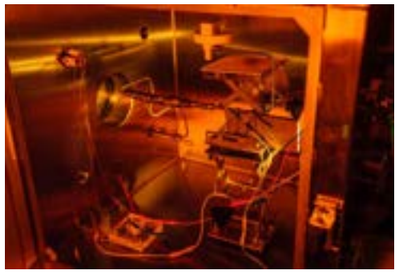
"In the first year, solution composition and process design for electrodeposition of highly resistive CoFeX films will be demonstrated. Process will be optimized to deliver good magnetic properties and high moment. In addition, electrochemical lamination/deposition process will be developed producing high resistivity laminated structures. This will be achieved by potential modulation between the potentials at which CoFeX alloy deposits and potentials at which only hydrogen evolution and $(PO_3)^{3-}$ reduction occur."

"In the second year, the goal is to fabricate prototype inductor device structures incorporating the CoFeX alloys and CoFeX/X laminated thin films to test their high frequency performance. This goal will be achieved in tight collaboration with industrial liaisons from Intel which will have direct input into the device design and testing."

"In the third year, we will focus on device testing and further optimization of the CoFeX alloy CoFeX/X laminates performance and synthesis process. We will correlate the alloys and laminates properties with their metallurgical structure, thus providing the link between high frequency performance and their metallurgical structure and synthesis conditions."

Ghasemi Earns Award To Expand Research Into COOLING HIGH-TEMPERATURE MACHINES

BY STEPHEN GREENWELL



Top: Equipment used to conduct research. Bottom: Hadi Ghasemi (far right) and his research students. Right: Hadi Ghasemi teaching his student.

Hadi Ghasemi, Cullen Associate Professor of Mechanical Engineering, has earned another significant, six-figure award to expand his research into cooling the high-temperature and hot-burning machines that now power modern life.

The Office of Naval Research awarded a $500,000 grant to Ghasemi for his proposal, "Physics-informed machine learning-driven hierarchical structures for thin-film cooling." Ghasemi said that this would be new research. His ongoing work on "icephobic" coatings has attracted multiple funding sources, including a $750,000 grant in March 2021 from the Air Force Research Laboratory. Elemental Coatings is the business entity for Ghasemi's commercial applications.

According to an abstract written by Ghasemi, he highlights the need for more efficient cooling structures for the advancement of power generation, electronics, photonics, battery modules for electrical vehicles and other applications.

"In this program, we plan to address this long-standing challenge by providing a new platform to discover high-performance micro/nano/molecular structures for thin-film evaporation and to understand the physics behind these high-performance structures," he wrote. "Through a comprehensive physic-informed machine-learning (ML) platform, we aim to predict heat transfer characteristics of a material structure before fabrication and experimentation. The governing variables on heat flux including geometrical dimensions of the material structure and properties of the working fluid will be determined."

He added, "Through optimization, we will find the optimal material structures for each working fluid. These structures will be fabricated and experimentally tested to validate this new platform. Furthermore, this platform enables us to reveal new fundamentals of liquid-vapor phase change at nano/molecular scales including the role of interface curvature on mass flux, wetting characteristic and momentum transport in confined geometries."

The research will span about three years, from December 2022 through November 2025.

NEW PULSED LASER DEPOSITION TOOL to Predict Superconductor Failures

BY LAURIE FICKMAN

A researcher at the Advanced Manufacturing Institute and the Texas Center for Superconductivity at the University of Houston (TCSUH) has found a way to reduce superconductor failures, enabled by a Pulsed Laser Deposition (PLD) tool. The popular thin film deposition instrument will be purchased with an $800,000 grant from the U.S. Office of Naval Research.

At extremely low temperatures (as low as cryogenic temperatures), superconductors allow electric current to flow without resistance and produce strong magnetic fields. That's the principle behind Magnetic Resonance Imaging (MRI) machines, particle accelerators used for subatomic physics research, magnetically levitated high-speed trains deployed in Japan and minesweepers being developed by the U.S. Navy to detect undersea mines.

"The PLD tool will be used to fabricate thin films of several types of materials that can enable advanced superconductor tapes," said **Venkat Selvamanickam**, M.D. Anderson Chair Professor of Mechanical Engineering. Superconductor tapes are second generation superconductor wires in the form of metal tape.

"Specifically, we are developing 'intelligent superconductor tapes' that can inherently act as a very fast sensor to detect impending quench that can cause catastrophic failure of expensive coils, magnets and cables that are constructed with superconductors," said Selvamanickam.

Quench refers to a sudden transition from a superconducting state to a normal state. When a coil, magnet or cable that carries hundreds of amperes in a superconducting state suddenly quenches at a localized region, that portion of the coil, magnet or cable will be irreparably damaged.

Pulsed laser deposition system

"We have developed a novel method to use the superconductor itself as a quench detection sensor. A type of such an 'intelligent superconductor tape' requires incorporation of specific thin films in the superconductor architecture. The PLD tool will enable fabrication of those films," said Selvamanickam.

Thin films are very thin layers of material that scientists can deposit or apply onto surfaces to achieve unique properties not seen in a bulk form of the material. They offer a wide range of benefits and are utilized in various industries, including electronics, energy, optics, sensing and others.

Although magnet quenches are fairly routine, in 2008 at CERN's Large Hadron Collider, a magnet quench caused damage to more than 50 superconducting magnets.

The PLD will also be used in other projects led by Selvamanickam and other faculty and underwritten by the U.S. Navy, including improving energy storage and propulsion systems, enhancing high-performance of solid-state, flexible batteries and reducing fuel consumption and surface corrosion of ships.

PROMES and TAME Host Competition for *Local Students*

BY STEPHEN GREENWELL

An event co-hosted by the Program for Mastery in Engineering Studies (PROMES) and the Texas Alliance for Minorities in Engineering (TAME) brought more than 150 students from 18 local middle and high schools to the campus of the University of Houston's Cullen College of Engineering.

PROMES engages in community outreach as the regional university partner for the Texas Alliance for Minorities in Engineering (TAME). TAME works with local independent school districts to create experiences for students from underrepresented groups to explore futures in engineering.

Jennifer Luna-Singh, the director of PROMES and instructional assistant professor, coordinated the one-day engineering competition.

"PROMES was thrilled to bring the TAME Gulf Coast Regional Competition back to campus for the first time since February 2020," she said. "Many participants at the competition have never been to a college campus, and spending an entire day on campus while interacting with current engineering students opens up new pathways and opportunities for participants."

Shell, Chevron Phillips and PPG Industries sponsored the event. More than 50 UH undergraduate engineering students volunteered, serving as mentors for the students and judges for their work.

During the competition, students were challenged to solve a problem relating to the transportation of clean water, which is a topic they've been learning about in TAME Clubs. TAME plans the Engineering Competition, including the engineering design challenge, while UH executes the competition with its volunteers and facilities.

"PROMES has a longstanding relationship with TAME and looks forward to hosting the competition and growing its activities with TAME in the future," Luna-Singh said.

There are currently 14 TAME Chapters across the state, spanning from West Texas to the Rio Grande Valley to Houston and to Amarillo, and most points in-between. The Gulf Coast TAME Chapter, which maps to the TEA's Region 14 and encompasses the Houston metro area, features 22 participating schools and more than 350 enrolled students.

"Collaboration has been part of our DNA since our start in 1976. We knew cross-sector partnerships were critical to ensuring more Texas students could visualize and pursue an engineering career," said Andrea Herrera Moreno, the Executive Director of TAME. "From hosting the Gulf Coast TAME Engineering Competition to helping us connect our alumni to the Cullen College of Engineering, our partnership with PROMES and UH has been and continues to be a critical component of the Texas Alliance for Minorities in Engineering for more than a decade!"

PROMES (pronounced "promise") provides engineering students with recruitment, academic advising, workshops, scholarships and development opportunities. The organization's mission is to provide a positive learning environment that supports the needs of undergraduate students. For more information, visit its website.

For more information on TAME
VISIT WEBSITE:
www.tame.org

Student competition challenged students to solve a problem relating to the transportation of clean water.

ARTIFICIAL INTELLIGENCE WITH A HUMAN TOUCH

BY LAURIE FICKMAN

Despite the remarkable progress in artificial intelligence (AI), several studies show that AI systems do not improve radiologists' diagnostic performance. In fact, diagnostic errors influence 40,000 to 80,000 deaths annually in U.S. hospitals. This lapse creates a pressing need: Build next-generation computer-aided diagnosis algorithms that are more interactive to fully realize the benefits of AI in improving medical diagnosis.

That's just what **Hien Van Nguyen**, Associate Professor of Electrical and Computer Engineering at the University of Houston's Cullen College of Engineering, is doing with a new $933,812 grant from the National Cancer Institute. He will focus on lung cancer diagnostics.

"Current AI systems focus on improving stand-alone performances while neglecting team interaction with radiologists," said Van Nguyen. "This project aims to develop a computational framework for AI to collaborate with human radiologists on medical diagnosis tasks."

That framework uses a unique combination of eye-gaze tracking, intention reverse engineering and reinforcement learning to decide when and how an AI system should interact with radiologists.

To maximize time efficiency and minimize the amount of distraction on the clinical work, Van Nguyen is designing a user-friendly and minimally interfering interface for radiologist-AI interaction.

The project evaluates the approaches on two clinically important applications: lung nodule detection and pulmonary embolism. Lung cancer is the second most common cancer, and pulmonary embolism is the third most common cause of cardiovascular death.

"Studying how AI can help radiologists reduce these diseases' diagnostic errors will have significant clinical impacts," said Van Nguyen. "This project will significantly advance the knowledge of the field by addressing important, but largely under-explored questions."

The questions include when and how AI systems should interact with radiologists and how to model radiologist visual scanning process.

"Our approaches are creative and original because they represent a substantive departure from the existing algorithms. Instead of continuously providing AI predictions, our system uses a gaze-assisted reinforcement learning agent to determine the optimal time and type of information to present to radiologists," said Van Nguyen.

"Our project will advance the strategies for designing user interfaces for doctor-AI interaction by combining gaze-sensing and novel AI methodologies."

Hien Van Nguyen testing our VR headset.

UH TEAM DEVELOPS NOVEL

MICROSCOPE TO DESIGN BETTER HIGH-PERFORMANCE BATTERIES

BY RASHDA KHAN

Lithium-ion batteries have transformed everyday lives – almost everyone has a smartphone, more electric vehicles can be spotted on the roads, and they keep power generators going during emergencies. As more portable electronic devices, electric vehicles and large-scale grid implementations come online, the demand for higher energy density batteries that are safe and affordable continues to grow.

Now, a University of Houston research team, in collaboration with researchers from the Pacific Northwest National Laboratory and the U.S. Army Research Laboratory, has developed an operando reflection interference microscope (RIM) that provides a better understanding of how batteries work, which has significant implications for the next generation of batteries.

"We have achieved real-time visualization of solid electrolyte interphase (SEI) dynamics for the first time," said **Xiaonan Shan**, an Assistant Professor in the Electrical and Computer Engineering Department at UH's Cullen College of Engineering and corresponding author of a study published in the journal *Nature Nanotechnology*. "This provides key insight into the rational design of interphases, a battery component that has been the least understood and most challenging barrier to developing electrolytes for future batteries."

The highly sensitive microscope allows researchers to study the SEI layer, which is an extremely thin and fragile layer on the battery electrode surface that determines battery performance. Its chemical composition and morphology are continuously changing – making it a challenge to study.

"A dynamic, non-invasive and high sensitivity operando imaging tool is required to understand the formation and evolution of SEI. Such a technique capable of direct probing SEI has been rare and highly desirable," said Yan Yao, the Hugh Roy and Lillie Cranz Cullen Distinguished Professor of electrical and computer engineering and a co-corresponding author who has worked with Shan on this project for the last four years.

"We have now demonstrated that RIM is the first of its kind to provide critical insight into the working mechanism of the SEI layer and help design better high-performance batteries," said Yao, who is also the principal investigator of the Texas Center for Superconductivity at UH.

How it works

The research team applied the principle of interference reflection microscopy in the project, where the light beam – centering at 600 nanometers with spectrum width of about 10 nanometers – was directed towards the electrodes and SEI layers and reflected. The collected optical intensity contains interference signals between different layers, carrying important information about the evolution process of SEI and allowing the researchers to observe the entire reaction process.

"The RIM is very sensitive to surface variations, which enables us to monitor the same location with large-scale high spatial and temporal resolution," said UH graduate student **Guangxia Feng**, who performed much of the experimental work on the project.

The researchers note that most battery researchers currently use cryo-electron microscopes, which only take one picture at a certain time and cannot continuously track the changes at the same location.

"I wanted to approach energy research from a different angle by adapting and developing new characterization and imaging methods which provide new information to understand the reaction mechanism in energy conversion processes," said Shan, who specializes in developing imaging techniques and spectrometry techniques to study electrochemical reactions in energy storage and conversions. This new imaging technique could also be applied to other state-of-the-art energy storage systems.

Feng, who earned a Ph.D. in electrical engineering from UH in 2022, plans to pursue further research in the growing field of battery technology.

"To realize the next generation of batteries, it is essential to understand the reaction mechanisms and novel materials," she said, adding that developing higher energy batteries also benefits the environment. "I have always wanted to be a scientist because they can make great things happen for people and change the world for the better."

Wu Xu from Pacific Northwest National Lab, an expert in the electrolyte designs, helped with the project design and provided critical insight on the electrolyte to use. Kang Xu, an expert in the SEI research at the Army Research Lab, provided significant insights to help understand the phenomenon observed. Both are co-corresponding authors for the paper.

Feng and another UH engineering student, **Yaping Shi**, along with Hao Jia from PNNL, are the lead authors of the study. Other contributors are **Xu Yan, Yanliang Liang, Chaojie Yang** and **Ye Zhang** from UH; and Mark Engelhard at PNNL.

Below: Xiaonan Shan observes research student Guangxia Feng as she works on RIM inside a "glove box" because lithium-ion battery electrolyte is flammable.

ME'S FLORYAN FINDING

SIMPLICITY WITHIN COMPLEXITY

Daniel Floryan

BY LAURIE FICKMAN

Picture a tall stately grandfather clock, its long pendulum swinging back and forth, over and again, keeping rhythm with the time. Scientists can describe that motion with an equation, or dynamical model, and though there are seemingly hundreds of factors contributing to the sway, (the weight of the clock, the material of the pendulum, ad infinitum) there is only one variable necessary to describe the motion of the pendulum and translate it into math: the angle of the swing. How long it took scientists and mathematicians to discover that is unknown. It could have taken years to test each variable in the equation to determine the single important variable for sway.

Now a University of Houston researcher is reporting a method to describe these kinds of complex systems with the least number of variables possible, sometimes reducing the possibility of millions to a minimal amount, and just one on rare occasions. It's an advancement that can speed up science with its efficiency and ability to understand and predict the behavior of natural systems, and it has implications for speeding up an array of activities that use simulations from weather forecasting to production of aircraft.

"In the example of the grandfather clock, I can take a video of the pendulum swinging back and forth and from that video, automatically discover what is the right variable. Accurate models of system dynamics enable deeper understanding of these systems, as well as the ability to predict their future behavior," reports **Daniel Floryan**, Kalsi Assistant Professor of Mechanical Engineering, in the journal *Nature Machine Intelligence*.

To begin building the compact-yet-accurate models, one principle is fundamental: For every action, even those seemingly complex and random, there exists an underlying pattern that enables a compact representation of the system.

"Our method finds the very most compact description that is mathematically possible, and that's what differentiates our method from others," said Floryan.

Using ideas from machine learning and smooth manifold theory, the method makes simulations extremely fast and inexpensive.

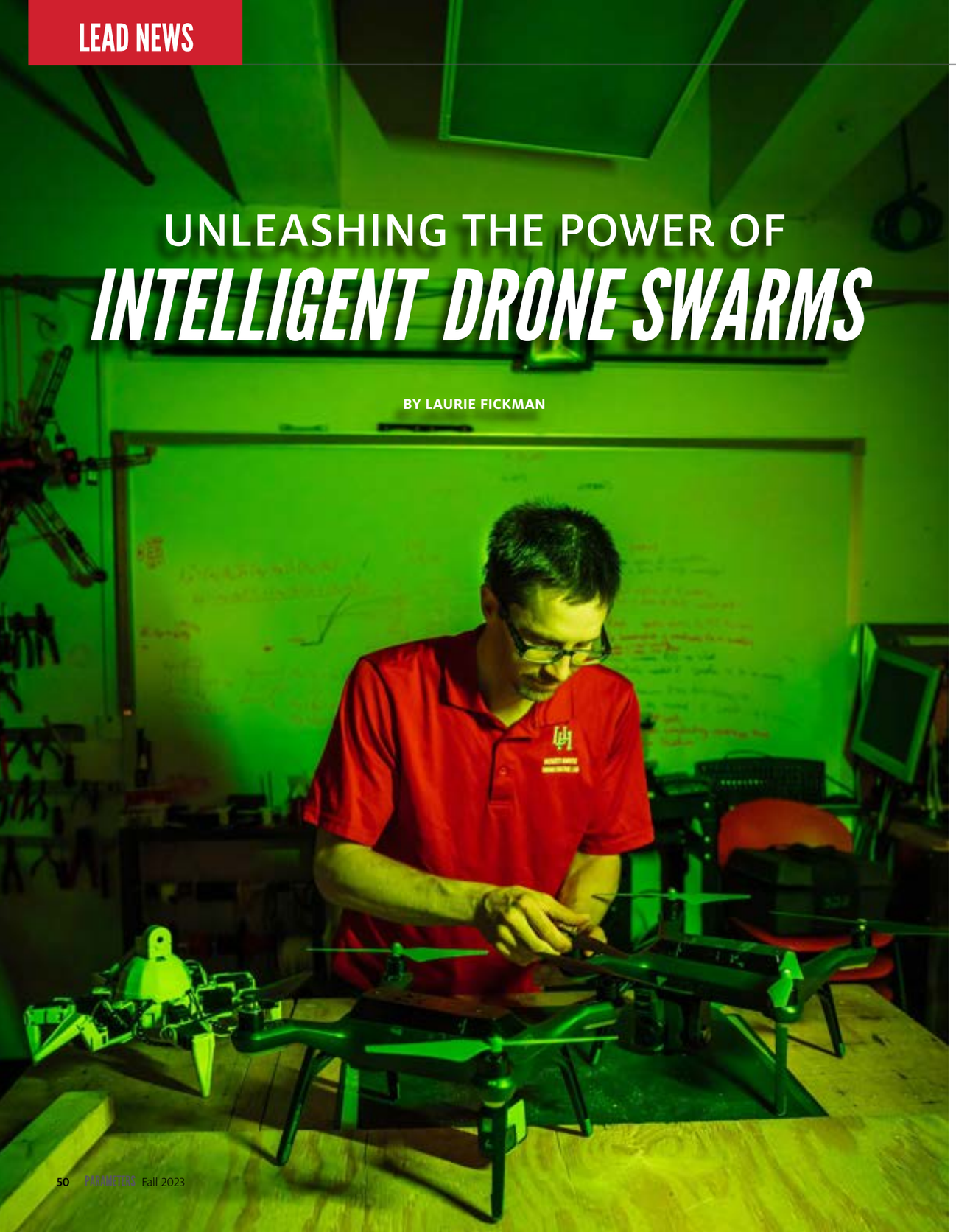
In one application, Floryan simulated a reaction between a couple of chemicals. The reaction resulted in complex behavior among the chemicals when they met: a repetitive rhythmic spiraling requiring more than 20,000 variables to simulate it. Floryan fed video of the reaction into his algorithm, and it discovered he needed just one variable to understand the action. The necessary variable was the time the spiral took to come back to where it started, like a second hand on a watch.

Regarding weather prediction, numerical models are computer simulations of the atmosphere that use complicated physics and fluid dynamics equations.

"For weather prediction and climate modeling, if you have something that is much faster you can better model the earth's climate and better predict what's going to happen," said Floryan.

UNLEASHING THE POWER OF *INTELLIGENT DRONE SWARMS*

BY LAURIE FICKMAN



Technology Will Allow Drones to Respond Fluidly to Changes in the Environment

It's a long-held notion, proven in fact, that robots are the perfect instrument to free humans from jobs that are dull, dirty and dangerous – the "3 D's" in industry speak – with flying robots (drones) leading the way.

As low-cost drones have proliferated worldwide, they are tasked with a variety of objectives, including remote sensing, situational awareness, material delivery and as communication relays. Heady stuff, even military in nature, prompting the deployment of not a single drone at a time, but rather, swarms of drones to complete tasks.

But as their importance and numbers have soared, their swarm mechanics have remained largely dormant. While it is now possible to fly large numbers of drones in sync, these swarms are preprogrammed by teams of animators and are refined with hours of computer simulations.

But what if the drones themselves could respond dynamically to obstacles, vehicles, predators and insect swarms? It's a concept long ago mastered by birds flying in flocks and fish swimming in schools.

"These movements are not pre-programmed but are based on local decisions by individual birds or fish," said **Aaron Becker**, associate professor of electrical and computer engineering, who is working to refine algorithms to apply those same theories to devise coordinated control of drone swarms to improve their fleet-like delivery of services. His work is supported by the commitment of a $1.7 million grant from Kostas Research Institute at Northeastern University, LLC.

Becker's team includes **David Jackson**, professor of electrical and computer engineering; **Julien Leclerc**, assistant research professor of electrical and computer engineering; and **Daniel Onofrei**, associate professor of mathematics.

"The majority of current research on swarms follows the same pattern and either relies on offline computation or uses simple rule-based logic such as 'don't bump into your neighbor while following the leader.' Computers are great at fast computation and implementing tactics, but humans can excel at strategic decision making. We want to combine these," said Becker.

"We want our swarms to behave optimally yet respond fluidly to changes in the environment. We aim to use computation on drones to locally make smart decisions, relay that information to the operator's computer to make clear visualizations, and let the human operator make high-level decisions."

Two initial application scenarios will be studied. The first scenario is aerial sensing of a forest fire, where the drone swarm must both track the fire and relay communications to firefighters. The second scenario is for aerial security coverage of a commercial facility and campus. Drones must escort vehicles that enter and leave the campus, but each drone has limited battery life and must recharge when batteries are depleted.

It's not Becker's first robot rodeo. With years of experience in studying and developing robots, Becker is now using his expertise to enhance drone swarms. In the past, he has worked on controlling massive swarms of robots and exploring systems where only a handful of instructions were needed to guide large groups of robots to complete tasks.

> "These movements are not pre-programmed but are based on local decisions by individual birds or fish"
>
> - AARON BECKER

Aaron Becker

Aaron Becker and his research students all displaying their favorite robots.

Balan Using BIOTECHNOLOGY, ALGAE, FUNGI For a Sustainable Future

BY ALEX KEIMIG

The way **Venkatesh Balan** sees it, one can go to bed, dream about going to the moon and say, "I went to the moon last night in my dreams," or one can work hard to get to the moon and someday say in honesty, "I have been to the moon." He's going to the moon - figuratively - in a ship made of mushrooms, algae and cattails.

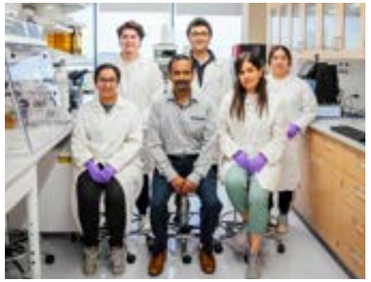
Balan, assistant professor of Biotechnology in the Cullen College of Engineering's Technology Division, is working with the U.S. Environmental Protection Agency to address the realities of climate change with microalgae and coastal grasses; collaborating with the U.S. Department of Agriculture to address poverty and food insecurity in developing nations with mushrooms; writing and publishing eight to 10 manuscripts each year; teaching undergraduate students, supervising graduate students and working together with other departments to advise Ph.D. students.
In short, he's doing it all.

Algae, mushrooms and coastal grasses may seem like unlikely heroes against the looming antagonists of climate change and food insecurity, but they have mighty potential, and their mutual comfort in the climate along the Texas Gulf Coast is exactly what brought Balan to Houston.

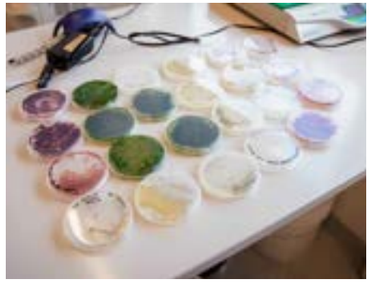
"I worked at Michigan State University for 12 years, with experience on energy-related projects with the Great Lakes Bioenergy Center," he said. "After gaining all this experience, I wanted to set up my own lab and venture into a new sub-research area – developing methods of fuel and chemical production using micro and macroalgae. It's my strong belief that microalgae and plants are the only ways we can save this planet."

He decided on UH after considering others in the area.

Venkatesh Balan and his research students



Algae and fungi samples in Balan's Lab.



Research students examining fungi samples.

"I considered Rice and Texas A&M universities because of the weather. I come from a semi-tropical climate zone in India, so I'm used to the heat. But I saw the diversity in Houston, and I had this craving to work on algae-related research, so I thought the University of Houston would be a great place for me to grow and showcase my expertise."

The Managing Urban Runoff project (see page 18) aims to reduce pollutants in coastal waters by growing native plants, such as cattail, miscanthus and khus grasses, on floating synthetic mats that can be moved along waterways with their long roots hard at work below the surface.

"It's about sustainability and climate-related problems - that's the primary focus of all my funded projects. Whenever there's a problem, I see an opportunity," Balan said. "The biggest problem for waterways right now is algal bloom."

This uncontrolled algal growth due to fertilizer runoff produces harmful toxins and reduces oxygen in the water, leading to suffocation for aquatic species.

"My experiences with mangrove forests made me believe that we could develop a nature-driven ecosystem to address this problem. Instead of growing the grass near the water, I thought of growing the grass on the water – that's what is so innovative here," he said. "When you grow these grasses on the waterways, their roots penetrate the water - sometimes three meters deep - and harbor all different kinds of microorganisms like algae, bacteria and fungi, which can sequester the compounds that contribute to algal bloom. Eventually, we can take the plants out and reutilize them as biochar that goes back into nourishing the fields. That carbon can enrich the soil for hundreds of years."

He may be thinking centuries ahead, but in the present, not a moment goes unaccounted for.

"Every minute is important to us. I tell my students to be mindful of their time and what they want to accomplish, and to keep in mind if they lose the time, they cannot buy it back," he said. "You can pay for a replacement if you spill some chemicals or break something. But time is precious. You must spend time wisely."

When he's not toiling with aquatic plants at the PVAMU watershed, Balan is hard at work with fungi in Sugar Land.

"I still remember the day when I first saw a milky white mushroom almost 20 years ago," he said. "I became fascinated. It attracted me to fungal biotechnology."

The tropical milky white mushroom – the apple of Balan's eye – is what he calls a high-temperature fungus: one that grows between 30-38 °C (or 86-100 °F), perfectly suited for the Texas Gulf Coast. Instead of trying to force low-temperature mushrooms to thrive in a high-temperature environment, he's working in sync with local weather conditions.

"Why waste energy cooling down the growth beds to grow a low-temperature mushroom in a place where it's hot most of the year? We were able to do a full genome sequencing and annotation on a high-temperature fungus, and we're working on a manuscript," he said. "Hopefully, this will help to revolutionize how we look at edible high-temperature fungi and how we can solve one of the world's big food security problems. We're building a test bed at the Sugar Land campus with USDA and UH infrastructure grants to demonstrate the applications of fungal biotechnology - particularly growing mycelium mushrooms to small-scale growers. I want to see how we can commercialize this technology. I had an upbringing with poverty and hunger. I don't want others to go through what I went through."

"The inspiration comes with experience," he added. "I have a strong core belief that science can change the world in a positive way. My scientific discoveries could bring people out of poverty. That belief helps me to get out of bed every morning to come to the lab. It's what I'm passionate about. The first most important thing is belief; the second most important thing is passion. Those two factors really drive me to make this world a better place to live."

The work of changing the world never really stops, so neither does Balan.

"If I stop working, I'm stopping for so many people who are underprivileged and who don't have access to these resources. Whatever thing is doable within our capacity, to change things and fix things, is what I am trying to do to make a better place for future generations to come."

Cullen College
MERGER
EXPANDS ACCESS
For Research & Student Success

BY STEPHEN GREENWELL

The merger of the Cullen College of Engineering and the College of Technology is perhaps the most transformative event in the college's more than 80-year history. The leadership of the new, combined college talk about how this merger will improve student success and outcomes, by offering more robust and varied degree options. We also take a look at the excellent work that Technology Division professors and students have been producing, which are in line with the excellence already being done at the Cullen College of Engineering. »

Joseph W. Tedesco

Heidar A. Malki

Calling it the “greatest and most significant transformation in its 80-year history,” **Joseph W. Tedesco** – the Elizabeth D. Rockwell Dean of the Cullen College of Engineering – sees the merging of the Cullen College of Engineering and the College of Technology as an exciting opportunity that will allow for more collaborative research opportunities, and new opportunities for students and faculty at both colleges.

“This makes us the third largest engineering college in the state of Texas, and the second largest College at the University of Houston,” Tedesco said. “The university's strategic plan and the ultimate goal is to become a Top 50 public institution. We will never achieve that unless we have a high performing engineering program.”

Heidar Malki, the senior associate dean of the Technology Division, also spotlighted the ability of the merger to improve student success and research for both colleges.

“The combined college will have very strong programs with multidisciplinary research, as well as applied programs that are in line with the university's vision when it comes to energy, medical, manufacturing and cybersecurity,” he said. “The faculty among these two colleges can put their efforts to increase grant activities, as well as recruiting the best faculty and top-rated students across the nation.”

While Tedesco noted that the six-year graduation rate is already high, at 75 percent, the merger will enhance student outcomes by providing more degree programs for students, as well as leveraging Cullen initiatives like the First Year Experience and PROMES to improve outcomes.

“We plan on using our strategies that helped bolster the student's successful six-year graduation rate for the College of Engineering, and we can now apply those to the technology division,” he said.

Malki also saw the ability for students to have access to these programs as an important reason for the merger.

“Right from the start, students will take the appropriate courses, and hence increase their graduation rate by not taking unnecessary courses,” he said. “We want to mentor them right from the beginning. Based on performance, they can choose a wide variety of options as they finish the first year and then move on to the program of their choice.”

Tedesco described how the merger would provide students with more flexibility to pursue the topics that interested them.

“I think that we're able now to accept many more students into the college that typically were not admitted into engineering. With our expanded curriculum, we really open up a menu of courses that were never available before. Students have the opportunity of coming into engineering, and they may find that they're more inclined towards technology, and they can seamlessly transfer. And the same holds true for students that we bring into the technology program. If they can meet the metrics for engineering, we will seamlessly let them in as well. I think it's a win-win for the students.”

The new student pool has the potential to help faculty members, as well as enhance the offerings of the Technology Division.

“The faculty will have access to a greater variety of students, a very diverse pool,” Tedesco said. “We're able to create new research initiatives that were not possible in the standalone College of Engineering, due to the different backgrounds that are brought to us by the technology faculty. Also in the past, technology did not have a Ph.D. program. Their faculty were unable to mentor those types of students. Now they will have the opportunity to meet the Ph.D. students within the College of Engineering.”

The merger is part of a larger expansion of both colleges. Engineering courses are taught at the Katy campus, and the Technology Division will have new facilities in Sugar Land for all technology students and programs by Fall 2025. The college also has partnerships with the systems of Houston Community College, Lone Star and San Jacinto. Tedesco called it an “engineering network.”

“We can offer both technology courses and engineering courses at all three of those locations, either synchronously or asynchronously,” he said. *“I think we're doing a much better job now and really catering to the needs of the Houston community by providing them high quality engineering and technology education.”*

Malki added that the move of the technology programs from the main campus to Sugar Land aligns with the goals of UH President Renu Khator, who led the acquisition of 300 acres for that campus. The design of a second building for the Sugar Land campus is complete, with construction projected to finish by Summer 2025. Starting in Fall 2025, all undergraduate and graduate technology programs will be at Sugar Land.

“President Khator's vision is to extend the university offerings beyond the main campus, both at Sugar Land as well as the Katy campus, where the industry and commercial bases are expanding at a rapid basis,” he said. “The combined college will be better positioned to serve these communities.”

When Tedesco looks at the future of the combined college, he can't help but think of a famous line.

“I think the future of the Cullen College of Engineering is so bright, I gotta wear shades,” he said, laughing. “We will have a curriculum that would rival any curriculum of any engineering college in the country. We have great support from the local community, great support from the alumni and great support from the university administration. Our academic programs will excel, our research enterprise will grow to tremendous heights, and we are going to bring this university to the Top 50.” »

> “I THINK THE FUTURE OF THE CULLEN COLLEGE OF ENGINEERING IS SO BRIGHT, I GOTTA WEAR SHADES.”
>
> *- Dean Joseph W. Tedesco*

The 4 NEW DEPARTMENTS of the *Cullen College of Engineering*

BY STEPHEN GREENWELL

Four new departments – Human Development and Consumer Sciences, Engineering Technology, Construction Management, and Information Science Technology – will be at the Cullen College of Engineering starting with the Fall 2023 semester, thanks to the merger with the College of Technology.

These departments will expand the current offerings of the College, as well as allow for synergy when it comes to research and networking opportunities with industry, for students and faculty. Here's a look at each of the departments.

HUMAN DEVELOPMENT AND CONSUMER SCIENCES

A researcher can make a great new finding in their field, or innovate on an existing product. But ultimately, that discovery might languish or go nowhere if its just done in the secrecy of a lab and pushed minimally afterward.

Barbara Stewart, the department chairwoman for Human Development and Consumer Sciences, points to this as one of the major reasons to be excited about the merger between the colleges.

"The programs in Human Development and Consumer Sciences offer real value to engineers," she said. "The content seems very different, but when you think about what engineers do, they need to find application in the real world. That's how Human Development and Consumer Sciences can be of use to engineers."

The department offers degrees focusing on Human Resource Development, and Retailing and Consumer Sciences. Human Resource Development allows students to become relationship-focused, problem solvers and key players that assess, design and deliver solutions for training and performance management.

The Retailing and Consumer Science degree offers diverse opportunities for students to develop into successful retail professionals. Students are prepared for a broad range of careers including merchandising, technology entrepreneurship, retailing, e-tailing, sales, customer service, marketing, and public relations.

Foresight graduates assist industry leaders to anticipate significant changes ahead and to influence those changes to achieve long-term goals. Professional forecasting methods emphasize systemic and transformational change to describe alternative plausible and preferable futures.

Stewart noted that while shopping habits have changed drastically thanks to the Internet, only 20 to 25 percent of retailing is done online. Companies might offer an online storefront, but this marketplace still requires employees and a system to hum.

"It's an exciting time because the workplace is being redesigned," she said. "The future is not hocus pocus. It's not crystal ball magic. It's looking at the past and building out from there, so strategic decisions can be made."

CONSTRUCTION MANAGEMENT

Starting with the Fall 2022 semester, the U.S. Department of Education and the U.S. Department of Homeland Security recognized something evident to anyone actually in the matter – that degree programs like construction management, and supply chain and logistics technology, fell under the umbrella of STEM.

The bachelor of science in construction management provides the ultimate balance of construction, business and engineering courses. The program emphasizes the skills that are highly sought in today and tomorrow's job markets. Graduates of the program are prepared to enter relevant fields as project managers, field operations engineers, construction estimators and construction planners.

The Supply Chain and Logistics Technology major offers a broad array of career paths with global opportunities. There are four academic tracks students can pursue:

- Operations - knowledge for a domestic and international career in sales, marketing and operations.
- Systems Management - a technology oriented focus with a strong analytical approach designed to achieve optimum solutions to complex supply chain/logistics problems.
- Global Logistics - in-depth analysis in international logistics and its role in the supply chain with a focus on maritime attributes and activities.
- Directed Emphasis - designed for community college transfer students whose colleges have an articulation agreement with the University of Houston. »

ENGINEERING TECHNOLOGY

Anyone who's worked an industry job knows that there can be a substantial difference between the scientific principles of a textbook vs. the conditions on a factory floor or in a busy research lab. Fatima Merchant, the department chairwoman of Engineering Technology, knows that as well as anyone. She worked as a lead research engineer for about a decade before joining UH as a faculty member.

The department offers undergraduate degrees in biotechnology, computer engineering technology, electrical power engineering technology, and mechanical engineering technology. The department also offers a master's degree in Engineering Technology in the following areas: biotechnology, computational health informatics, network communications, and mechanical engineering technology.

Merchant sees the access to the available Ph.D. programs in engineering and the natural research connections that can be made between college departments as strong, positive factors for the merger.

"We have the opportunity to initiate projects at both the undergraduate and graduate levels, fostering interdisciplinary collaboration across departments, which I believe would yield great outcomes," she said. "Bringing together students with well-founded theoretical skills alongside those with extensive hands-on experience could be immensely beneficial."

Echoing remarks from the leadership of the newly combined college, Merchant saw the merger as a good opportunity to take the best practices of each entity in order to maximize student success.

"An essential starting point is to focus on student success metrics," she said. "Our objectives undoubtedly include boosting enrollment at both the bachelor's and master's levels, with a primary emphasis on elevating the four and six-year graduation rates. Moreover, leveraging existing research partnerships and forging new collaborations among engineering and technology division faculty, with a focus on securing team-based interdisciplinary grants tailored to tackle complex challenges, substantial advantages can be reaped in terms of funded research and scientific advancement."

INFORMATION SCIENCE TECHNOLOGY

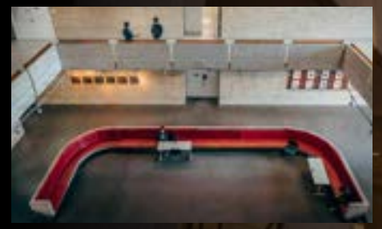
The Department of Information Science Technology is producing new ideas and knowledge within the fields of information, logistics, graphic communications and leadership technology. Degrees are offered in four fields:

The Computer Information Systems (CIS) program addresses the demands of a dynamic and integral part of business and industry – the Information Systems environment. The program challenges students to extend their reach into small to medium-size organizations and develop real-world application solutions.

The Digital Media program prepares leaders for the multi-faceted and ever-changing profession. Students gain competencies in various graphic-related technologies as well as a broad background in leadership and supervision in one of the largest industries in the United States. Graduates discover a broad range of options for a career in digital and video production, publishing, content marketing, social media and social networking, e-commerce, web design and other related fields.

The Master of Science degree in Cybersecurity is a hands-on program designed specifically to prepare individuals for responsible leadership roles in the technology-based and information-based workplaces. Designed for working professionals, this two-year program connects theory and experiential learning to equip technology professionals with the skills to assess the security needs of information systems and then to lead and manage the implementation and maintenance of the recommended security solutions.

Technology Leadership and Innovation Management is the business discipline for developing and managing organizations and teams to solve problems and achieve results. The TLIM degree focuses on building the foundational leadership skills in technology subject matter expertise, communication, goal management, asset alignment, team organization and project supervision. »



With these four new departments, the Cullen College of Engineering will expand by more than 5,200 students – an additional 1,000 undergraduate and 150 graduate students earning their degrees each year. The combined unit will offer new degree options for students, as well as opportunities for faculty members to conduct collaborative research, while maintaining the high standards set by both colleges.

TECHNOLOGY DIVISION

Cullen College of Engineering WELCOMES 31 NEW HIRES

BY STEPHEN GREENWELL

The Cullen College of Engineering is happy to announce the hiring and promotion of 31 faculty members for the upcoming academic year.

BIOMEDICAL ENGINEERING

Yuncheng Du, associate professor, starting Sept. 2023. Du earned his doctorate from the University of Waterloo in Ontario, Canada, in 2016. The same year, he was hired as an assistant professor at Clarkson University in New York. He earned a NSF CAREER Award in 2022.

Lu Wang, assistant professor, starting Sept. 2023. Wang earned her doctorate degrees in Industrial Engineering from the University of Toronto in 2023 and Computer Science from Wayne State University in 2019, respectively.

CIVIL & ENVIRONMENTAL ENGINEERING

Mahdi Safa, instructional assistant professor, starting Jan. 2023. Safa was promoted from his role as senior lecturer, which he has held since 2021. He earned his doctorate in 2013 from the University of Waterloo in Ontario.

Krishna Rishi Vijay Saladi, lecturer, starting June 2023. Saladi earned his doctorate in Environmental Engineering from UH in 2018, followed by a M.S. in Statistics and Data Science in 2022.

Yuntian Wu, senior lecturer, starting Sept. 2023. Wu earned his doctorate in Civil Engineering from the University of Southern California in 2008.

Siavash Zamiran, senior lecturer, starting July 2023. Zamiran earned his doctorate in Civil Engineering-Geotechnical from Southern Illinois in 2017. For the past four years, he has worked as an adjunct professor at Missouri University.

WILLIAM A. BROOKSHIRE DEPARTMENT OF CHEMICAL & BIOMOLECULAR ENGINEERING

Omar A. Abdelrahman, associate professor, starting Jan. 2024. Abdelrahman earned his doctorate from Syracuse University in 2016. He has been an assistant professor at the University of Massachusetts since 2018. He earned a NSF CAREER award in 2021.

CONSTRUCTION MANAGEMENT

Dwight Beadle, professor of practice, starting Sept. 2023. Beadle has been an adjunct professor at the University of Houston for 6 years and earned his M.S. in Construction Management from UH in 2018.

Eva Lyon, professor of practice, starting Sept. 2023. Lyon has been a lecturer and adjunct professor at the University of Houston for 13 years, and earned her M.S. in Construction Management from UH in 2012.

ELECTRICAL & COMPUTER ENGINEERING

Pieremanuele Canepa, assistant professor, starting Sept. 2023. Canepa earned his doctorate in chemistry from the University of Kent in the United Kingdom. Since 2018, he has been an assistant professor at the National University of Singapore.

Chu Meh Chu, senior lecturer, starting Sept. 2023. Chu earned his doctorate from the Georgia Institute of Technology in 2015. Chu is a machine learning expert with research, teaching and work experience in data visualization using data compression tools.

Sebastian Csutak, lecturer, starting June 2023. Csutak earned his doctorate in Electrical and Computer Engineering from the University of Texas at Austin.

Deepa Ramachandran, instructional assistant professor, starting Sept. 2023. Ramachandran was promoted from her role as senior lecturer for the computer engineering and analytics program at UH at Katy, which she was hired for in July 2021.

Jianfeng Zheng, assistant professor, starting Sept. 2023. Zheng has been working at UH since 2012, first as a postdoctoral fellow and then as a research assistant professor. Along with Ji Chen, he has landed four grants for their work on electrical devices.

ENGINEERING TECHNOLOGY

Samia Afrin, instructional assistant professor, starting Sept. 2023. Afrin earned her doctorate in Environmental Science and Engineering from the University of Texas at El Paso in 2015.

Adnan Al-Ibadi, professor of practice, starting July 2023. Al-Ibadi earned his doctorate in Petroleum Engineering from the University of Oklahoma in 2014. The past four years, he has been employed as a lecturer and labs coordinator at the University of Central Oklahoma.

Eman Ibrahim, professor of practice, starting April 2023. Ibrahim earned her doctorate in Microbiology from Al-Azhar University in Egypt, in association with Texas A&M, in 2017.

Gowtham Mohan, assistant professor, starting Sept. 2023. Mohan earned his doctorate from the Australian National University in 2018. Since 2019, he has been an assistant professor at the University of New Mexico.

HUMAN DEVELOPMENT AND CONSUMER SCIENCES

Ebony Robinson, assistant professor, starting Sept. 2023. Robinson earned her doctorate in Consumer and Design Sciences from Auburn University this year, where she also served as a teaching assistant and lecturer for three years.

INDUSTRIAL ENGINEERING

Matthew Hu, lecturer, starting Sept. 2023. Hu earned his doctorate in Industrial Engineering from Wayne State University in Michigan. He has more than 20 years experience as an adjunct professor at the University of Houston, Wayne State University, Walsh College and Tianjin University in China.

Neil Diaz Martinez, lecturer, starting Sept. 2023. Martinez earned his doctorate in Industrial Engineering this year from Texas A&M, where he has also served as an instructor for the past two years.

Nathanial Wiggins, instructional assistant professor, starting Feb. 2023. Wiggins was promoted from his role as senior lecturer, which he was hired for in Aug. 2021.

Na Zou, assistant professor, starting Jan. 2024. Zou earned her doctorate from Arizona State University in 2015. She has earned an NSF CAREER award, and more than $840,000 in external funding.

INFORMATION SCIENCE TECHNOLOGY

Maria Burns, assistant professor, starting Sept. 2023. Burns has been with the university since 2014, serving as a program coordinator, faculty member and researcher at the Technology Leadership and Innovation Management program.

Yueqin Huang, assistant professor, starting Sept. 2023. Huang has been with the university since 2019, as a research assistant professor. She has also served as the founder and chief scientist for Cyentech Consulting, LLC., since 2017. »

Seo Yoon Lee, assistant professor, starting Sept. 2023. Lee earned her doctorate from the University of Illinois this year.

Jovita Nsoh, assistant professor, starting Sept. 2023. Nsoh earned his doctorate from Colorado Technical University in 2021. For the past year, he has served as a professor of practice at the University of Houston.

MECHANICAL ENGINEERING

Kelly Huang, assistant professor, starting Jan. 2024. Huang earned her doctorate from Princeton University in 2021. For the past two years, she has been employed as a postdoctoral researcher at Notre Dame.

MyoungKyu Lee, assistant professor, starting Sept. 2023. Lee earned his doctorate from the University of Texas in 2015. He was previously an assistant professor at the University of Alabama, and a postdoctoral researcher at Sandia National Laboratories and the University of Texas.

Rasiah Raja Loganantharaj, lecturer, starting Sept. 2023. Loganantharaj earned his doctorate from Colorado State University. For the past three years, he has served as chief technology officer for RasBro Technology, LLC.

Lucy Nwosu, lecturer, starting Sept. 2023. Nwosu earned her doctorate in 2023 from Prairie View A&M University. Since 2019, she has been a data engineer for both the Department of Homeland Security and the Center for Computational Systems Biology at Prairie View A&M.

Information Science Technology Professor

LEADING THE WAY TO CYBER SAFETY

On Roads And Highways

BY SALLY STRONG

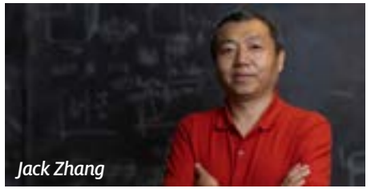
Photo credit: Jon Burke/UH

Once this tiny "smart car" is programmed with data, it can simulate several types of vehicles and point out weak points that could be susceptible to cyberattacks. It also can simulate communications between vehicles and the national Advanced Traffic Management System, then suggest to researchers where to look for potential trouble.

BME PROFESSOR

KIRILL LARIN

NAMED **TOP RESEARCH PRODUCING FACULTY MEMBER** IN 2022



Jack Zhang

A new research center led by the University of Houston is helping prevent potential cyberattacks that could threaten to impede the safe and efficient movement of people and goods in the United States and throughout the world.

CYBER-CARE – the Transportation Cybersecurity Center for Advanced Research and Education – is a U.S. Department of Transportation (USDOT) University Transportation Center (UTC), Tier 1. The center is supported by a $2 million USDOT grant for its first year with anticipated total federal funding of $10 million over five years.

"We all use transportation. Therefore, maintaining our transportation system's cybersecurity is a crucial goal. Any security breaches or failures could have significant consequences for this country and its cyber-physical systems, even our quality of life," said **Yunpeng "Jack" Zhang**, associate professor in the Department of Information Science Technology at the UH Cullen College of Engineering and the center's director.

"Our goal to make our intelligent transportation system (ITS) safer for all road users. That aligns well with the USDOT's strategic goal of improving safety," Zhang explained. "We also will promote interdisciplinary research and education across the transportation and cybersecurity domains."

Joining UH in the consortium are Embry-Riddle Aeronautical University (ERAU); Rice University (RICE); Texas A&M University-Corpus Christi (TAMU-CC); University of Cincinnati (UC); and University of Hawai'i at Mānoa (UHM).

The teams will establish a fundamental knowledge base and explore advanced theories of how to best mitigate impacts of potential large-scale cyberattacks on transportation infrastructure.

Photo credit: Jon Burke/UH

Researchers use data from the Advanced Traffic Management System to monitor traffic status and adjust flow. Here, real-time data from three road intersections describe the current status of Houston traffic close to the UH campus.

CYBER-CARE will focus on four goals:

- Protecting vehicle control systems that perform safety-critical functions
- Detecting and responding to potential cyber incidents involving U.S. traffic networks
- Building a framework that incorporates cyber-resilience and enables rapid recovery after cyber incidents
- Disseminating information as a resource in the development of industry-wide best practices

In their studies, the researchers will consider various types of threats.

"In one example, in-vehicle networks can be vulnerable to failures or attacks on individual components, such as feeding an individual vehicle's onboard computer incorrect commands in a way that compromises traffic safety," Zhang explained.

Or a threat might have a larger, system-wide focus with a DoS (denial of service) or DDoS (distributed denial of service) attack.

"In a DoS example, an attacker might repeatedly send useless data to distract a busy computer server in a city's traffic control center from fulfilling the critical jobs it is needed to do. Or the attacker might escalate to a DDoS attack – a distributed denial of service – by coordinating many computers to send millions, maybe trillions of useless data requests to a city traffic center computer server, effectively locking it out of its required flow of work," he said.

It is estimated that cybercrimes of all forms cost the global economy more than $1 trillion in 2020. Those costs are estimated to reach $10.5 trillion annually by 2025.

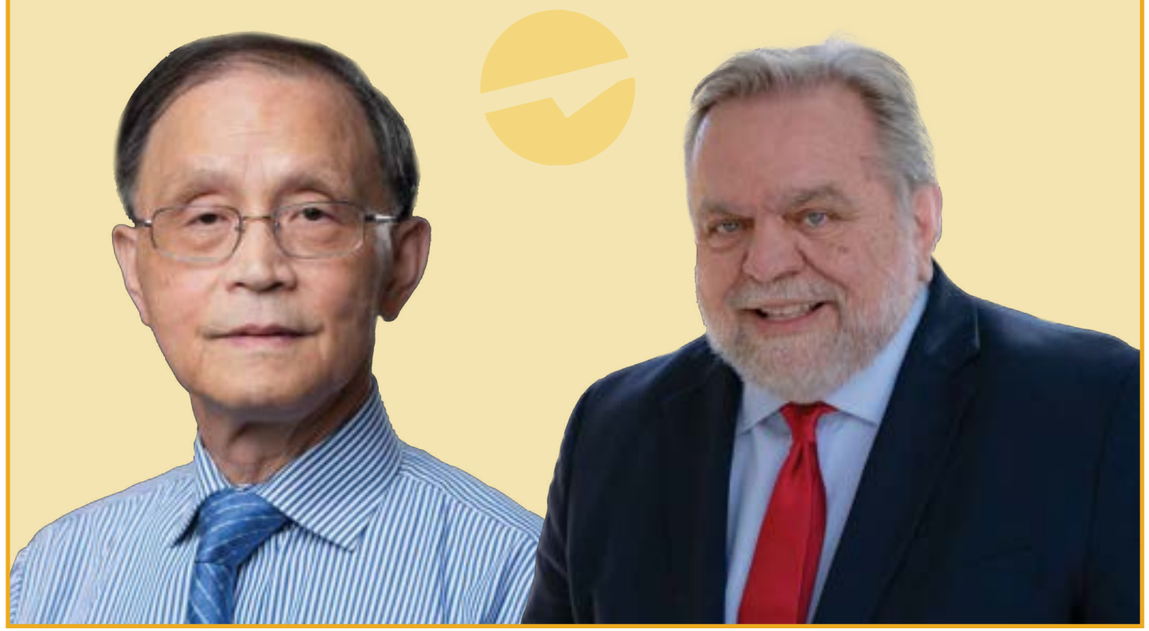
The U.S. Bureau of Labor Statistics estimates that cybersecurity jobs could grow by 31% over the next decade, a confirmation of the need for research and training.

"What we learn from the CYBER-CARE research projects will help inform policy decisions and allocation of public resources. We are in a position to accelerate industry collaboration, foster new technologies and provide industry professionals with the skills and career development to become leaders in their fields," Zhang said.

NAI EXCELLENCE

TWO FACULTY NAMED FELLOW AND SENIOR MEMBER

BY STEPHEN GREENWELL



NAI Fellow

Hao Huang, Ph.D., a Distinguished Adjunct Professor of Electrical and Computer Engineering at the Cullen College of Engineering, was officially inducted as a Fellow of the academy during the NAI's annual meeting in June. Election to the NAI Fellow is the highest professional distinction accorded solely to academic inventors.

Huang, a member of the National Academy of Engineering, started at the University of Houston in July 2021. He retired from the position of Technology Chief of G.E. Aviation ¬– Electrical Power in 2020 after 33 years of serving in various aviation and land vehicle electrification industries. In addition to NAE membership, Huang is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) as of 2013, and a Fellow of the Society of Automotive and Aerospace Engineers (SAE) as of 2014. He was also the winner of 2019 IEEE Transportation Technologies Award.

NAI Senior Member

Triantafillos J. (Lakis) Mountziaris, Ph.D., professor and chair of the William A. Brookshire Department of Chemical and Biomolecular Engineering in the Cullen College of Engineering, has been elected to Senior Member status of the National Academy of Inventors. Mountziaris joined the Cullen College of Engineering in 2021, as department chairman for the William A. Brookshire Department of Chemical and Biomolecular Engineering. With more than 30 years of experience as a professor between UMass-Amherst and the State University of New York at Buffalo, he has overseen and supported 24 doctoral advisees, and received authorship credit for more than 80 research papers and received three U.S. patents for his research work. Mountziaris is recognized for innovations related to scalable synthesis of quantum dots and development for a new class of optical biosensors.

FACULTY ACCOLADES

Jacinta Conrad Named Fellow of the American Physical Society

Jacinta C. Conrad, Ph.D., the Frank M. Tiller Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the Cullen College of Engineering, has been elected to Fellow status in the American Physical Society.

APS Fellowship was created to recognize members who may have made advances in physics through original research and publication, or made significant innovative contributions in the application of physics to science and technology. They may also have made significant contributions to the teaching of physics or service and participation in the activities of the Society.

Each year, no more than one half of one percent of the Society's membership is recognized by their peers for election to the status of Fellow of the American Physical Society. Conrad is the 15th member of the University of Houston faculty to receive the honor.

Haleh Ardebili Named Fellow of the Society of Engineering Science (SES)

Haleh Ardebili, Ph.D., the Bill D. Cook Professor of Mechanical Engineering and the Director of the Cullen College of Engineering Innovation and Entrepreneurship Program, has been named a Fellow of the Society of Engineering Science (SES).

The SES Fellow honor is highly selective and recognizes members of the society "who have contributed significantly to the activities of the SES and who have had a major impact on the advance of the engineering sciences by independent, original research or who have rendered some other exceptional service to the cause of the sciences."

Ardebili performs research in the broadly defined area of materials for energy storage and has made several impactful contributions to the development of stretchable and flexible lithium-ion batteries that may even be integrated in clothes and wearable devices.

Assistant Professor *Xingpeng Li* Named 'Emerging Leader'

Xingpeng Li, an assistant professor in the Department of Electrical and Computer Engineering at the University of Houston's Cullen College of Engineering, has been named an Emerging Leader by the 2023 Offshore Technology Conference. Of the nine honorees, Li is the only one from an institution of higher education.

The program selects young professionals with fewer than 10 years of experience in the offshore energy sector who demonstrate exceptional talents, commitment and promise as future leaders from the OTC.

Li is also the associate director of the Power Electronics, Microgrids & Subsea Electrical Systems Center (PEMSEC) at UH.

Thakur To Lead 'Best And Brightest' Scientists And Researchers In Texas

University of Houston Distinguished Professor of Petroleum Engineering **Ganesh Thakur** has been elected as the next vice president, and eventual president, of the Texas Academy of Medicine, Engineering, Science and Technology (TAMEST). The organization brings together the state's "best and brightest" scientists and researchers to foster collaboration and advance research, innovation and business in Texas.

Thakur — the first UH faculty member ever elected to lead TAMEST — will help coordinate and guide the board of directors with strategic planning, programs and communication. He will serve a two-year term as vice president beginning in 2023 before becoming president in 2025. TAMEST membership includes all Texas-based members of the National Academies of Sciences, Engineering and Medicine, the state's nine Nobel laureates and 18 member institutions, including the University of Houston.

A member of the National Academy of Engineering and the National Academy of Inventors, Thakur is a globally recognized pioneer in carbon capture, utilization and storage (CCUS). His patent on forecasting the performance of water injection and enhanced oil recovery (EOR) using a hybrid analytical-empirical methodology provided a much faster approach and served as an alternative to more time-consuming reservoir simulation. His team continues to research CCUS employing world-class lab research, simulation, machine learning and artificial intelligence.

Jerrod Henderson Named Associate Editor for the Journal of Women and Minorities in Science and Engineering

Jerrod A. Henderson, a faculty member of the William A. Brookshire Department of Chemical and Biomolecular Engineering in the Cullen College of Engineering and the co-founder of the St. Elmo Brady STEM Academy, was named to an Associate Editor position for the Journal of Women and Minorities in Science and Engineering. Henderson has served as a reviewer for the journal, and contributed as recently as January 2022.

Rimer Wins Outstanding Mentor Award From CSGS

For several years, the mentoring work of **Jeffrey Rimer**, Abraham E. Dukler Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, has been recognized internally. He has earned research and teaching excellence awards from the Cullen College of Engineering and the University of Houston in 2013, 2014, 2015 and 2022. He also received two awards from the University of Houston for mentoring students – the Early Faculty Award for Mentoring Undergraduate Research in 2014 and the Outstanding Graduate Mentor Award in 2022.

Now though, Rimer has been honored by an external organization. The Conference of Southern Graduate Schools has presented him their 2023 Outstanding Mentor Award, from a field of 102 member organizations.

According to the CSGS, the award acknowledges and honors a person who has enjoyed outstanding success in mentoring graduate students in the Southern Region. The award is open to full-time, tenured faculty members that have a demonstrated track record in mentoring graduate students at the master's or doctoral level.

Rimer is currently mentoring 17 graduate students, as well as four undergraduates, three postdocs and several high school students during the summers. In the past five years, he has had 15 students earn their doctorates. These graduates were employed in a variety of positions upon earning their degrees – as assistant professors, as postdocs at MIT and the University of Minnesota, as researchers for large companies like Samsung and UOP Honeywell.

Megan Robertson Named Associate Editor for Macromolecules

Cullen College of Engineering professor **Megan L. Robertson**, was selected as Associate Editor of the Macromolecules, which publishes original, fundamental and impactful research on all aspects of polymer science. ACS has published Macromolecules since 1968, starting as a bimonthly publication. It is now published twice per month. Robertson is also currently the Chair-Elect of the ACS Polymeric Materials: Science and Engineering Division (2023) and was previously a member of the Macromolecules and ACS Macro Letters Editorial Advisory Board. Prof. Robertson's research focuses on polymer sustainability, including polymers derived from renewable resources, degradable polymers, and polymer recycling/upcycling.

Krishnamoorthy Selected For Early-Career Research Fellowship

Harish Krishnamoorthy, assistant professor of Electrical and Computer Engineering at the University of Houston, has been selected by the Gulf Research Program (GRP) of the National Academies of Sciences, Engineering and Medicine as an early-career research fellow in the Offshore Energy Safety track. He and four other fellows will "contribute to the understanding, management and reduction of systemic risk in offshore energy activities."

He is the first UH professor to win this GRP early-career research fellowship. "I am happy and honored to be the first one, but hopefully there will be a lot more in the coming years," Krishnamoorthy said.

Krishnamoorthy's research interests include high-density power conversion for grid interface of energy systems, machine learning-based methods for improvement in quality and reliability of power electronics, advanced electronics and control for mission-critical applications.

The National Academies' Gulf Research Program is an independent, science-based program founded in 2013 as part of legal settlements with the companies involved in the 2010 Deepwater Horizon disaster. Its goal is to enhance offshore energy system safety and protect human health and the environment by catalyzing advances in science, practice and capacity, generating long-term benefits for the Gulf of Mexico region and the nation.

Soliman Honored As 2023 Legend Of Hydraulic Fracturing

Mohamed Soliman, William C. Miller endowed chair holder and Chairman of the Petroleum Engineering Department, was recognized as a 2023 Legend of Hydraulic Fracturing at the SPE Hydraulic Fracturing Technology Conference and Exhibition, an annual event held in the Woodlands.

The award dates back to 2013, and to date only 10 other researchers have been recognized as Legends of Hydraulic Fracturing by the SPE fracturing community. Soliman is the only UH professor to receive this prestigious award.

With the unique combination of both industrial and academic experience, Soliman has authored and co-authored more than 250 technical papers and holds 40 US patents. He is the first author of "Fracturing Horizontal Wells", published in 2016; and the co-author of "Optimization of Hydraulic Fracture Stages and Sequencing in Unconventional Formations", published in 2018. Dr. Soliman is a distinguished member of SPE.

NAE Member *Joseph Powell* Named Director Of UH Energy Transition Institute

The University of Houston has named **Joseph Powell**, former chief scientist for Shell and member of the National Academy of Engineering (NAE), as the founding director of the new UH Energy Transition Institute. Powell's recruitment to the University was funded by a matching grant from the Governor's University Research Initiative (GURI) aimed at helping Texas public institutions of higher education recruit distinguished researchers from around the world to the state. Started in 2015 by Gov. Greg Abbott's Office of Economic Development & Tourism and the state legislature, the program has led to several transformative faculty hires at UH in recent years.

A nationally renowned chemical engineering expert with 36 years of industry experience, Powell has led research and development programs in new chemical processes, biofuels and enhanced oil recovery. Additionally, he chaired the U.S. Department of Energy Hydrogen and Fuel Cell Technical Advisory Committee (HTAC) and was elected to the NAE in 2021 after serving two terms on its board on chemical sciences and technology. He is UH's 18th member of the NAE. Instead of enjoying a quiet retirement from industry, Powell chose to join UH to make a difference in the global shift to clean energy. In addition to leading the institute, Powell serves as a faculty member in the Department of Chemical & Biomolecular Engineering at the UH Cullen College of Engineering.

UH HONORS CULLEN COLLEGE PROFESSORS WITH AWARDS

Each Spring, the University of Houston recognizes the best and brightest faculty members, honoring them with teaching and research awards. This year two members of the Cullen College of Engineering community earned distinctions.

Dr. Haleh Ardebili, Bill D. Cook Professor of Mechanical Engineering, received the University's Excellence in Research, Scholarship and Creative Activity Award. This award recognizes faculty who have a substantial continuing record of outstanding research, scholarship and creative endeavors.

Monika Atlers, received the Innovation in Instructional Technology Award. This award recognizes faculty who have demonstrated excellence in innovative teaching using instructional technology.

CONGRATULATIONS!

2022-2023 CULLEN COLLEGE FACULTY EXCELLENCE AWARDS

Teaching Excellence Awards

•Olga Bannova- Mechanical Engineering
•Marsha Kowal- Instructional Assistant Professor and Director of the Honors Engineering Program.
•Theophilus Kaaya- Mechanical Engineering (Teaching Assistant)
•Megan Mendieta- Biomedical Engineering (Teaching Assistant)
•Dimitrios Kavvadias- Mechanical Engineering (Teaching Assistant)
•Varad Joshi- Chemical and Biomolecular Engineering (Teaching Assistant)

W.T. Kittinger Teaching Excellence Award

•Zheng Chen- Mechanical Engineering

William A. Brookshire Teaching Excellence Award

•Fritz Claydon- Electrical and Computer Engineering
•Farah Hammami Ep Kammoun- Mechanical Engineering

Research Excellence Awards

•Alamgir Karim- Chemical and Biomolecular Engineering

Andrea Prosperetti Research Computing Faculty Award

•Kalyana Nakshatrala- Civil and Environmental Engineering

Career Teaching Award

•Gangbing Song- Mechanical Engineering

Best Dissertation Award

•Jacklyn Hall- Chemical and Biomolecular Engineering (1st Place)
•Nam-In Kim- Mechanical Engineering (2nd Place)

CHBE'S VEKILOV WINS FRANK PRIZE FOR CRYSTAL WORK

BY STEPHEN GREENWELL

It was a bit of a "full circle" moment for **Peter Vekilov**, Moores Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, to learn he was the winner of the 2022 Frank Prize from the International Organization for Crystal Growth.

"I was extremely proud and honored," he said. "I was a graduate student in the 1990s in the Soviet Union, and my advisor, Alexander Chernov, got the inaugural award in 1989."

As a result, Vekilov said as far as he is aware of he and Chernov are the first pair with the advisor-mentor relationship to both have earned the Frank award. According to the IOCG, the honor is given every three years for "significant fundamental (not necessarily theoretical) contributions to the field of crystal growth." Vekilov is the 14th recipient in its 34-year history.

"It's a huge honor, so that's why I felt both proud and humbled," he said, adding that the group has provided served as a valuable source for research organization and sharing.

Vekilov has been a member of the IOCG since 1992, when he attended the conference in San Diego. It took doing on his part – he was doing research in his native Bulgaria at the time, and he had to raise funds to afford the flights. It was his first visit to the United States, and it included an unexpected, overnight layover in North Carolina after a canceled flight.

Despite the difficulties with attending his first IOCG conference, Vekilov hasn't missed one since. He will receive the Frank Prize during this year's conference in late July in Naples, Italy.

Vekilov pointed to Chernov and his postdoctoral mentor, professor Franz Rosenberger, as being significant positive influences in his development. He also noted that his success would have been impossible without his students over the years – 6 current Ph.D. students, 19 graduated Ph.D.s, 24 postdoctoral students, and several visiting scholars and undergraduate researchers.

"There were very talented, and several of them are professors in their own right, and they're producing their own Ph.D. students now," he said. "I'm extremely proud of them. I'm also proud that all of my students will graduate, and they find jobs before they graduate. That's a very important point for me. I want to make sure that I train people who will have a fulfilling, lifetime career stuff."

When it comes to his future research goals, Vekilov said his group is still building on its finding from 2020, which overturned a century-old belief on how crystals formed. His lab has published 20 papers since then, as the research has proven fruitful. Vekilov added that they are starting to use artificial intelligence and data science in their methods, to account for the permutations of solvents and structures available.

Cullen Students Examining Summer Coastal Resilience

FIRSTHAND IN NETHERLANDS

BY ASHLEY V. VELAZQUEZ

Dan Burleson, Alex Landon and undergraduate students in the Netherlands.

Textbooks and college lectures are the building blocks to earning our degree, however, there is absolutely no better way to learn than by using a hands-on approach. Taking the classroom beyond the classroom walls and getting your hands dirty is an opportunity that you shouldn't let slip by.

Cullen College of Engineering professors **Dan Burleson** and **Alex Landon** spearheaded a faculty-led, study abroad program in the Netherlands for Summer 2023. For 10 days, 20 undergraduate students had the opportunity to learn about coastal resilience and urban infrastructure in the Netherlands, a global leader in flood mitigation innovations.

Coastal resilience is a community's ability to recover from catastrophic weather and climate-related events. About 26 percent of the country is below sea level, making it crucial to have strategic and effective methods in place to keep the country from flooding. Additionally, they maximize the potential of their urban infrastructure by strategically designing them to become part of their coastal resilience strategies.

The Netherlands is at the forefront of innovations in coastal resilience, and the study abroad program offered the opportunity to learn about the subject firsthand from the engineers and industry leaders themselves.

For biomedical student **Adrianna Taing**, earning course credit abroad was a meaningful experience she will never forget. "Taking opportunities to continue enriching yourself is one of the most valuable things that you can do," she said.

Through this trip, the students were exposed to coastal resilience in a unique and engaging hands-on approach. The trip itinerary included visits to Shell and Fluor's corporate offices and the Erasmus Bridge. They also visited governmental entities like the Delta Works, which is a collection of locks, dams and storm surge barriers; and the Water Authority (Hoogheemraadschap van Delfland) that oversees the country's water safety and systems.

"They are the people who are in charge of water cleanliness and think broadly about how the flooding might impact [them]," Taing said.

Her most notable visit was when they went to the beach to view the sand dunes.

"Instead of having homes like they do in Galveston, they have parking garages in sand dunes, which are good for flood prevention," she said. "The sand engine pumps are based on mathematical modeling, which determines which is the best place to dump sand so that nature does the rest of the work and distributes it. It is the first one to be implemented in the world."

For Taing getting to visit the Shell and Fluor offices was also a wonderful networking experience.

"It was very nice to know people in the industry and hear about their perspective and journey."

Not only did the group receive technical knowledge, but they were also offered advice on their career and life choices. During her visit to Fluor, Taing said that one of the most valuable pieces of advice she received was to take her time.

"Take your time to figure out what you want to do. If you don't end up liking it, don't be afraid to switch out. You do not have to follow the same linear path."

Taing also expressed that she felt the work-life balance was completely different and admired the engineers and professionals that they met. "The drive felt different ... Dutch engineers dedicate their time to natural causes and helping preserve the place they live in."

Although the goal of the trip was to learn, the students also had plenty of free time to explore the country. Taing took advantage of this time by "visiting the Van Gogh Museum and the Anne Frank House," she said, both of which are important historical and cultural landmarks.

When asked if she would recommend taking a study abroad program, Adrianna expressed that it was "a good experience," and that "there are opportunities to attend." The University of Houston Learning Abroad office provides multiple faculty-led programs abroad that offer enriching opportunities and scholarships for students such as Taing, to attend these types of programs.

"It gave me inspiration and reignited the passion to continue to work on the classes I have to take," said Taing.

Ashley V. Velazquez is a student columnist currently studying strategic communications and minoring in supply chain and logistics. She also has a degree in industrial engineering from Universidad Internacional, and an associate's degree from Houston Community College.

Dan Burleson, Alex Landon and students adventuring through the Netherlands.

CHBE'S SOLANKI NAMED CO-CHAIR OF GRS

BY STEPHEN GREENWELL

Surya Pratap Singh Solanki, a Ph.D. candidate from the Cullen College of Engineering's William A. Brookshire Department of Chemical and Biomolecular Engineering, has been picked to serve as co-chair for the next Gordon Research Seminar (GRS), which is focused on Chemical Reactions on Surfaces. This conference will take place in the first quarter of 2025

Solanki will be serving as co-chair with Liping Zhong, a post-doctoral research from the Swiss Federal Institute of Technology in Lausanne. Solanki said he's always enjoyed volunteering for and engaging with organizations – he is a member of the American Chemical Society, the American Institute of Chemical Engineers and the Southwest Catalysis Society.

Solanki is advised by **Lars Grabow**, Dan Luss Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, but he noted that he works closely with professor Michael Harold, also of ChBE.

"My current area of research involves using a computational and experimental techniques to understand a variety of catalytic processes, and I have been always interested in the area of catalysis and reaction engineering," he said, adding that it was a field that Grabow is also involved in.

During his time at UH, he has received numerous accolades, including the Kokes Student Award, the ACS Catalysis Division Travel Award, a Best Poster Award at the UH Graduate Showcase and Southwest Catalysis Society Research Symposium.

QUINTERO WINS CCA POSTER COMPETITION

BY STEPHEN GREENWELL

Nathaly Andrea Castaneda Quintero had a successful career in the oil and gas industry for several years after getting her bachelor's degree from the Universidad Industrial de Santander, Bucaramanga, Colombia in 2014, but she knew she wanted to advance further in her career – and the University of Houston and Lone Star Community College have enabled her to thrive in that effort.

"Early in 2018, I decided to improve my English skills and took classes at Lone Star Community College-CyFair," she said. "By 2019, I applied for the master's program and was admitted to the College of Technology at the University of Houston. I finished my master's in Mechanical Engineering Technology in 2021. I also won the Graduate Student Excellence Award from the College of Technology the same year."

She is now in her second year of her doctorate program in Materials Science and Engineering, and her hard work is being recognized. She was the winner of the inaugural Poster Prize Competition at CCA 2023, the Coated Conductors for Applications International Workshop, held at UH in April.

Castaneda's research work focuses on the characterization and quality control of rare earth-coated conductors using Raman spectroscopy.

"We can say we are the first group to do 2D-scanning Raman spectroscopy on long areas and plan to extend to long lengths of hundreds of meters," she said. "We are building a reel-to-reel system for offline and in-line characterization that allows us to have fast feedback on the thin film's quality and better control of the fabrication process."

Castaneda was proud to receive the honor, and noted the demographics of the field as one reason.

"Receiving this award signifies a lot to me. The superconductivity field is a male-dominated field, and few women take part in it," she said. "In this workshop, I was the only woman student participating out of 13. I feel very proud of myself for getting this prize and proving that all my hard work and commitment have paid off."

Castaneda thanked her family for their support and understanding as she's pursued her educational goals, adding that it would have been so much harder with her without it. At UH, she works closely with **Francisco C. Robles Hernandez**, professor of Engineering Technology; and **Goran S. Majkic**, research professor in the Mechanical Engineering Department.

"Dr. Majkic has been an important support through my research path in the last couple of years," she said. "He is the smartest person I have ever met, and I am delighted to work with him. All the knowledge and skills I have acquired in the last few years are because of him. He's the example to be followed not only as a researcher, but also as a person."

"Afterward, I would like to continue with a postdoctoral position in the same superconductivity field, and study the possibility of becoming a professor here or back in my country," she said.

Castaneda [second from right] poses with the poster jury committee [left to right]: Xiaorong Wang, Michael Eisterer, and Venkat Selvamanickam

AI Chat Bots Might Be The *BIGGEST CHANGE TO LEARNING SINCE INTERNET*

BY NUSAYBA EL-ALI

Nusayba El-Ali is a student columnist for Parameters. She is currently studying biomedical engineering at the Cullen College of Engineering

The last great change (that I can think of) in the way students learn was the introduction of the Internet in the early 2000s. Since I was a small child at the time, I have only heard stories about the major impact it had on learning from those who were students at the time. The shift from having to look up words in a physical dictionary to simply having to type on a keyboard stood out to me as transformative.

The next significant change in the way students learn emerged in December of 2022. My younger brother excitedly showed me a new site he described as "a robot that will do anything you ask it to!"

Intrigued yet skeptical, I decided to put it to the test. I asked the chatbot to write me a short poem about trees. To my surprise, within seconds, it presented me with one of the most remarkable poems about trees I had ever read.

In ancient woods, tall and strong,
Nature's guardians, they belong.
Leaves whisper, branches sway,
Trees sing life's melody each day.

Impressed, I delved further and discovered that AI chatbots could generate code in any programming language the user desired. I inputted a prompt from my homework, and just like that, it produced a brilliantly organized and concise solution in a matter of seconds.

Initially, the immediate impact of this new technology on learning was not apparent, as its popularity began during winter break. When I returned to school the following semester, I noticed more and more people making use of AI technology. Whether they needed creative ideas for Instagram captions or assistance in debugging code, the screens of the sites seemed to shine bright wherever I went.

Before I knew it, AI chatbots became a go-to resource for professors, students and working professionals alike. Even during my summer engineering internship, my mentor recommended consulting the site for help in understanding complex code.

With its new popularity, I have begun to realize just how much AI chatbots are transforming the way we learn. They offer students personalized learning experiences by engaging in dynamic conversations. Students can ask questions, seek clarification and receive instant feedback. Worldwide, students are able to access vast knowledge resources at any time and from anywhere. Additionally, AI chatbots enhance problem-solving skills, a crucial aspect of engineering education..

AI chatbots represent a groundbreaking innovation that is revolutionizing the educational landscape. With this being said, it is important to embrace this technology responsibly, mindful of the ethical implications it presents. As AI chatbots continue to evolve, we can only somewhat predict the changes it will bring. As students who learned how to use such bots to advance their education, I am interested to see how its continued use will impact their future careers.

Interestingly enough, when coming up with an idea to end this column, I asked an AI chatbot to give me suggestions. As said by ChatGBT, the world's fastest-growing AI site, "In a world where AI chatbots are reshaping the educational landscape, the future of learning holds endless possibilities."

HERRERA THRIVING AS 1ST GEN STUDENT

in Supply Chain and Logistics program

BY ALEX KEIMIG

For Supply Chain and Logistics senior **Celeste Herrera**, a student in the Cullen College of Engineering's Technology Division, community has been an integral part of the path to success. She is the daughter of Peruvian immigrants and a first-generation college student – not to mention one of seven children – and her determination and commitment to success not only led her to seek out new connections, but to ensure that they continue to grow and thrive for those who follow after her.

Herrera is the Director of Engagement for the Supply-Chain Industrial Distribution Organization (SIDO), one of the Division of Technology's largest student organizations, and an intern at Bechtel Corporation. She earned this position after a particularly successful presentation from her all-woman capstone project research team.

It hasn't always been effortless, but building community and togetherness with other like-minded students has kept her on track.

“School is not easy,” she said. “It's hair pulling, it's dedication, and it's saying 'no' to a lot of activities and feeling like you're missing out on the parties. I am graduating a little bit later because I did need to retake some courses. I would feel upset about it, but it's led me to where I am now, and all of it has paid off. I think it's easy to feel alone [when you're] in school. All of my siblings decided to go right into the work field or continue with the jobs they already had, so being alone in this... I think I wasn't fully in the community until I joined SIDO, until I made those connections and I found a community that supported each other. If we're struggling, we're struggling together."

Herrera wants to extend that support to serve more than just current students. As SIDO's Director of Engagement, she's hoping to help plan more events open to alumni, like formals, tailgates and more, to encourage them to stay involved after graduation. Her goal is to strengthen industry partnership ties and create mentorship opportunities for students while making sure everyone feels welcome.

It can be hard to make friends and find new connections, Herrera said, even when you're in a room full of people. That's why she strives to be a friendly face in the crowd.

"I try to be the social one, to go up to them and introduce myself and make the connections. To get to see people open up and make friends within the organization - to me, that's a big deal. I like to think that I bring the best out of other people," she said. "Everyone is looking for their place, even professionals outside of school, and it's nice to invite them in. It's community. I've been to a lot of networking events, and at first I was very shy because I didn't think that people would take me seriously as a young woman. But it's actually the complete opposite. Everybody in my network is very supportive and wants to see me succeed. They want me to do my best, and they ask how they can help me. It's amazing."

> “Everyone in my network is very supportive and wants to see me succeed. They want me to do my best, and they ask how they can help me. It's amazing.”
>
> - CELESTE HERRERA

Herrera and her team drew on some of that support for their capstone project, collaborating with Bechtel to investigate alternative packing material options.

"We had formed a team for our senior capstone – myself and three other strong women. We worked with Bechtel, and we had many different project options and routes we could take, but we chose alternative packaging materials. We did a lot of research on the current standards for alternate materials, and we eventually landed on coco[nut] pallets. The pallets are made out of actual coconuts with no added adhesives, because once the husks burn, they create their own.”

Herrera noted that the process wasn't entirely seamless – it required work and refinement.

“We had to go through so much failure to get to coco-pallet... it felt like we hit a wall every week, and we were so scared because we thought we would have nothing to present [to Bechtel] and we would not be taken seriously again,” she said. “We all worked so hard together, we practiced our presentation for weeks in advance, we sought outside help, and it all came together."

In fact, it was a roaring success, according to Herrera.

"The fact that they loved it so much that I got hired on to continue my research was mind-blowing,” she said. “That's why this project was so very important to me, for the research work, for the friendships that I made, and for the networking opportunities as well."

Perhaps there is another secret to her success, though – As a blue belt in Brazilian Jiu-jitsu, Herrera credits much of her academic determination and perseverance to her martial arts training.

"I think everybody should try mixed martial arts, like jujitsu or kickboxing. I think that that has a lot to do with where I am now. I don't think that I would have been as confident as I am. It taught me patience and helped me come to appreciate delayed gratification."

The journey hasn't been easy, and Herrera's accomplishments have been earned at every step. She has felt immense pressure to succeed as a first-generation college student, but not from the source one might expect.

"When I would go to my mom for advice, I felt like she couldn't understand the kind of stress that I had on myself. I put a lot of pressure on myself because I want to succeed. I definitely put some of that on myself, but for good reason. I think my experiences growing up have shaped me to work harder. Not only because I want to do well, but because I felt like I was in a box for a long time, and finally going off to college and learning what the world is like made me want to continue that journey, and continue my education, because I feel like that really can't be taken away from me, right? I feel like I'm doing myself a service - and I feel like I'm doing the world a service - by learning every day."

CEE PH.D. STUDENT PAUL Earns AMTA Fellowship

BY STEPHEN GREENWELL

Siddhartha Paul, a Civil Engineering Ph.D. student at the Cullen College of Engineering, is one of four recipients of the 2022 American Membrane Technology Association (AMTA) and U.S. Bureau of Reclamation Fellowships for Membrane Technology.

Siddhartha Paul

According to a press release from the AMTA, Paul's research focuses on chlorine-resistant covalent organic framework. His advisor is Devin Shaffer, Assistant Professor in the Civil & Environmental Engineering Department.

"Siddhartha has been a dedicated researcher and has mastered numerous challenging experimental techniques to advance his research about the chlorine-resistance of covalent organic framework (COF) nanofiltration membranes," Shaffer said. "His work is demonstrating that COF membranes are a robust alternative to chlorine-sensitive polyamide membranes that can be effectively cleaned with chlorine to maintain their performance and extend their useful lifespan."

Paul noted that the award was a welcome honor for him to hear about and receive.

"I was extremely overwhelmed with joy and felt zeal to continue my research endeavors in the domain of membrane cleaning using chlorination," he said.

Paul earned his Bachelors in Technology from the National Institute of Technology Silchar and his Masters in Technology from the Indian Institute of Technology Guwahati, both in India. He started his Ph.D. studies at UH in 2021.

When asked why he chose the Cullen College of Engineering, Paul spoke positively of the vibrant industrial and business atmosphere of the Houston metro area.

"I always wanted to pursue a career in industry, and Houston seemed right for me, being in the energy capital of the world," he said. "There are lot of opportunities to build a start-up company through pitching ideas and to gather investments for my ideas."

Paul mentioned forming a start-up, or pursuing R&D opportunities, as options he's considering for the future.

"I have a dream to make a circular economy the new norm in the future, which is a more sustainable approach given the global climate crisis," he said. "I definitely look forward to becoming a leader in the domain of the sustainable technology sector."

Paul's Fellowship comes with an award of $11,750. AMTA and Reclamation have awarded more than $680,000 to students since 2007.

"AMTA would like to thank Reclamation for its ongoing generous support of AMTA's fellowship program, which has awarded $680,000 to 65 of the membrane industry's brightest young leaders since 2007," said Brent Alspach, AMTA's Fellowship Committee Chair, in a press release. "Our collaboration continues to both advance the frontiers of membrane technology and support the next generation of leaders that will guide the industry into the future."

For more information on AMTA/ Reclamation and Paul's Fellowship,

VISIT WEBSITE:
https://www.amtaorg.com/announcement-usbr

CEE PH.D. STUDENT FLORES EARNS WATSON FELLOWSHIP

BY STEPHEN GREENWELL

Dana R. Flores, a doctoral candidate in the Civil & Environmental Engineering Department at the Cullen College of Engineering, has earned the Ian C. Watson Fellowship for Membrane Advancement from the American Membrane Technology Association.

"My parents have had a huge impact on my academic development by always emphasizing the importance of education and encouraging me in my various academic and career goals," she said. "Specifically, my mom provided my first exposure to engineering as she told me growing up about her undergraduate degree in electrical engineering, and she showed me by example that it's never too late to shift career paths, gain more education and align your work with your interests. Like her, I returned to graduate school after several years in the workforce and am excited about the new career directions in my future after graduation."

As part of the fellowship, Flores presented at the 2023 Membrane Technology Conference in Knoxville, Tenn., the week of Feb. 20 through Feb. 23.

Flores is advised by **Devin Shaffer**, Assistant Professor in Cullen's Civil and Environmental Engineering Department. He emphasized the need and importance of the research she is doing.

"Dana is smart and ambitious, as evidenced by her desire to tackle the unresolved research questions about transport in nanofiltration membranes," he said. "Her research is addressing a critical need for accessible, predictive models of nanofiltration performance that membrane scientists and engineers can use to develop nanofiltration membranes for drinking water treatment and wastewater recycling."

Flores attributed her academic success to a combination of inspiration and support from her family and from Shaffer.

She added, "My advisor, Devin Shaffer, has also had a really positive effect on my academic development. As a professor during my master's program, he recognized my potential and interest in research and has been a supportive mentor throughout my experience in the Ph.D. program. Getting to learn from his experiences in both research and industry has been a real benefit for my growth."

Flores successfully defended her dissertation proposal in 2022, and she is targeting December 2023 for graduation.

"After graduation, I'm interested in working in consulting for industrial wastewater treatment," she said. "With my previous experience in the energy and chemicals space and the research skills I'm developing at UH, I'm excited for what's next."

According to the AMTA, the Watson fellowship is "in honor of his long and distinguished career dedicated to the beneficial application of membrane technology and his positive influence on both novice and seasoned membrane practitioners." Watson is known as a modern pioneer of membrane processes, and he served as AMTA's first Executive Director.

Dana R. Flores

For more information on AMTA/ Dana's Fellowship,

VISIT WEBSITE:
https://www.amtaorg.com/the-ian-c-watson-fellowship-for-membrane-advancement-ment-usbr

MIXED REALITY RAISING THE BAR FOR SPACE ARCHITECTURE ON THE MOON AND MARS

University of Houston 'Cage' Immerses Students in Space by Merging Physical and Digital Worlds

BY LAURIE FICKMAN


Paolo Mangili and Vittorio Netti

On the third floor of the University of Houston architecture building, inside **Olga Bannova**'s space architecture laboratory, **Paolo Mangili** is strapped into a harness suspended on a crane and hovering about two feet above the ground, simulating weightlessness. It's the sort experienced by astronauts in outer space or on the moon or even on Mars. The research assistant is dressed for it too, wearing an extravehicular activity space suit mockup and mixed reality (MR) goggles. He and a fellow researcher, **Vittorio Netti**, built the suit.

While suspended by the crane, Mangili can take a virtual spacewalk in a simulated virtual reality (VR) environment. Once he plants his feet back down on the ground, his simulated environment changes, and through his goggles he can see the vast landscape that is Mars with a rover already landed and a habitat that astronauts can one day call home. He can then work on them, tinkering, fixing various parts, assuring they are secure. Depending on what the group is studying, he may also be on the moon or even float into the International Space Station via extended reality (XR).

"I've seen Earth from space. That was quite a feeling actually because the realism of the simulation is quite overwhelming," Mangili said.

No metaphor here, but when it comes to realities, there are plenty. The Bannova lab is an XR lab, with a big family that includes MR, VR and augmented reality (AR).

XR is all about a feeling of realness. It blends physical and digital worlds, mixing natural and intuitive 3D human, computer and environmental interactions. Anybody who's used an Instagram or Snapchat filter, or a virtual eyeglass fitting application, has used mixed reality. It basically puts you into the computer world.

"Any environment can be recreated in virtual reality. I've seen earth from space. That was quite a feeling actually because the realism of the simulation is quite overwhelming. It felt great and it felt real," Mangili said.

In the Bannova lab, XR is used to integrate mixed reality into the design of space structures, making space design more interactive and relatable for designers.

"Optimization of human-system integration is a fundamental task of the hardware design process for crewed space missions," reports Bannova, in American Society of Civil Engineers library, an article that resulted from studies sponsored by the Boeing company conducted in 2020-2021 and continued through 2023. "Innovation has stalled for a few decades on design methods currently in use. The standard method uses computer simulation or high-fidelity mockups. Such an approach involves high costs and a long implementation time."

Bannova is director of the Sasakawa International Center of Space Architecture (SICSA) and its MS-Space Architecture program (the only one in the world) at the University of Houston. And while most everyone dreams of flying to outer space or going to the moon, Bannova dreams of where you'll sleep once you get there, or what car you'll drive to take you around. Her students work on all of that virtually.

"These technologies should be harnessed to mitigate the dependency on physical prototyping of assets and help optimize the design process, drastically reducing research-and-development time and providing a higher level of immersion," said Bannova. "However, there is a gap in the general understanding of how to utilize these emerging technologies effectively and apply them for space hardware development."

It doesn't look like a gap in the Bannova lab.

The proposed methodology was developed during a six-month research and design study of lunar surface architecture sponsored by Boeing. Netti, head of the XR lab, led the work which was conducted by faculty and students at SICSA. The study sought to define a design process that includes possible surface operations scenarios, development of an evaluation methodology and surface analysis for the conceptual design of a lunar terrain vehicle and a small lunar habitat.

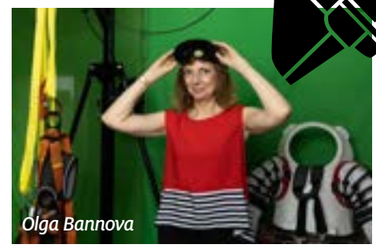
Coincidentally, in the last few years while the space industry struggled to implement new evaluation techniques that place humans in-the-loop, development of commercial immersive technologies spiked and even became affordable.

"Our current study for Boeing is to extend the methodology to apply it for testing designs in microgravity, which is different from the moon's partial gravity environment," Bannova said.

Over two years, Netti designed and built the "cage," as it is called, that houses the XR setup. It is similar to the NASA Cave with a twist.

"The green screens allow us to set cameras as in space. When I look at the screen and I look at the point of view of the camera, I can see the person performing the operation inside the virtual reality environment," said Netti who runs the show when Mangili is dangling.

There is lots to be done before a Mars landing. Hardware must be tested, lunar rovers deployed. Bannova's students are working on all of it. Future tasks include demonstrating and testing the proposed system using different types of habitats designed for both lunar and Martian surfaces.


Olga Bannova

WATCH THE VIDEO:
https://www.youtube.com/watch?v=P_6P-Fmgh6HUment-usbr


Paolo Mangili investigates the lunar surface in mixed reality.

SYSE STUDENT SIBERT RECEIVES **DOD SMART SCHOLARSHIP**

BY STEPHEN GREENWELL

Jordyn Sibert

The Cullen College of Engineering has another member of the Department of Defense's Science, Mathematics and Research for Transformation (SMART) scholarship program in its ranks, as Systems Engineering student **Jordyn Sibert** has been picked for the 2023 cohort.

"I am beyond excited to announce that I am one of the scholars to receive the SMART Scholarship for the 2023 cohort," she wrote in a LinkedIn post about the honor. "It is an absolute dream to have the opportunity to work with the Missile Defense Agency, and I would like to take the time to thank my mentors **Nathanial Wiggins** and Houston Green for their guidance over the past couple of years. I'm excited for what the future will bring, and know the best is yet to come."

The scholarship will cover Sibert's tuition for the rest of her undergraduate degree pursuit, while also providing a stipend and a health allowance. Beyond financial support, the scholarship will also provide Sibert an opportunity to work directly in a government-affiliated, STEM-related field, via an internship in Summer 2024.

"Winning the SMART Award means that the Missile Defense Agency [MDA] in Colorado Springs has recruited me as a Systems Engineer to train and work with them on performance of their systems, simulation testing and much more, including hyper-sonic testing and real world launch applications," Sibert said. "This is beyond life changing for my family and I."

After successfully completing her degree and the internship program, Sibert will work full-time as a systems engineer at the MDA. She's excited for the opportunity to use her skills there, and to work on the computer and network systems for target detection sensors, ground and sea-based missiles, and other important defense mechanisms.

"On a personal level, I am interested in researching more streamlined and energy-efficient methods to implement into these complex systems," she said. "I am thrilled to have the opportunity to have a hand in keeping our country safe as a civilian with the MDA, since this is their top priority."

Sibert stressed the importance of her family as well as her academic mentors in her success. Wiggins is a Senior Lecturer in Cullen's Industrial Engineering Department. Green is a designer and builder of NASA Human Rated Robotics Systems for Jacobs Engineering.

"They've both guided me along this path to success, and I look forward to having the opportunity to help others as they have helped me," she said.

DOCTORAL STUDENT SENSENBACH EARNS DOD SMART SCHOLARSHIP

BY STEPHEN GREENWELL

A doctoral student from the Cullen College of Engineering is the latest member of the Department of Defense's Science, Mathematics and Research for Transformation (SMART) scholarship program, after a competitive application and evaluation process.

Shayne Sensenbach began his studies in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the University of Houston in Fall 2020, after earning his B.S. from Oregon State. As part of being chosen for the SMART program, he will get the opportunity to complete two internships with the Department of Defense, and receive stipends for his tuition and research efforts. After graduation, Shayne will take a full-time position with his sponsoring DoD agency.

"The process has been so exciting and uplifting for me. I am beyond grateful for the SMART program for offering me their support, and I look forward to the future career opportunities with the DoD," he said.

Sensenbach is part of the Orman Lab, which is led by Mehmet A. Orman, Assistant Professor in the Chemical and Biomolecular Engineering Department. He is a listed author on two papers in Metabolites and Microorganisms.

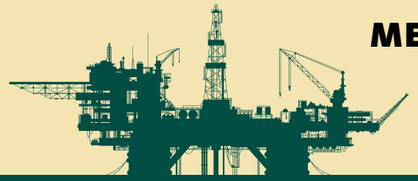
Sensenbach attributed his academic success to several people in his life.

"First of all, almost every drop of my success can be attributed to the support from my family and my close friends. My parents have always supported me in every way they could. They have always believed in me and lovingly encouraged me in every aspect of my life," he said. "Dr. Orman was also very supportive of me during the scholarship application process. He helped me revise all of my applications to multiple fellowships and scholarships, and it's safe to say I would not have received an offer without his help. Additionally, I am very grateful for countless teachers and advisors through the years - many names and faces come to mind. Dr. Milo Koretsky at Oregon State (now at Tufts University) was especially kind and helpful to me throughout my undergraduate studies. I am very fortunate to have so many great people in my life."

Sensenbach's projected graduation date is currently the 2025 academic year.

"I'm sure my future work with the DoD will provide a lot of learning opportunities and exposure to various fields," he said. "I hope to eventually focus my career on therapies for cancer and other diseases, but I will welcome any opportunities that may present themselves."

Shayne Sensenbach



ME ALUM IVERS LEADING NEW INNOVATION INTO DEEPWATER DRILLING

BY STEPHEN GREENWELL

While there is a push for renewable energy sources, the world's growing energy consumption means that generation from fossil fuels will still be required for decades. However, even if that's the case, Cullen College of Engineering alumni Terrance "Terri" Ivers (BSME '80) still sees an opportunity for that process to be done in a way that is more environmentally-conscious and responsibly manages our critical energy resources.

"I think all engineers are curious, and they should be, and we should set goals to improve what has been done previously," Ivers said. "What we saw was a great opportunity to enhance ultra-deep water appraisal and production in the Gulf of Mexico in particular, but also globally. And yet, we saw the industry going down a path that was heavily reliant on unproven subsea production systems for the deepest and riskiest oil plays in the high temperature, high pressure (HPHT) formations beneath the Gulf of Mexico."

Ivers is the founding chairman of Frontier Deepwater Appraisal Solutions, LLC. The company is in the startup phase with a small but highly experienced core team. Ivers himself has extensive experience in the energy and construction industries. He is the former executive president of the North American unit of Germany's Bilfinger, an international construction and maintenance company with more than $4 billion in yearly revenue.

Ivers noted that, because many ultra-deepwater subsea drilling and completion methods are reliant on complex systems that are extremely expensive to deploy and maintain, production efforts have suffered financially on the most challenging HPHT oil fields.

"We set about to tackle that particular challenge to economic performance, recognizing the need to eliminate inherent risks in terms of safety and environment associated with industry's reliance on a new generation of unproven equipment for these very deep reservoirs," he said. "We felt that there was a solution that involved more environmentally friendly and safer production techniques. Could we solve that challenge by enabling adoption of proven surface well systems supported on the movable wellbay concept that we designed?"

Wellbays can provide direct surface access to wells and accompanying equipment on drilling / production platforms for safer, more efficient operations. Ivers saw the opportunity for patents and new technology to enable this highly desirable direct access to wells and completion/control systems in ultra-deep waters with a straightforward innovation to the way the wellheads are supported in the wellbay.

"We came up with this concept of a movable wellbay, which enabled us to position each wellhead centrally (beneath the derrick) for critical operations as/when needed," he said.

Ivers added that he fully supports renewable energy efforts, but he acknowledges that there needs to be a transition period, given how much of modern life revolves around access to fossil fuels.

"We believe and support following a path to alternate means of producing energy," he said. "But there's no practical way to get to that concept fully without managing a gradual weaning off fossil fuels. Just shutting off their production doesn't get us to the energy transition. I mean, much of the equipment that is used to produce alternate forms of energy, like solar panels and all the components that go with it, or even with turbines and the blades, they're all using petroleum products. Just like most industrial processes, they depend on fossil fuels in the manufacture of the key components."

To bridge the gap while energy storage, alternative materials and renewable energy methods are further developed, Ivers said that fossil fuels will continue to be utilized.

"Fossil fuels are going to play a role," he said. "Our most abundant reservoirs of oil exist deep offshore. They exist in deepwater plays. We must find a way to shepherd our reserves to maintain our capability to produce at the level needed to sustain our country. We need to continue to find these reserves and, and we should all be working in a way that challenges the status quo and opens up our minds to new ways of doing so."

"The remarkable thing about Frontier's innovation is that it's not the most technologically advanced concept that exists out there. It's an insightful evolution of what's already existed in the industry but has just been overlooked. We believe that helps industry to accept and deploy the technology, because basically it is so familiar."

Terri Ivers

Cullen College Alumna Appointed To City Park Redevelopment Authority Board

Mackrena L. Ramos

The Houston Mayor and the City Council have appointed **Mackrena L. Ramos, P.E.**, to the City Park Redevelopment Authority and Tax Reinvestment Zone #12 Board of Directors.

Ramos is a Vice President with Lockwood, Andrews & Newnam, Inc. (LAN), which is a planning, engineering and program management firm headquartered in Houston. She is also a graduate of the Civil Engineering program at the University of Houston's Cullen College of Engineering.

The Tax Increment Reinvestment Zones (TIRZ) are special areas created by the City to promote growth and attract new investment to the designated districts. Houston Council Member Abbie Kamin, District C, nominated Ramos for the position.

Wayne Swafford, President of LAN, said Ramos's professional expertise will be an asset to the board.

"Ms. Ramos has been with LAN for 24 years and has significant experience with City of Houston water and wastewater projects. She has directed the development of numerous infrastructure projects involving hundreds of millions of dollars," he said. "She is a valuable member of our team and is definitely an asset for the city with her appointment."

Ramos said, "I'm very appreciative of this honor. I grew up in Houston and went to school here. This city is very dear to me and I'm committed to doing my best to serve our community."

She added, "The objective for TIRZ #12 is to support revitalization, redevelopment and infrastructure upgrades in Houston's Timbergrove area. The TIRZ 12 area, which covers almost 700 acres, is currently targeting improvements in stormwater drainage, detention and flood mitigation. The focus in TIRZ 12 is also to expand mobility, green spaces and infrastructure initiatives."

Special taxing initiatives will help to fund the public improvements in the zone.

At LAN, Ramos leads the Surface Water Transmission Program (SWTP). She has extensive experience with capital improvement planning, design quality, cost reduction reviews and optimal phasing of improvements for infrastructure projects. A licensed professional engineer, she is a graduate of the University of Houston and holds a bachelor's degree in civil engineering.

Ramos is an active member of the American Water Works Association, American Society of Civil Engineers, Texas Water Conservation Association, and Houston Hispanic Architects & Engineers.

LAN is a full-service consulting firm offering planning, engineering and program management services for the nation's heavy civil infrastructure needs. With nearly 350 employees across the United States, LAN is a national leader in the engineering industry and is consistently ranked among the "Top 100 A/E Firms" by Engineering News-Record. LAN is a LEO A DALY company, an international architecture and engineering firm.

Press release courtesy of LAN

LILLY ROELOFS Receives *2023 Rising Star Award*

BY STEPHEN GREENWELL

Lilly Roelofs awarded the 2023 Rising Star Award at the 2023 Women In Engineering Celebration.

Lilly Roelofs didn't even know she was being considered for this year's **Cynthia Oliver Coleman**, P.E. Rising Star Award, but she was ecstatic when she received the email announcing her as the recipient in January.

"It was a huge honor to be given an award in the name of Mrs. Cynthia Oliver Coleman," Roelofs said. "I've gotten to know her previously through her involvement with SWE [Society of Women Engineers], and she is such an inspiration and role model for me. Her support of the incoming generations of women engineers is incredible."

Roelofs received the award in March, at the 2023 Women in Engineering Celebration. She noted that Coleman asked her to share the three things she was most proud to accomplish in her undergraduate studies. She provided her notes from that night.

"One thing I'm very proud of is the efforts I contributed to organizing our involvement with the WE22 conference as Vice President Internal of SWE-UH. I was able to make this opportunity accessible to many additional UH students and women, as well as promoted further growth of our organization.

"In addition to this, I co-first authored two conference publications during my junior year, one of which received an award at the conference. I never thought I would be able to publish research in my undergrad, especially in such an exciting field as computer-aided diagnosis, so this meant a lot to me!

"Lastly, I'm proud of completing a minor in data science and pushing myself to pursue programming in addition to my major. I didn't consider coding as something I could be interested in, as I knew nothing about it until college. Through this, I found a unique career that I'm very passionate about."

When it came to picking a college, Roelofs didn't lack choices when graduating from her high school, Judson Early College Academy in San Antonio. However, after being in a class of about 100 students when she graduated, the environment of UH appealed to her.

"I loved how big the campus was," she said. "I really wanted to go to a big college. UH checked that mark off. I also liked how close UH was to downtown. I wanted to be closer to the city, so that was perfect. And also, it kind of sounds corny, but I just felt really comfortable on the campus."

Ultimately, it was a combination of campus size, a competitive financial aid package and the offered courses that made Roelofs enroll. She was also accepted into the Honors Program at UH, which provided her with some of the smaller classes that she was comfortable with from high school.

"It was one of the most affordable options for me. I had received a four year scholarship, so financially that was a really big factor," she said. "Also, I definitely wanted to major in biomedical engineering and some schools don't offer BME as a program, so I was intrigued when I saw that UH did."

Roelofs identified several people that she considered instrumental in guiding her toward her academic success, starting with her high school physics teacher, Eric Botello, now at Byron P. Steele II High School in Cibolo, outside of San Antonio.

"Mr. Botello implemented programs like the Engineering Club, Robotics Club, AP Physics, even the opportunity to take calculus classes, and he encouraged me to take advantage of these options," she said. "Without his involvement, I doubt I would have pursued engineering."

At UH, Roelofs said a pair of professors in the First-Year Experience Program have been mentors for her throughout her undergraduate work – **Jennifer Luna Singh**, who is also the director of PROMES, and **Marsha Kowal**, who is also the director of the Honors Engineering Program.

"Dr. Luna was my Introduction to Engineering professor," Roelofs said. "She kept in touch with me after, and she also gave me a great letter of recommendation that helped me get into my first research program. That was huge for me. She's now the director of PROMES, so I've worked closely with her for SWE. She has gone out of her way to help support student success countless times, and she always has her door open to talk."

When it came to Kowal, Roelofs said, "I really enjoyed her class. It was one of the greatest factors in my decision to pursue data science as a minor, and more coding-based work, which really changed the trajectory of what I wanted to do after college."

"Beyond that class, a few years later she recruited me as a mentor for a program she was starting, and I really enjoyed it, so much so that I asked if I could help lead it the following year. Now I organize it with her on a weekly basis, and it's been an amazing opportunity. Dr. Kowal really cares for students and is willing to help in any way she can."

Roelofs excels in part because of her disciplined organizational skills. She uses three different methods – Google Calendar, an open Word document to take information down, and an old school, written agenda – depending on what she has access to at the time.

She has stayed busy while at UH, serving as an officer for SWE and volunteering for several other organizations.

"A lot of my on-campus involvement is focused around supporting women in STEM, which I'm really passionate about. I feel very fortunate that I've found such welcoming and empowering groups on campus." she said. "I hope to continue contributing to these causes in my professional career."

Roelofs graduated this past May, and she's already lined up a full-time job that she's excited to start soon after.

"I will be working with Mercury Data Science in the position of a Data Scientist," she said. "MDS is a software consulting company which builds AI applications for healthcare and life sciences companies. They do really fascinating work that I'm passionate about. I actually started a part-time internship position with them in April, and I am on top of the world!"

Distinguished Alum

CYNTHIA OLIVER COLEMAN P.E.

Honored As **Fellow Grade** By SWE

BY STEPHEN GREENWELL

Cynthia Oliver Coleman, P.E. at the Women in Engineering Celebration in 2019

Cynthia Oliver Coleman P.E., a distinguished alumni of the Cullen College of Engineering and a longtime supporter of the university, is one of seven women that received Fellow Grade in 2022 from the Society of Women Engineers at its annual awards program.

Coleman was honored during WE22, the world's largest conference and career fair for women engineers and technologists, which took place in Houston for 2022. Fellow Grade is conferred on SWE members in recognition of continuous service to the advancement of women in the engineering profession. Her profile is available on the SWE website.

Coleman was also profiled in the Fall 2020 edition of Parameters magazine. She was the first Black woman to graduate from the University of Houston's Chemical Engineering program, in 1971.

"When I was at UH, I was a young Black woman pursuing chemical engineering during a time when women were discouraged from pursuing the male-dominated engineering profession, because nobody would hire a woman as an engineer, especially not a Black woman," she said.

Following her graduation, Coleman started a career at Exxon – then known as Humble Oil – that would span 33 years. In 2019, she was inducted into the Cullen College of Engineering Bridgebuilder Society, the highest honor bestowed upon donors. She is an organizer of the yearly Women in Engineering celebration, and the Cynthia Oliver Coleman Rising Star Award is presented yearly to the College's Outstanding Senior.

The 2023 Women in Engineering Celebration was held on March 8 in the UH Hilton's Shamrock Ballroom.

Cullen College **Honors**

DISTINGUISHED ALUMNI AND FACULTY

at the **2023 Annual Alumni Awards Gala**

The 2023 UH Cullen College of Engineering Alumni Awards Gala was held at the Bayou City Event Center on Thursday, June 8. The annual event, hosted by the Engineering Alumni Association (EAA), celebrates the professional achievements and contributions of Cullen College alumni and faculty. This year's honorees are:

LIFETIME ACHIEVEMENT AWARD
Ronald Lohec (BSME '55)

President (Retired), Global Reservoir Engineering, Inc.

Ronald Lohec received his B.S. in mechanical engineering from the University of Houston's Cullen College of Engineering in 1955. A U.S. Marine and Korean War veteran, he worked for Exxon Corporation, now ExxonMobil Corporation, for more than 30 years in the field of petroleum reservoir engineering. His job assignments took him all over the world. Throughout his professional career, Lohec contributed to the field of reservoir engineering by authoring and co-authoring several technical papers. After his retirement in 1986, Lohec developed a consulting practice and designed two software sets to simulate oil and natural gas well activity.

Ronald married his wife, Bertha "Bo" (Johnston) Lohec, in 1953. Throughout her life, Bo valued engineering and joined Ronald in his unwavering support of the Cullen College by constantly encouraging young people, especially young girls, to find a sense of purpose in engineering. Ronald felt it was important to give back to the college that enabled him to have such a successful engineering career.

As a token of their gratitude to the college, Ronald and Bo created a scholarship endowment fund. This scholarship fund provides support to UH engineering students to experience the same success. The fund, which consists of matched contributions by the ExxonMobil Foundation, covers the cost of tuition, books, fees and supplies for engineering undergraduate students to achieve academic success while attending UH.

Following the passing of Bo, Ronald established the Bertha "Bo" Johnston Lohec Engineering Endowed Scholarship—a scholarship aimed at helping UH engineering students achieve their dreams of becoming an engineer.

Ronald serves on the Engineering Leadership Board at the Cullen College of Engineering. In 2006, Ronald and Bo were inducted into the Bridgebuilder Society, the highest honor bestowed on donors to the Cullen College of Engineering. They were also early investors in the Multidisciplinary Research and Engineering Building (MREB), which opened in 2017.

In his retirement, Lohec enjoys golfing, sailing and spending time with his three adult children, nine grandchildren and nine great-grandchildren.

DISTINGUISHED ENGINEERING ALUMNI AWARD

James Ortiz, Ph.D. ('96 ECE)

Senior Advisor to the NASA Associate Administrator, NASA Retired

James Ortiz, Ph.D., is an adjunct professor in the Electrical and Computer Engineering Department at the University of Houston. Ortiz received his B.S. degree in electrical engineering from Los Andes University in Columbia, South America, an M.S. degree in systems engineering from the Naval Postgraduate School in Monterey, California, and a Ph.D. in electrical engineering from the University of Houston. Ortiz is a graduate of the Senior Managers in Government Program of the Kennedy School at Harvard University.

Ortiz has served in many roles at the NASA Johnson Space Center (JSC). He began his career at NASA in July 1990 from the U.S. Air Force, where he served as a flight test engineer for electronic warfare systems on high-performance aircraft. Ortiz has held several technical and executive assignments including Head for International Space Station Astronaut and Flight Controller Systems Training, Senior NASA Research Exchange Engineer with the Air Force Research Laboratory in New Mexico, Chief of the JSC Mission Operations Advanced Projects Office, and Manager of the Office of Analysis and Assessment reporting to the JSC Center Director.

He later served as Deputy Manager for Integrated Avionics and Software for the next human space exploration vehicle, the Orion project. Ortiz also led the design certification review of the Space Shuttle fleet for return to flight after the Columbia accident.
Ortiz was the former director of the Independent Program Assessment Office (IPAO) from 2009 to 2015 at NASA Headquarters. As director of the IPAO, he was responsible for the independent assessment of the Agency's highest priority spaceflight projects including assessing for sound technical approaches, adequate cost, schedule, management and overall risk posture to ensure that spaceflight projects were on a path to mission success.

Before retiring in 2021, Ortiz served as the Senior Advisor to the NASA Associate Administrator. As part of this role, he led the transition of the Agency Independent Assessment function for space flight programs and projects from a centralized construct to a new decentralized model.

DISTINGUISHED YOUNG ENGINEERING ALUMNI AWARD

Eric Rodriguez (BSEE '96)

Founder and Speaker of Change Maker LLC

When Eric Rodriguez was just 11 years old, his family made the life-changing move from Houston to Ecuador. The stark contrast between wealth and poverty was a culture shock for young Eric, and he quickly realized the power of education in helping to bridge this gap.

It wasn't until he was in seventh grade that Eric's perspective on what was possible truly began to take shape. His school, El Colegio Javier, opened its first computer lab and Eric's class was the first to use it. In just minutes, the students were connected to the rest of the world. This experience ignited Eric's passion for technology and its potential to shape the future.

Today, Eric is the founder and speaker of Change Maker LLC., after most recently serving as the Education Regional Director at Intel. His impact has been felt across the globe, as he has led technology programs, workshops and talks in places like Arizona, New York, Texas, Louisiana, California, Swaziland and his beloved Ecuador.

Eric's commitment to using technology for good has been recognized through his work with organizations such as Aguila Youth, SHPE, Prospanica, Intel Foundation and INROADS. He has been named to Arizona's prestigious 40 Under 40 list and recognized as a Young Hispanic Corporate Achiever.

With a background in engineering, operations, chief of staff, human resources, project, program and product management, Eric brings a wealth of experience to his role at Intel. He holds a B.S. in electrical engineering from the University of Houston and an MBA from Loyola University in New Orleans.

Eric's journey has been one of resilience, determination, and a deep commitment to making a positive impact on the world. His story is an inspiration and a testament to the power of education and technology to drive positive change.

ROGER EICHHORN SERVICE AWARD

Jerrod Henderson, Ph.D.

Assistant Professor, William A. Brookshire Department of Chemical and Biomolecular Engineering

Jerrod A. Henderson ("Dr. J") is an Assistant Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering in the Cullen College of Engineering.

He began his higher education pursuits at Morehouse College and North Carolina Agricultural & Technical State University, where he earned dual B.S. degrees in chemistry and chemical engineering as a part of the Atlanta University Center's Dual Degree in Engineering Program. While in college, Henderson was a Ronald E. McNair Scholar, allowing him to intern at NASA Langley. He also earned distinctions as a Phi Beta Kappa member and an American Chemical Society Scholar. Henderson completed his Ph.D. in chemical and biomolecular engineering at the University of Illinois at Urbana-Champaign. During his time as a graduate student, he was a NASA Harriet G. Jenkins Graduate Fellow and mentor for the Summer Research Opportunities Program.

Henderson has dedicated his career to increasing the number of students who are on pathways to pursue STEM careers. He believes that exposing students to STEM early will have a lasting impact on their lives and academic pursuits. He is the co-founder of the St. Elmo Brady STEM Academy. SEBA is an educational intervention aimed at providing underrepresented fourth and fifth-grade students and their families hands-on STEM experiences. Henderson also served as the Director of the Program for Mastery in Engineering Studies (PROMES, pronounced "promise"), a program aimed at increasing engineering student achievement, engagement and graduation rates at the University of Houston.

His research interests are in engineering student success among underrepresented students, especially African American males. Henderson's research has garnered several awards and acknowledgments by INSIGHT Into Diversity Magazine as an Inspiring STEM Leader, the University of Illinois at Urbana-Champaign with the College of Liberal Arts & Sciences with the Outstanding Young Alumni Award and the Career Communicators Group awarded Henderson the Black Engineer of the Year Award for college-level promotion of engineering education. He was also recently selected as an associate editor of the Journal of Women and Minorities in Science & Engineering.

ABRAHAM E. DUKLER DISTINGUISHED FACULTY AWARD

Miguel "Micky" Fleischer (MSCE '75, Ph.D. '78)

Adjunct Professor, William A. Brookshire Department of Chemical and Biomolecular Engineering

Miguel "Micky" Fleischer, Ph.D., is an adjunct professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the University of Houston. Fleischer received B.S. degrees in chemical engineering and industrial engineering from Universidad Católica de Chile in 1973. He earned a M.S. degree and Ph.D. degree in chemical engineering from the University of Houston in 1975 and 1978. While in Chile as an undergraduate student, Fleischer developed a program sponsored by Universidad Católica de Chile aimed at preparing high school students for college.

Fleischer worked at Royal Dutch Shell for more than 26 years in research and development, manufacturing, finance and management. Prior to leaving Shell, Fleischer served as the Economics Manager of Shell Chemicals. Some of his responsibilities included creating an investment decision framework with an emphasis on economics, value-based management, risk management and capital structuring.

He was the co-owner and CEO of Fleischer International Trading, a private enterprise that imported and distributed wines from all over the world for 13 years.

Fleischer is the recipient of several awards from the Cullen College of Engineering, including the Outstanding Lecturer Award, the Career Teaching Award and the Distinguished Engineering Alumni Award. He also received the William A. Brookshire Teaching Excellence Award from the University of Houston.

Thank you!

We look forward to seeing you at next year's EAA Awards Gala!

YouTube

WATCH THE HONOREES TELL THEIR STORIES:

www.youtube.com/playlist?list=PL7Cm6PJI-AJKLEIm6ucBUUjlnMDoWuDGp

ME ALUM **AKIHIKO "AKI" HOSHIDE** MAKES HIS MARK IN *SPACE*

BY BRYAN LUHN

Aki takes a selfie during a six-hour spacewalk outside the ISS during Expedition 32 in 2012

From the moment he saw his first rocket up close, **Akihiko "Aki" Hoshide** knew he wanted to be an astronaut. But his journey to outer space was far from typical, and it might not have happened at all without an unexpected, three-year stay in Houston.

Born in Tokyo in 1968, Aki spent a few of his childhood years in the United States where his father once took him to the Kennedy Space Center, which launched his lifelong love for space.

"That's what started it for me, my dream of being an astronaut," Aki said. "I looked at all of those rockets and thought to myself 'how cool would it be to go into space?'"

In 1992, Aki graduated from Keito University in Tokyo with a Bachelor of Science in mechanical engineering, then joined the National Space Development Agency of Japan (which is now the Japanese Aerospace Exploration Agency, or JAXA). But circumstances would soon take him back to the U.S., and eventually to the University of Houston.

"In the Japanese space agency, we were allowed to take a year off and go study wherever you wanted to," Aki said. "I asked my boss for that year, and he said yes, on one condition… he needed someone in Houston."

Aki arrived at the Johnson Space Center in 1994 as a support engineer helping astronauts prepare for their upcoming missions. But he still dreamed of one day being an astronaut himself.

"While I was there, I applied for Japan's astronaut program, but when I didn't make it, someone suggested I go get my master's degree," Aki said. "The University of Houston Cullen College of Engineering had what I was looking for, what I thought would help me prepare for the next astronaut candidate selection."

Aki wasn't the only JSC employee that saw the value in a master's degree from UH. He studied with several co-workers who were involved in a variety of areas, including extravehicular activity training (EVA), programming and systems training.

"A lot of my classmates were also working at JSC, so learning from them, sharing ideas and stories was a huge help," Aki said. "You got to see different aspects of space activity in that classroom, different systems, and it helped me to be able to speak the same language when talking about those systems."

Not long after earning his Master of Science in aerospace engineering in 1997, Aki's dream was realized when he was selected by the Japanese space agency as one of three candidates to work on the International Space Station (ISS). In 2001, after two years of training, he was certified as an astronaut, and flew his first mission (STS-124) aboard Space Shuttle Discovery in 2008.

"The first impact for me was seeing the ISS with my own eyes, getting close on the shuttle and actually see that massive facility just floating up there," Aki said. "We'd seen bits and pieces of it on the ground but seeing it in space was unbelievable."

Aki returned to the ISS aboard a Russian Soyuz capsule in 2012 as a flight engineer on Expeditions 32 and 33. Then, in April 2021, he launched on the SpaceX Crew-2 Dragon spacecraft for Expeditions 65 and 66 and served as ISS commander for the final five months before the crew returned to earth in November. It was the second manned mission in the new Commercial Crew Program and the nearly 200-day trip is the longest crewed capsule mission in U.S. spaceflight history.

In all, Aki has spent more than 340 days in space, including 332 on the ISS, and performed more than 28 hours of spacewalks. He's traveled nearly 15 million miles on his missions which is a little less than a quarter of the way to Mars. That's a lot of time spent in small spaces with several other crew members without most of the comforts of home.

"It's not a luxurious hotel, but it's not a camping trip either," Aki said.

According to Aki, the bathroom has a suction fan built into it, so things don't float away. There aren't any showers, so the astronauts put shampoo and soap on towels and wipe themselves down. And space food is served in pouches and cans, but sometimes a new crew will bring something fresh like apples and oranges.

"The first three days you're trying to adjust to everything but after that I was happy," Aki said. "I didn't have any complaints."

Aki is at least the ninth astronaut to earn an undergraduate or graduate degree from UH, and many other graduates have served in other civilian roles. With its home in the heart of "Space City" and proximity to the JSC, UH's prominence in the space program isn't surprising. In fact, it's only growing. Last year, the UH System and NASA expanded a longtime partnership to work collaboratively on joint research, technology development and transfer, training and education and outreach initiatives. Aki's message to those hoping to carry the UH space tradition further is simple.

Aki installs a modification kit on the ISS during Expedition 66 in 2021

Akihiko Hoshide

"Work hard, study hard and challenge yourself," Aki said. "I didn't get into the astronaut corps until my third try, so when you bump into challenges, overcome them and strive for what you want to do."

As for his own journey, Aki isn't sure where he's going next. Right now, he continues his work through JAXA supporting other missions and programs. He would love to return to space one day if his family and the agency allow him to. Whatever happens, he knows the future is bright.

"It's a very exciting era with more commercialization happening and the Artemis missions taking us back to the moon," Aki said. "And it will be challenging, but we could see someone land on Mars in our lifetime. Nothing is impossible."

> *"Work hard, study hard and challenge yourself"*
>
> - AKIHIKO HOSHIDE

IE GRAD PROVIDES A CASE STUDY FOR **IMPORTANCE OF LOGISTICS**

BY STEPHEN GREENWELL

A graduate of the Industrial Engineering master's program at the University of Houston's Cullen College of Engineering is now leading a team optimizing the operational dynamics at DHL as the firm continues to grow in size and revenue.

Viraj Lele earned his Master of Engineering in 2017, after completing his undergraduate studies at the University of Mumbai in 2014 with gold medalist distinction. He has also since earned a Master of Science degree from Penn State in 2020. This knowledge has merged with his experience in the field in order to be a valued member to perform critical roles at DHL Supply Chain.

"Based on today's life, one of the forefront industries is supply chain logistics and management, where the contest is ferocious," he said. "Breakthroughs are achieved not just because of the front line associates but also due to the team working in the background, and one such role which makes it possible is an Industrial Engineer, which I'm employed as."

Lele chose the University of Houston because it had a highly ranked program of faculty and researchers in IE. The amenities, like instate scholarships and the campus, provide great growth opportunities in the fifth largest metro area of the United States. Lele was also the recipient of the Scott T. Poage Merit scholarship, which was awarded to him in his graduating semester.

Lele's work has been recognized in several different ways. He was interviewed for an article on Artvoice in January 2023 about the growth of DHL. Lele also contributed three papers to the International Journal of Science and Research one of which was while at UH.

Taking Thomas C. Chen's course on Supply Chain Management was one of the important events making Lele's journey align in its current successful direction. With his support, Lele wrote a research paper that was published and is now used by industry professionals in fixing their transportation modules.

The Artvoice article contains a case study that Lele likes to use to illustrate the problems a business can run into even as it expands. In 2022, their facility supporting the wine and alcohol business in the eastern and central counties of Pennsylvania acquired a new business. As a result, the facility more than doubled its output, from 20,000 to more than 50,000 cases per day.

However, this created a sort of "good problem" for the facility. The large volume of replenishments caused delays in product delivery due to picking – the selection and retrieval of items for an individual orders – as well as requiring more labor.

From the skills and knowledge he acquired at UH, Lele performed velocity analysis of the Stock Keeping Units (SKUs) and identified the high number of heavy volume SKUs being directed to the carton flow (CF) and hand stack (HS) locations by the system, which caused high replenishments.

The purpose of CF & HS locations was to acquire low volume SKUs. As a consequence their replenishments took until noon on a heavy picking day. This impeded operations as a delay in filling locations with cases made the pickers waiting for their product.

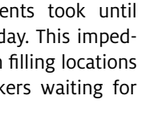
To address this issue, Lele studied the pick pattern for each product and identified its pick velocity. The objective was to have less products go to CF & HS locations. Lele worked with the IT team in building a velocity tool of SKUs that were high, medium and low picked. Later, he slotted products based on their velocity in different regions.

The solution as implemented involved studying velocity of high, medium and low picked SKUs for their trend over a past year; slotting high picked SKUs in bulk regions and permanent big locations; and relegating the low picked SKUs to dynamic CF & HS locations.

Lele is currently leading other projects with managing supervisors, operations managers and associates in making their facility move towards LEAN processes.

"When challenges are high, only achievers rise above it," he said.

Viraj Lele



This graph shows the Replenishment Count Per Hour over 13 month time span.

UH ALUMNI EARNS **NSF GRADUATE RESEARCH FELLOWSHIP**

BY CHRIS GUILLORY

Damon Spencer

Damon Spencer, a University of Houston May graduate receiving dual degrees in mathematics and computer engineering, has earned a National Science Foundation Graduate Research Fellowship.

Spencer was awarded the fellowship based on his undergraduate research at UH involving cloaking, as well as other research involving artificial intelligence (AI) security for 5G networks.

The five-year fellowship provides three years of financial support for students who are early in their graduate careers of science, technology, engineering or math. Fellows receive a $37,000 stipend per year for three years and a $12,000 cost-of-education allowance to the graduate institution.

Spencer will pursue a doctoral degree in computational and applied mathematics at Rice University in the Department of Computational Applied Mathematics and Operations Research.

Spencer spent a summer working at the Idaho National Laboratory, one of the national laboratories of the Department of Energy.

While there, Spencer collaborated with Matthew Anderson, director of high performance computing, along with Matthew Sgambati, Denver Conger, Cooper Coldwell, Edward Goodell, Brendan Jacobson, Bryton Petersen and others, on AI and 5G network security.

Through Spencer's contributions to the development of machine learning models, 5G network attacks will eventually be easier to detect because the models continuously check for data that pinpoint attacks.

"I loved the work because I was able to help protect the country's 5G networks from attacks," said Spencer. "I learned a lot of useful skills."

His work resulted in a published paper and U.S. patent application #63/383,208.

At UH, Spencer's research focused on "cloaking" or making noise or objects appear invisible with respect to radar, sonar or other detection methods. In the future, it may be used to hide objects or noise from the human eye as well. The concept is currently being used in national defense efforts by hiding military vehicles from radar or sonar, but also has applications in acoustics, circuits, electromagnetics, atomic lattices and metamaterials.

"It's literally like trying to make an invisibility cloak from Harry Potter," said Spencer.

Spencer became part of a standout group of students pursuing not just one, but two, majors at UH's College of Natural Sciences and Mathematics and Cullen College of Engineering.

Spencer and **Larry Shi**, associate professor of computer science, worked on several projects involving blockchain for cryptocurrency.

"Blockchain is a database or ledger that is distributed among the nodes of a computer network," said Shi.

Spencer credits his path in research to help from his friends, family, past teachers and current professors.

Spencer's long-term goal is to do meaningful work that will make life easier for everyone. He wants to use what he's learning to help people and solve problems.

CEE Grad Adjusts From

PITCH TO PROFESSIONAL LIFE

BY STEPHEN GREENWELL

For **Emma Clarke** there was admittedly a bit of an adjustment period to life at the University of Houston. After all, a metro area with 7.3 million people is quite different than Christchurch, the city of about 381,500 she grew up in on the east coast of New Zealand's South Island.

"It's a huge city, which is hard to get adjusted to," she said. "The biggest adjustment for me would most likely be that there's always so much to do and see. I've been here five years and I still feel like there's more of the city to see and more that Houston has to offer. That's something I love about living in such a big city."

However, Clarke thrived at the Cullen College of Engineering, both academically and as a five-year starter for the women's soccer team. After earning her degree following the Fall 2022 semester, she is now an Engineer in Training with Morris + Associates in Cypress.

Emma Clarke and her teammate Taylor Garza-Freeman.
Photo Credits: Houston Athletics

"Its only been a few months, but I am already looking up to the people I work with," she said. "They are encouraging and helpful, and make sure that I understand everything they teach me. I'm excited to keep growing and learning as I spend more time with them."

Clarke was recruited by UH to play soccer, and she said academics were a key factor in her decision.

"I had a few other schools that I was looking at, but I knew I wanted a school with a great engineering program," she said. "I visited UH and another school in California, and UH really stood out to me as having not only an amazing team and coaching staff, but also as it was a tier one research school. I knew it would have the program and professors I was looking for."

With the Cougars, Clarke logged 84 appearances and 71 starts across five years. Despite being a defensive back, she still had two goals and three assists in her appearances. She was named to the 2022 Mac Hermann Trophy watch list, the U.S.'s highest individual honor that recognizes the National Player of the Year. She was also named to two All-Conference Second Teams, as well as the 2022 College Sports Communicators Academic All-District Team.

Emma Clarke on commencement day.

Perhaps more impressively and suggestive of a work ethic that carried over into the classroom, as a fifth-year senior and captain Clarke logged 1,421 minutes in her final season of 16 games – an average of more than 88 minutes per game, an ever-present steadying presence for her team.

"There's definitely a cross over from the pitch to the classroom, as I think most student athletes would agree. You have a lot less time to fit in homework and studying so you tend to learn pretty quickly that procrastination is not really an option," she said. "Being an athlete taught me about the value of time and how much you can get done in the small window of time that you have. I have always had a strong work ethic in soccer and I always want to perform at the best of my ability, and that definitely transferred to the classroom. During my degree pursuit, I worked hard on every homework assignment and every exam to make sure that I was giving myself the best chance I could at success."

Clarke noted several positive academic influences in her life, before and during her UH studies.

"My dad was always an academic influence of mine," she said. "He always made sure to encourage me that it's not the grade that matters, but how much you learn. From this mindset you learn that when you're willing to study to learn and not just studying to get a grade, you enjoy learning and most often end up getting a better grade anyway."

Outside of engineering at UH, Clarke also identified **Thomas S. Teets**, associate professor in the Department of Chemistry, as a positive influence for her and a friend.

"My best friend and I had him for courses, and he was also an academic influence. You never realize at the time how much a professor can impact your life, but Professor Teets loves teaching chemistry," she said. "The way that he was so passionate about his subject matter and how hard he worked to make sure his students understood the material was inspiring, and it made us want to work hard to learn."

Although Clarke now has her degree, her pursuit of knowledge isn't over. She's absorbing the practical lessons provided by the fieldwork at her firm, as well as studying for the professional exams she needs to pass.

"I'm loving my new job and learning as much as I can," she said. "At this point I'm focusing on the FE [Fundamentals of Engineering] exam and then the PE [Principles and Practice of Engineering] exam will be my next goal. As I am from an international country, to one day be internationally certified would be the ultimate goal. But for now I am focused on enjoying where I'm at and I'm proud to call myself a Graduate Civil Engineer."

Emma Clarke high fiving her team.
Photo credits: Stephen Pinchback / Houston Athletics

STEMINIST PODCAST

Season 3 - Episode 19

ONE-ON-ONE WITH CULLEN COLLEGE SPACE ARCHITECTURE PROGRAM DIRECTOR, DR. OLGA BANNOVA

In this new STEMINIST episode, host **Trinity Doan** talks with **Dr. Olga Bannova** from the Cullen College of Engineering. Bannova is a Research Associate Professor and the Director of the Sasakawa International Center for Space Architecture (SICSA) Graduate Program. Listen to this episode to learn more about the SICSA program, Olga's engineering journey, and her perspective on the future of space exploration.

ABOUT THE STEMINIST PODCAST:

The STEMinist podcast aims to support an underrepresented topic: science communication. The podcast project seeks to improve science communication skills and give a voice to women in STEM fields, and features students, scientists, engineers and industry leaders. Season 3 features five student hosts: **Michelle Patrick-Krueger, Nusayba Eli-Ali, Sarah Mukhida, Aria Shankar** and **Trinity Doan**. Topics have ranged from student athletes, space exploration, career advice, and work-life balance.

Listen to new episodes online, or start from the beginning, at ***www.egr.uh.edu/news/podcast*** or on Anchor, Spotify, or anywhere you get your podcasts.

EPISODE EXCERPT:

Welcome to the STEMINIST podcast. Could you please state your name, what you do at the Cullen College of Engineering and what you studied?

Hi there! My name is Olga Bannova. I am a Research Associate Professor and the Director of the Space Architecture Graduate Program at the Cullen College of Engineering. The Sasakawa International Center for Space Architecture Graduate Program has been around for a while. But we're still growing and continuing to get better and better. I have been at the University of Houston for a long time. I started as a student and then started teaching while I was completing my Ph.D. in Sweden. Then I returned to the University to teach and serving as Director of the Sasakawa International Center for Space Architecture program.

Can you tell us how you became involved in STEM?

I got involved with STEM, but it's more like how did STEM get involved with me kind of. It's interesting how the program that I am heading now was originally part of the architecture college and was led by professor Larry Bell. This is how I got involved. Then in 2014, the Sasakwa program became part of the Cullen College of Engineering and was deemed a STEM program by the Texas Education Board. This is different from how I became involved with STEM because I was already involved on the architecture side. Now architecture is recognized as a STEM discipline because it depends on understanding all this engineering and systems and not only structural engineering but also civil engineering and systems engineering. So, mechanical systems, the city's building, and now we're talking about space of the spacecraft. I like the complexity of designing and solving complex and challenging problems.

What inspired you to pursue a Ph.D. in engineering?

Well, I postponed it for a while. I should have done it earlier in my life. I pursued my Ph.D. in Gutenberg, Sweden, at the Chalmers University of Technologies. The doctoral program I was in allowed me to work on a Ph.D. and still teach at the University of Houston. My Ph.D. focused on developing and researching the proper methodology for designing and planning big infrastructures in the Arctic.

What about studying the Arctic in Sweden interested you the most?

I was interested in designing for extreme environments while assessing the best way to make the Arctic region more sustainable in a long-term perspective. In 2005, I created a project for Greenland and Summit Station; we received support from a logistics company that worked with the National Science Foundation (NSF) to design facilities there that would incorporate smart structures that could survive on the surface of the snow. This was a unique condition because these buildings would have to be on 10,000 feet of ice in the middle of Greenland. There were so many variables to consider when approaching this project, from weather rotation and how people can safely exist in that environment.

When you're building space shuttles to go out into freezing temperatures in space, is it safe to say that you can apply the same approach to building structures in extreme environments and also go into space architecture?

Unfortunately, we don't have a shuttle anymore. The shuttle was retired in 2011. So far, there are only capsules that different companies are supporting. You must ensure your capsule is ready for extreme environments and outer space. It's not just freezing or super-hot temperatures and it depends; if you turn left side, one side of your spacecraft returns to the sun and overheats, and then another side is in the shade. Then it turns super cold. But also, you design for vacuum conditions. All the structures where people are should be pressurized, and that is the most critical part of the design. Also, how we can protect the crew and equipment from space, radiation, solid particles, events, and radiation is a critical problem.

Do you collaborate with other companies in addition to teaching here at the Cullen College?

Yes, we've worked on several projects that were sponsored by NASA contractors, such as toying with it before when space hap was around, so with space have ILC Dover then, again, Boeing is now on the team with Origins, and we will be working on it as a project with them. So, yes, what is happening in the space industry is always current. Students are presenting their projects for their master's thesis, and that can be anything artificial gravity and 3d printing and orbital debris orbiting and or collision avoidance systems incorporating it in space station design, so how that can be where it can be located, how it complicates the structure, how it complicates operations inside the station, all of that.

What advice would you give to future STEM students who are curious about pursuing an engineering degree?

Find something that you're really passionate about, and don't let anybody to tell you otherwise, if you're passionate, you need to keep it going. Don't get discouraged. If you're really passionate about something and you want to achieve your goal, you'll always find people who will be happy to help you. Most people are nice and want to help by sharing their experience and knowledge.

LISTEN TO THE FULL EPISODE AND OTHERS AT:
www.egr.uh.edu/news/podcast

SPRING CAREER FAIR

The Cullen College of Engineering Career Center held its Spring Career Fair at the UH Hilton in February 2023. More than 100 companies, 200 industry representatives and 1,500 students attended. For more information on future Career Center events, visit career.egr.uh.edu.

BROOKSHIRE SCHOLARSHIP LUNCHEON

The legacy of kindness, hard work and generosity left behind by UH engineering alumnus William A. Brookshire (BSChE '57) continues to live on at the Cullen College, where hundreds of undergraduate students receive significant support for their education through Brookshire scholarships.

The 2022-2023 recipients of the Brookshire scholarships gathered for a Luncheon in Brookshire's honor at the UH Hilton on March 7. At the Luncheon, scholarship recipients took turns sharing how the scholarship has helped them personally and professionally.

WOMEN IN ENGINEERING CELEBRATION

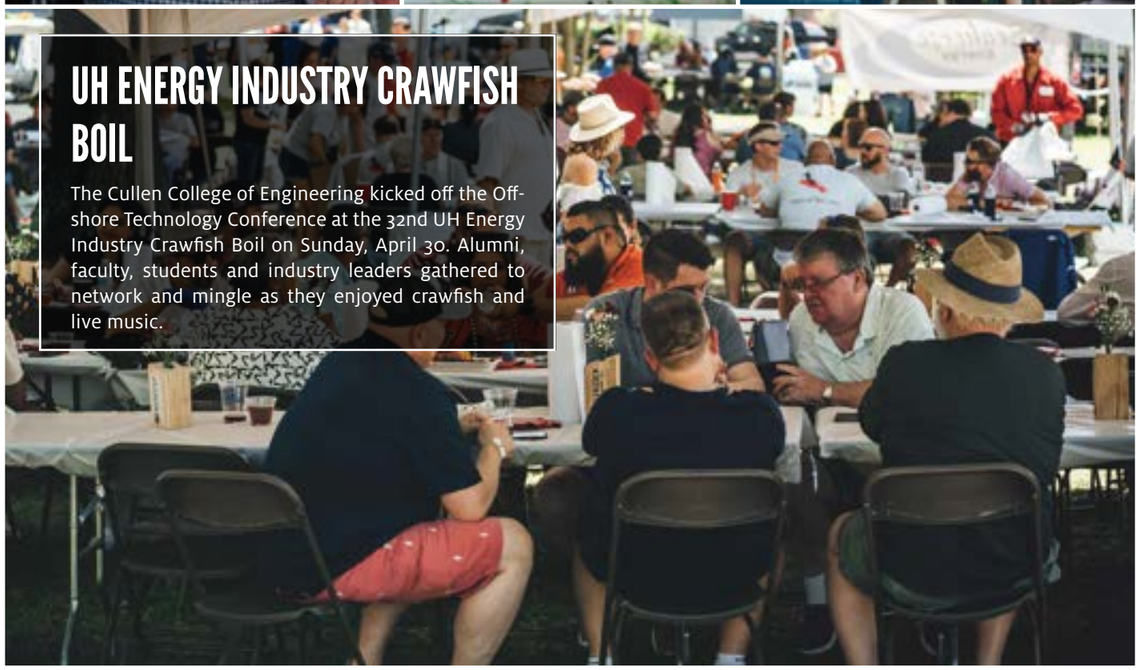
The Cullen College held the 9th Annual Women in Engineering Celebration on March 8 at the UH Hilton. The event is funded by distinguished alumna **Cynthia Oliver Coleman, P.E. (BSChE' 71)**, and honors its annual Rising Star Awardee, given to a graduating female student with the highest GPA. The 2023 Rising Star Award went to Lilly Roelofs, a biomedical engineering senior. Also, at this year's event, the Women in Engineering Endowment was established in Honor of Cynthia Oliver Coleman, P.E., to help raise funds and continue to support this empowering program.

ENGINEERS WEEK AWARDS PROGRAM

The Engineering Alumni Association (EAA) hosted another successful event on Feb. 21 as part of the 2023 Engineers Week Awards Program. This event would not be possible without the support of generous donors for this year's program. This year's celebration honored 42 students with more than $21,000 in scholarships raised from corporations, professional engineering organizations, Cougar alumni engineers, and friends of UH.

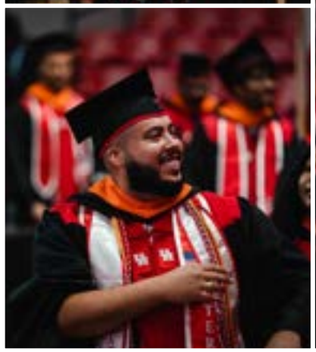
UH ENERGY INDUSTRY CRAWFISH BOIL

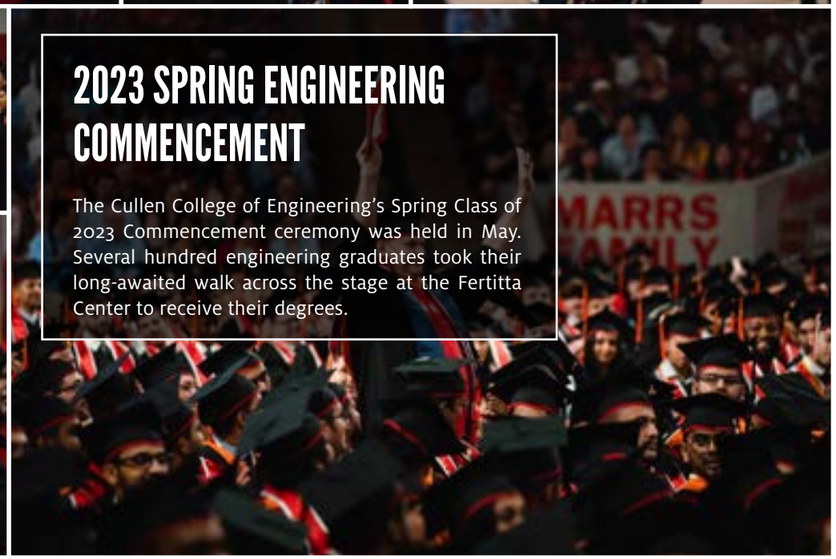
The Cullen College of Engineering kicked off the Offshore Technology Conference at the 32nd UH Energy Industry Crawfish Boil on Sunday, April 30. Alumni, faculty, students and industry leaders gathered to network and mingle as they enjoyed crawfish and live music.



EAA ALUMNI AWARDS GALA

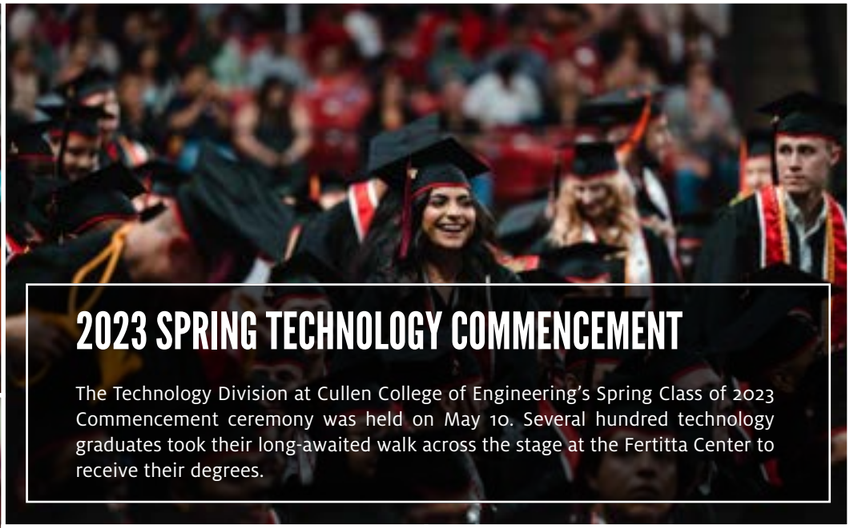
The Engineering Alumni Association (EAA) welcomed honorees, alumni and faculty for their annual Gala in June. The annual event celebrates the professional achievements and contributions of college alumni and faculty. This year's honorees included: **Ronald Lohec (BSME '55), James Ortiz, Ph.D. ('96 ECE), Eric Rodriguez (BSEE '06), Jerrod Henderson, Ph.D. and Miguel "Micky" Fleischer (MSCE '75, Ph.D. '78)**.





2023 SPRING ENGINEERING COMMENCEMENT

The Cullen College of Engineering's Spring Class of 2023 Commencement ceremony was held in May. Several hundred engineering graduates took their long-awaited walk across the stage at the Fertitta Center to receive their degrees.



2023 SPRING TECHNOLOGY COMMENCEMENT

The Technology Division at Cullen College of Engineering's Spring Class of 2023 Commencement ceremony was held on May 10. Several hundred technology graduates took their long-awaited walk across the stage at the Fertitta Center to receive their degrees.

To learn more about events and outreach at the Cullen College,

visit **www.egr.uh.edu/events** or follow us on social media!

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View more photos online at

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ENGINES OF OUR INGENUITY

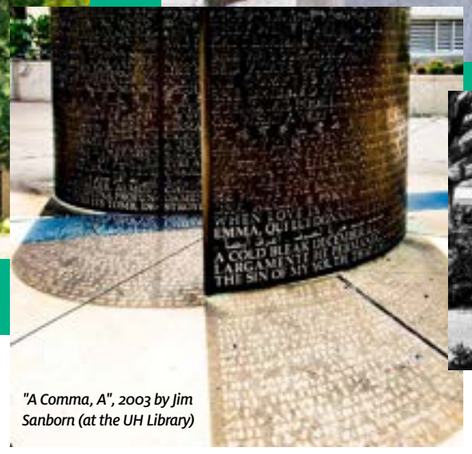
NO. 3290: TECHNOLOGY ENGINEERING & ART

BY JOHN H. LIENHARD

The Engines of our Ingenuity is brought to you by the Friends of Houston Public Media

Tower of the Cheyenne

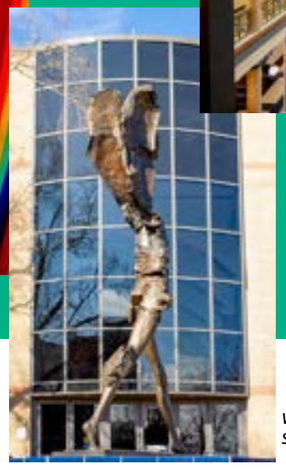
Bronze Cougar, Cullen Family Plaza



"A Comma, A", 2003 by Jim Sanborn (at the UH Library)

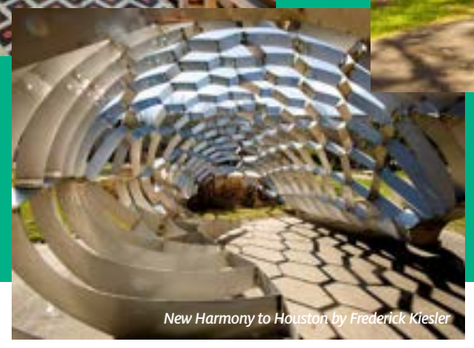
"Split Level" by Clement Meadmore, 1971

Double Physichromie by William King 2009



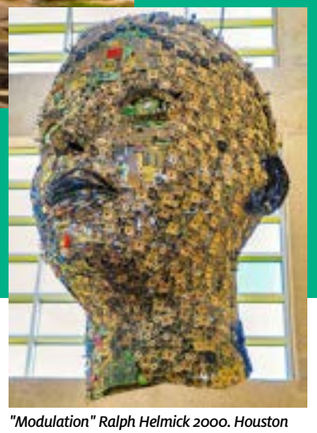
Winged Victory by Stephen de Staebler 1996

College of Architecture interior



New Harmony to Houston by Frederick Kiesler

Civil Engineering structural sculpture



"Modulation" Ralph Helmick 2000. Houston Public Media

Today, technology, engineering, and art. The University of Houston presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

I love to stroll through our Houston campus. Everywhere we look we see startling pieces of art. It is an outdoor/indoor museum. But let us be aware of the technology and engineering behind it all.

Here, in the campus center a jumble of structural steel bars forms a tall tower. But a pattern emerges as we circle it. It's actually made of three identical slabs, nested together. It uses a strangely logical structure to subtly engage our senses.

The early Greeks summed that up in a word: Techne! And that meant skill in doing – whether playing an instrument, building a structure, painting a picture, or doing mathematics. Aristotle added that a person who practices techne must be able to explain what he does. Which gives us our word techn-ology.

Technology is the lore, or the science, of techne. And that's what this campus is all about. The STEM subjects fused with the Liberal Arts.

So here's more art: a huge iron cylinder punctured with writings in all different languages. Sunlight dapples through it, scattering the words on the sidewalk.

So we pass fountains, bronze cougars, abstract forms – all made in ways too surprising to imagine. Like a gigantic square beam with a circular twist in the middle. Or a strange sinuous fence made of colorful slats. That sounds simple enough, until it shifts in color and form as we walk around it.

Many campuses (far from all) display public art. But we have a special mandate: Each time we erect a building, one percent of its construction cost must fund a piece of public art -- another half percent for large renovations. And that attracts private contributions, like our Music School's Winged Victory sculpture.

Or let's go indoors: The inside of our Architecture building is cathedral-like, with a square oculus on the roof far above. Outside, that oculus on top is surrounded by a wildly out-of-place Parthenon. Back on our walk, we pass art built by our students: Here is a huge open-mesh aluminum piece resembling a beetle's carapace – its parts formed with stunning precision. Over there is our engineering students' red assembly of beams and gusset plates.

We come at last to our Radio/TV station. Its art object is indoors. A huge human head hangs from the ceiling of the entry hall. Look closely. It's made entirely out of electronic parts and pieces of audio equipment.

John Lienhard

Weird? Maybe. But it's one more item that we cannot ignore. Everywhere we look, we see a fusion of art, engineering, and technology. We see a swirling reminder of what education is all about. The message is subtle, but it's inescapable. The Arts are the binding tissue of all that we make or do.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

YouTube

WATCH THIS EDITION OF LIENHARD'S LENS COME TO LIFE AT:
youtube.com/UHEngineering

The Engines of Our Ingenuity is a nationally recognized radio program authored and voiced by John Lienhard, professor emeritus of mechanical engineering and history at the University of Houston and a member of the National Academy of Engineering. The program first aired in 1988, and since then more than 3,000 episodes have been broadcast. For more information about the program, visit www.uh.edu/engines.

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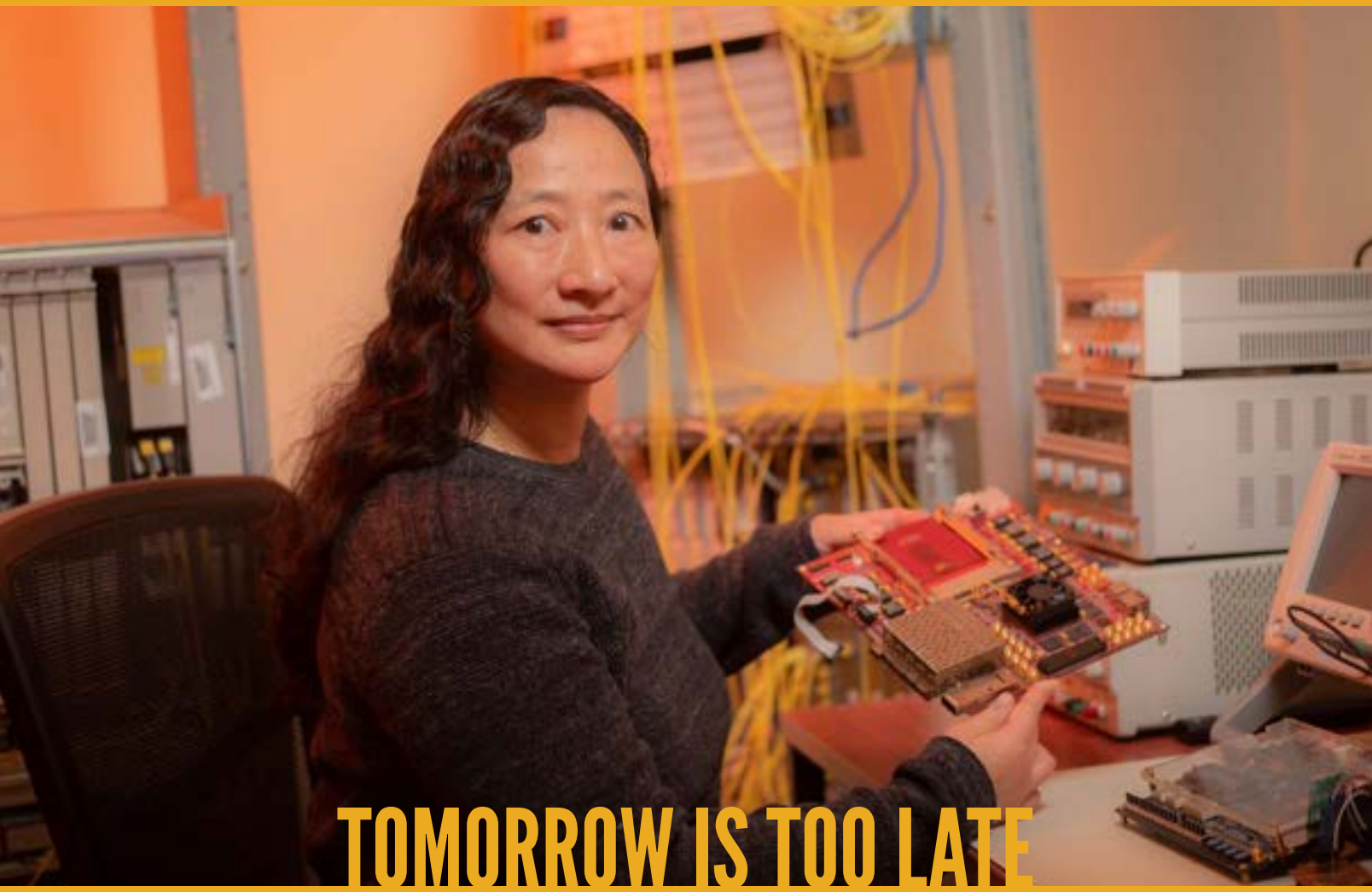

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