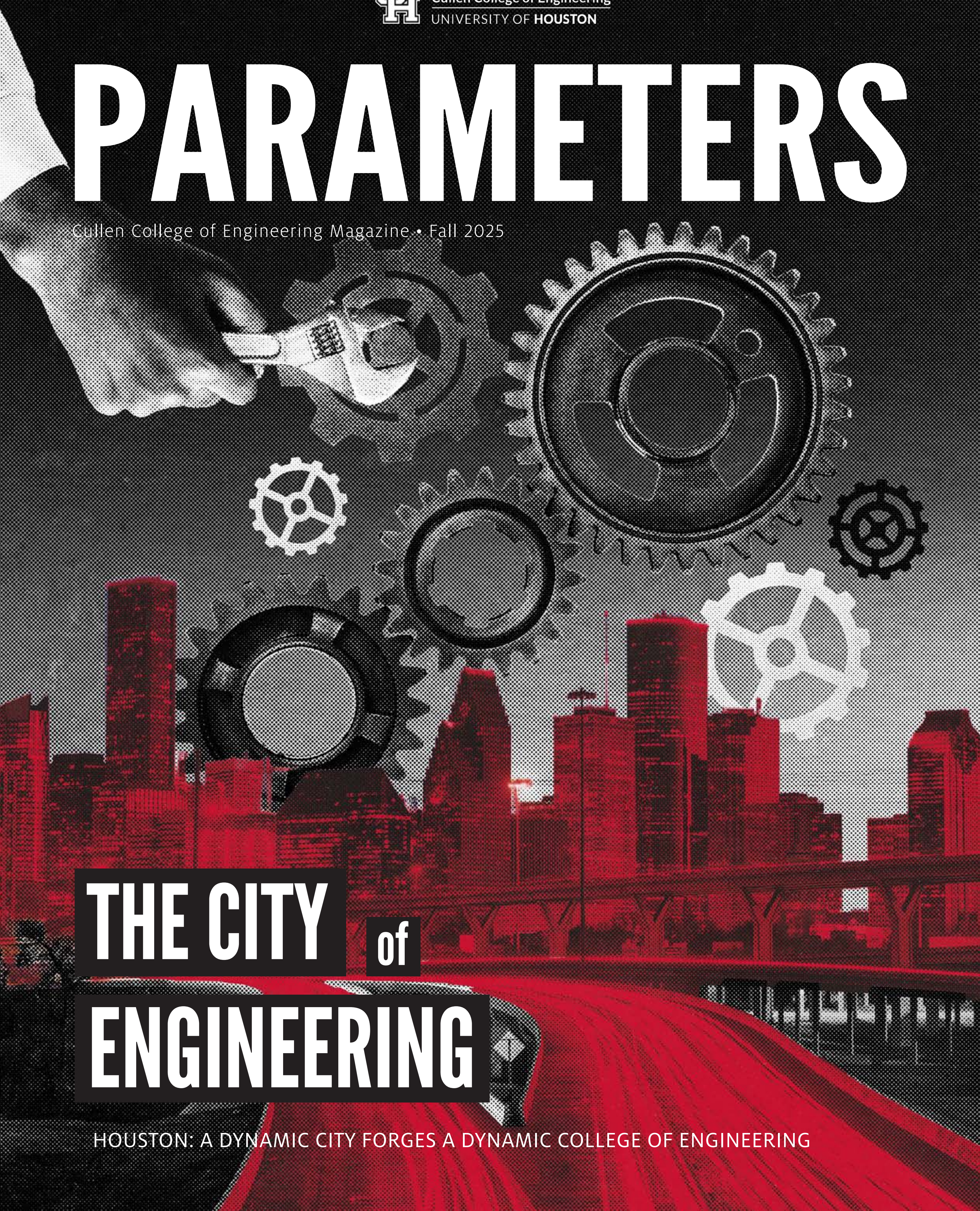
Cullen College of Engineering
UNIVERSITY OF HOUSTON

# PARAMETERS

Cullen College of Engineering Magazine • Fall 2025



# THE CITY of ENGINEERING

HOUSTON: A DYNAMIC CITY FORGES A DYNAMIC COLLEGE OF ENGINEERING


*In the REIGN Lab (Rehabilitation Engineering for Improving Neuromotor control), Mignote Tadesse (center-right) is performing a game task to assess her intermuscular coordination in isometric condition. While she does this, a single pulse TMS (transcranial magnetic stimulation) is applied over the primary motor cortex to assess the excitability and functional integrity of the corticospinal system. Associate Professor Jinsook Roh, leader of the REIGN Lab (far left), is helped by research assistants Manuel Portilla-Jiménez (center-left) and Ameerah Suleman (right) with the assessment.*

# LETTER FROM THE DEAN

*DEAR FRIENDS OF THE CULLEN COLLEGE OF ENGINEERING,*

When you walk through the streets of Houston, you don't just see buildings. You witness a symphony of innovation, discovery and communities thriving together. For more than eight decades, Cullen College of Engineering has been part of that story, drawing inspiration from our city's world-class research centers, energy industry, breakthrough technologies, unparalleled medical institutions and entrepreneurial spirit. There is no better place on Earth to study and practice engineering than here in the heart of Houston.

Since our founding in 1941, we've embraced every opportunity this vibrant region offers. From pioneering experiments at the Texas Medical Center to cutting-edge collaborations with NASA, our students and faculty push boundaries, develop real-time solutions for local businesses and share discoveries that ripple far beyond our city limits.

At the University of Houston, our mission is clear: serve Houston, and in turn, empower Texans from all backgrounds to reach their full potential. I am proud to say that our college ranks among the top 40 programs in the nation for economic mobility, lifting students from any circumstance toward lives of opportunity and impact.

Most of our students call Greater Houston home, and many choose to plant their roots here, building careers that fuel our region's growth. This year, we have welcomed a record number of new undergraduates: an 8.5 percent increase that underscores the demand for hands-on, future-focused engineering education in a city that never stops expanding.

In these pages, you will discover how Cullen College partners with the Houston community: lifesaving research at the Texas Medical Center; dynamic industry alliances that open doors at 26 Fortune 500 companies; and nimble programs like Human Resource Development, tailored to meet local employers' needs. These are more than highlights. They're proof that Houston's spirit of collaboration sets us apart.

Thank you for exploring our UH Engineering family. I hope you will see not only what we have accomplished today, but the promise of where we will go next.

Sincerely,

Pradeep Sharma
Dean of the Cullen College of Engineering
Hugh Roy and Lillie Cranz Cullen
Distinguished University Professor



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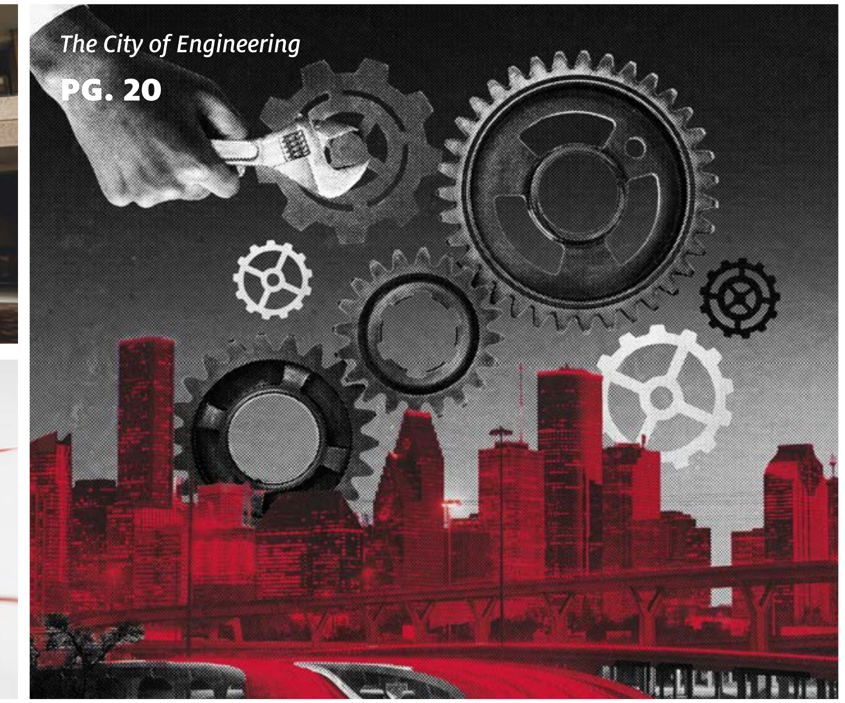



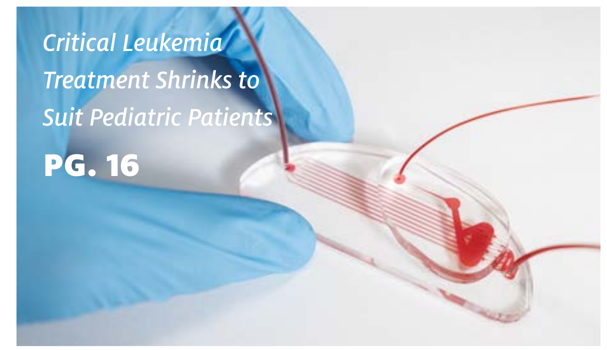



## IN EVERY ISSUE



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# IN THE MEDIA SPOTLIGHT

## UH ENGINEERS UNVEIL BREAKTHROUGH IN CARBON CAPTURE

A team led by Assistant Professor **Mim Rahimi** made two significant breakthroughs that could reduce the cost of capturing harmful emissions from power plants, marking a major step in addressing climate change. The first breakthrough introduces a membraneless electrochemical process that slashes energy requirements for amine-based carbon dioxide ($CO_2$) capture. The second breakthrough demonstrates a vanadium redox flow system capable of both capturing carbon and storing renewable energy.

"Climate change mitigation was basically the reason we pursued this research," Rahimi said. "We need solutions, and we wanted to be part of the solution. The biggest suspect out there is $CO_2$ emissions, so the low-hanging fruit would be to eliminate those emissions."

This research was covered by several publications, including Carbon Capture Magazine.

**READ ONLINE AT:**

## 3D PRINTED CERAMICS BEND WITHOUT BREAKING

Given their inherent brittleness, ceramics are typically ill-suited for high-impact or adaptive applications. However, assistant professor of mechanical and aerospace engineering **Maksud Rahman** has demonstrated that shapes modelled on origami patterns can yield tough, flexible ceramic structures when they're combined with a soft polymer coating.

"Ceramics are incredibly useful — biocompatible, lightweight and durable in the right conditions—but they fail catastrophically," said Rahman in a press release. "Our goal was to engineer that failure into something more graceful and safer."

The research was covered by Engineering.com and other smaller publications.

**READ MORE ONLINE AT:**

## TREES MAY BE ABLE TO WARN US WHEN A VOLCANO IS ABOUT TO ERUPT

A new study looking at carbon dioxide levels has the potential to save lives, showing that tree leaf colors can act as a warning signal around a volcano that's about to erupt.

Civil and Environmental Engineering Ph.D. Candidate **Nicole Guinn** was the first author of a recent study examining Mount Etna in Italy. The study compared data from sensors around the volcano with satellite imagery, finding a strong relationship between more carbon dioxide and greener trees.

This research is featured in our cover story on page 24 and was covered by sciencealert.com and other publications.

**VIEW ONLINE AT:**

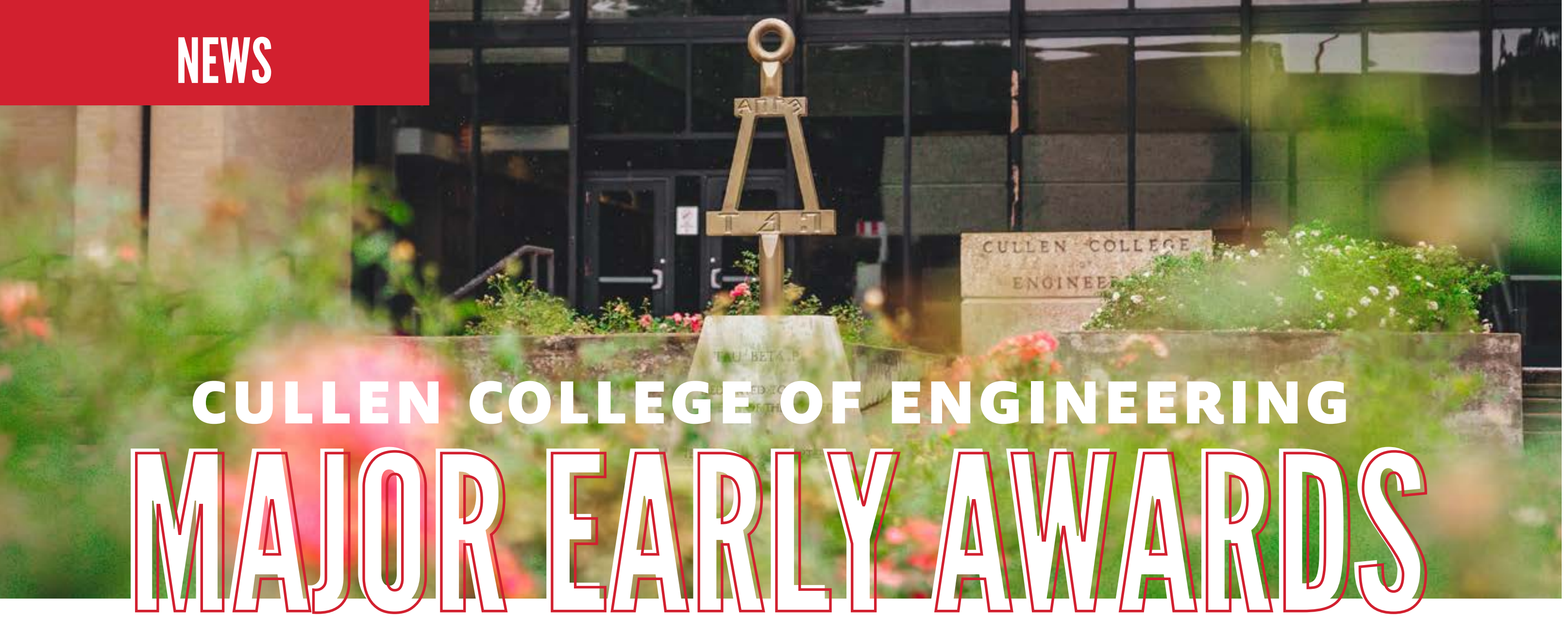
## CULLEN COLLEGE FORMS PARTNERSHIP WITH DELHI TECHNOLOGICAL UNIVERSITY

A Memorandum of Understanding opens UH up to collaborate with Delhi Technological University in Delhi, India. The agreement will last five years with an option to renew in 2030. The partnership was signed by UH Senior Vice President for Academic Affairs and Provost **Diane Z. Chase**, UH Cullen College of Engineering Dean **Pradeep Sharma**, DTU Vice Chancellor Prateek Sharma and DTU Dean of International Affairs Pravir Kumar.

The announcement was covered by The Times of India, the largest English language newspaper in the world.

**VIEW ONLINE AT:**

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



# CULLEN COLLEGE OF ENGINEERING MAJOR EARLY AWARDS

## DANIEL FLORYAN

**BY STEPHEN GREENWELL**

**Daniel Floryan**, Kalsi Assistant Professor of Mechanical & Aerospace Engineering, has been selected for the 2025 Young Investigator Program Award by the Air Force Office of Scientific Research.

His research proposal, "Breaking Energy Efficiency Limits in Unsteady Wall-Bounded Flows," was chosen from more than 150 proposals. The total award amount is $450,000, spanning three years.

When airplanes fly through air, they expend tremendous energy cutting through the friction of the air. There is a long-standing interest in manipulating the airflow close to the airplane to reduce the required energy. Unfortunately, despite devoted research efforts to it over the years, net energy savings have plateaued around 10 percent.

"Our ability to surpass this level of energy savings is ultimately limited by energy bounds that derive from the governing dynamics of fluid flows," Floryan said. "We seek to develop a new class of flow control strategies that can break the established energy savings limits. This effort is guided by our theory that suggests that multi-modal control has great potential for energy savings."

Once the new flow control strategies have been developed, his research will attempt to combine newly understood physical mechanisms with methods from optimal control theory to refine control strategies, resulting in a step-change in the energy-savings capabilities of flow control.

The Air Force Young Investigator Research Program (YIP) supports early in career scientists and engineers showing exceptional ability and promise for conducting basic research. The program objective is to foster creative basic research in science and engineering, enhance early career development of outstanding young investigators, and increase opportunities for the young investigator to recognize the Air Force and Space Force mission and related challenges in science and engineering.

Floryan joined the faculty of the Cullen College of Engineering in 2021.

> "WE SEEK TO DEVELOP A NEW CLASS OF FLOW CONTROL STRATEGIES THAT CAN BREAK THE ESTABLISHED ENERGY SAVINGS LIMITS"
>
> – DANIEL FLORYAN

## ZHENG FAN

**BY ALEX KEIMIG**

Assistant Professor of Mechanical Engineering Technology **Zheng Fan** has been awarded $549,771 for his CAREER Award proposal, Understanding the Formation of Pore-Free Interlayers through Automated in situ Diagnosis to Tame Lithium Metal.

This project will investigate a new composite material, a metal-carbon mixed ionic-electronic conductor (c-MIEC), as a solution for overcoming interface issues common to current iterations of high storage density solid-state lithium metal batteries. Enhancing the performance and scalability of solid-state lithium metal batteries to improve range and performance will be crucial in the broader implementation of next-generation electric vehicles.

Fan describes himself as a materials scientist with a major focus on battery study and development, but this project goes far beyond the development of new battery technologies.

"My proposal is also for a new research framework in materials science — not just for battery design or chemistry," said Fan. "I'm going to integrate automatic experimentation, including sample fabrication and characterization, connected with AI analysis like machine learning algorithms to optimize the systems we select and use."

"We want to transform conventional material research and experiments — involving lots of manual labor and tools, making them slow and possibly involving human errors — and transform this process to an automatic, fast, data-rich and AI-guided research process," he added.

Most cutting-edge experimental research tools still require manual human operation. Fan seeks to integrate these tools into a scalable, closed loop of automatic operation and AI-driven data analysis that will reduce human effort and error while increasing the rate of successful discovery.

"In battery science, there will always be a lot of specimens to test different properties — chemical properties, structural properties, mechanical properties — and every property should be one [individual] sample, but that takes a lot of time."

In fact, he estimates that a manually-derived battery sample by a student takes about two hours.

Fan studied mechanical design as an undergraduate and focused on robotics during his master's degree, only settling into nano and micro materials while pursuing his PhD. This path, he believes, allows him to bring a unique perspective to his research.

"I think, due to my background… I have a broader approach in thinking about the whole process of the experiment. I can also see a bottleneck in the current pursuit of scientific discovery: although nowadays we have many experimental tools like the high-resolution microscope, the spectroscope, the x-ray, we scientists still have to operate them by ourselves.

"But if we have this automated lab assistant, we can break this limitation. Humans have to take a rest, have to eat, but the robot will not — and it will not involve errors," he added.

Fan expects the standardized automation of this research process to reduce battery fabrication time and allow it to run continuously, taking data collection "to a new level" while leaving researchers more time for critical thinking.

"Automation is no longer a luxury. This work will redefine the capabilities of small research groups. By creating an automated experimentation framework, we empower more researchers to tackle grand scientific challenges," he said.

Fan will also develop a related virtual lab wherein selected interested students will have the opportunity to participate in research.

"Decentralization is the key to this project, not only in the research plan, but also for the education. We are going to find future researchers and engineers. Conventionally, we would just invite certain schools or certain districts, but my principle is to decentralize the approach. Any student interested in my research will be invited, and in my proposal, this decentralization is essential. I want to break the conventional resource concentration patterns for research and education and make them accessible to everyone, so that everyone has a chance to be involved," said Fan.

"My hope is that we will develop a global benchmark in new patterns for data and new framework for materials science research — a single-PI laboratory with a closed loop and automatic experimentations that can be adopted in other industries.

"I believe this research will be a cultural shift," he added. "Right now, people may be afraid of more automation — they are afraid of whether they can let their life depend on a machine — but I think we should embrace it. It will be the future for automations to change not only our daily lives, but our scientific research."

››

## BO ZHAO

**BY ALEX KEIMIG**

Mechanical and Aerospace Engineering's Assistant Professor **Bo Zhao** has been awarded $549,770 for his NSF CAREER proposal, "Understanding and Controlling Nonreciprocal Thermal Radiation Exchange Between Surfaces."

The project seeks to challenge a centuries-old law, which would fundamentally change our understanding of the characteristics of light transport and potentially have a significant impact on the efficiency of solar energy harvesting and thermal management systems.

"Water flows because water at a higher elevation has more potential energy than water at a lower elevation; the flow is driven by this potential energy difference. What I do is another energy flow: not water, but sunlight," said Zhao.

Sunlight also carries energy in its waves — electromagnetic waves — but flows in a slightly different way.

"Usually a high-potential object emits energy outwards, but for sunlight or other similar radiation or electromagnetic waves, the reverse can happen: something cold can also transport [energy] back to the hotter high-potential object. My research is trying to remove this constraint for light transport," he said.

One of many reasons that this research is of interest is the potential for increased efficiency in solar energy capture. If sunlight could be made to only flow unidirectionally, without transporting any energy back toward the sun itself, then cascaded energy harvesting devices could allow for more complete and more useful collection of solar energy without waste due to reemission.

"From a fundamental perspective," said Zhao, "what I do is try to break the so-called reciprocity of this transport process. I want to make light transport as one-way as possible."

In other words, if reciprocity is currently a window through which light can travel in either direction, Zhao is working to create a one-way window, transparent only in one direction.

"There's a very interesting, very old — classic — law, like Newton's laws in mechanics, in our field of thermal radiation: Kirchhoff's Law. Kirchhoff's Law of thermal radiation has been around for nearly two centuries, and when I was doing my postdoc, I realized that we have the possibility to break that law," he said. "That inspired me to keep working in this direction and look into how we can, first of all, enable that law-breaking effect, and second of all, leverage that to achieve new thermal and energy applications. It's basically a new direction that hasn't been sought before."

"In that sense, I think this is a very unique and exciting opportunity. Much of this knowledge will be useful and transformable to other wave phenomena, such as mechanical waves, electron, and phonon. I think that eventually, the impact is going to be enormous."

As part of the project, Zhao will also operate a YouTube channel called "Everything Thermal" to help bring accessible explanations of higher-level concepts and research in thermal photonics to students across the world.

"I realize the importance and how rewarding it can be if you can engage more and more people in science. Of course, as a teacher, we do that by going into the classroom, but we are living in this digital world, and people now have more and more easy access to digital resources. How do we leverage those opportunities to disseminate knowledge in a way that makes physics and engineering easier, more engaging, entertaining, and effective?"

> WHAT I DO IS TRY TO BREAK THE SO-CALLED RECIPROCITY OF THIS TRANSPORT PROCESS. I WANT TO MAKE LIGHT TRANSPORT AS ONE-WAY AS POSSIBLE
>
> – BO ZHAO

"Everything Thermal" aims to do just that. Zhao is also excited to involve undergraduate students in the project, because "the best way to learn something is to teach it."

"In that way, by making a video, they're teaching themselves to explain the concept to other people. Students will therefore not only learn the concept, but also possibly find the process rewarding themselves. We will also be using various AI tools to create the videos. In a lot of ways, I think this is a nice vehicle for our undergraduate students to better learn engineering knowledge and AI tools, engage the public, and disseminate the knowledge that we have."





# UH LANDS $2.8M GRANT

## TO POWER NEXT-GEN MILITARY DRONES

**BY JONATHAN ADAMS**

A major grant will position the University of Houston at the forefront of redefining how military drones operate.

The grant, totaling $2.8 million, will fund a new induction machine-based electrical power generation system designed to replace the older, less efficient synchronous generator systems currently used in Unmanned Aircraft Systems. The goal is to create a power source that is lighter, more efficient and more cost-effective.

UH worked with GE Aerospace and Northrop Grumman to develop the technology. By improving power generation, the system could help drones consume less fuel and produce fewer emissions. The project is led by UH Electrical and Computer Engineering Professors **Kaushik Rajashekara**, who served as PI, and **Hao Huang**, co-PI.

"This project allows us to reduce the weight and cost of the overall system, while increasing its efficiency," Rajashekara said. "That means cleaner, more capable drones."

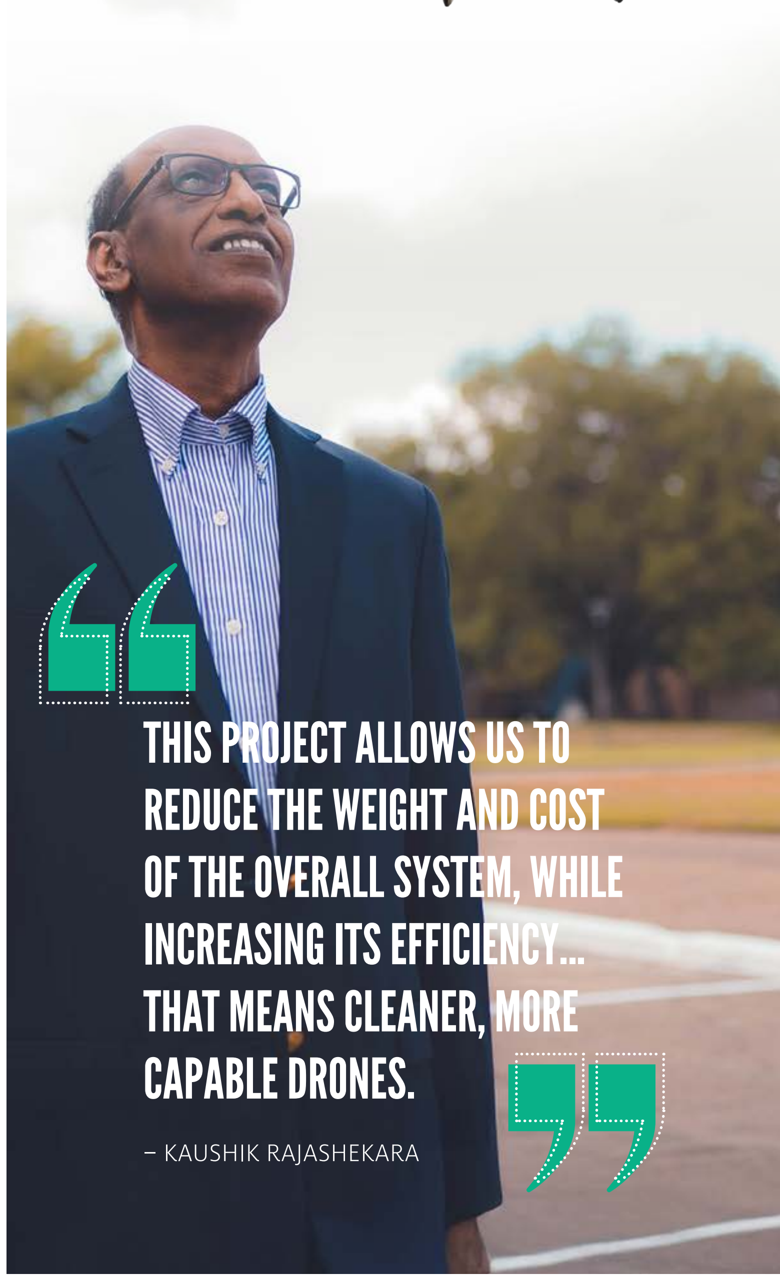
For UH, the project is an opportunity to build its reputation in aerospace research. The work is being carried out in collaboration with the Air Force Research Laboratory, making the university a key player in advancing drone technology.

The project is being executed in three phases, the first being a seven-month process in which UH worked with GE Aerospace to develop initial concepts and planning. That piece was completed in 2024.

The university is currently in the middle of the second phase, which will focus on design and analysis. Rajashekara expects this phase to take nine months. The final phase, which is the actual construction of the concept, will take about two years.

In all, technology has been simmering for more than 15 years, Rajashekara said, but the aerospace industry only recently realized its potential.

"We have been pushing for this technology," Rajashekara said. "Now, the Air Force is convinced they need to look at the induction generator-based technology for UAS applications. We're happy that there's interest."



> THIS PROJECT ALLOWS US TO REDUCE THE WEIGHT AND COST OF THE OVERALL SYSTEM, WHILE INCREASING ITS EFFICIENCY... THAT MEANS CLEANER, MORE CAPABLE DRONES.
>
> – KAUSHIK RAJASHEKARA

# SOFT, SMART-MATERIAL EXOSKELETON MARKS NEW ERA IN PEDIATRIC MOBILITY AID RESEARCH

BY LAURIE FICKMAN

*Elham Morshedzadeh and Jose Luis Contreras-Vidal guide a demonstration of a pediatric "SoftExo" device*

Just one look at the next-generation lightweight, soft exoskeleton for children with cerebral palsy reveals the powerful role technology can play in solving global challenges and improving lives.

Built to help children walk, the MyoStep addresses motor impairments that severely restrict children's participation in physical activities, self-care and academic pursuits, leading to developmental delays, social isolation and reduced self-esteem. It is lightweight, discreet, made of smart materials and wearable technology, and tailored to fit seamlessly into the lives of children and their families.

The MyoStep soft exoskeleton is being introduced in Electron Devices Magazine by a team from the NSF UH Building Reliable Advances and Innovation in Neurotechnology (BRAIN) Center, an Industry–University Cooperative Research Center (IUCRC) and TIRR Memorial Hermann.

"The MyoStep project represents a significant advancement in the field of pediatric mobility aids, particularly for children with cerebral palsy," said **Jose Luis Contreras-Vidal**, director of the NSF BRAIN Center and Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Electrical and Computer Engineering.

"By integrating cutting edge technologies such as artificial muscles, smart fabrics, and a comprehensive sensor network, MyoStep offers a promising solution to the challenges faced by existing exoskeletons," he said.

## HELPING CHILDREN TAKE THE NEXT STEP

Cerebral palsy is a common neurological disorder in children that affects motor skills, including the ability to walk, and it occurs in 1 to 4 out of every 1,000 births worldwide.

"Although exoskeletons offer some degree of assistance and stability, they often prove impractical for regular daily use," said Contreras-Vidal. "These devices typically fail to accommodate a child's growth and remain too heavy. By integrating cutting edge technologies such as artificial muscles, smart fabrics, and a comprehensive sensor network, MyoStep offers a promising solution to the challenges faced by existing exoskeletons."

The need for exoskeletons that promote healthy musculoskeletal development and can adjust as children grow prompted Contreras-Vidal to convene a cross-disciplinary team with clinical partner Gerard Francisco, MD, professor and The Wulfe Family Chair of Physical Medicine and Rehabilitation at UTHealth Houston and medical officer at TIRR Memorial Hermann.

The team includes experts in biomechanics and orthopedic surgery (Christopher J. Arellano, University of Arizona), medical officer at TIRR Memorial Hermann and from the IUCRC BRAIN at the University of Houston, costume design and technology (Paige A. Willson), industrial design (Elham Morshedzadeh and Jeff Feng), mechanical engineering (Francisco C. Robles Hernandez and Zheng Chen) electrical engineering students (Shantanu Sarkar, Aime J. Aguilar-Herrera and Lara Altaweel) and industrial design graduate student (Hannah Ritchie).

"This research represents a groundbreaking step forward in how we think about mobility and independence for children with cerebral palsy," said Francisco.

## INNOVATIONS IN MOBILITY

The team tailored the MyoStep to be lightweight, discreet and tailored to fit seamlessly into the lives of children and their families. The wireless sensor network, embedded inside the smart and flexible fabrics, is the backbone of the suit, collecting and sending real-time data about the user's movements so the device knows when to assist their arms or legs.

It also includes safety features such as temperature monitoring and emergency shut-off mechanisms.

All electronics and actuators are fully isolated from the user's skin to prevent direct contact and reduce the risk of irritation or discomfort. Integrated temperature sensors continuously monitor the device's surface temperature, automatically deactivating the system if it exceeds safe limits to protect against overheating or burns.

The various sensors in the network communicate with each other using Bluetooth technology.

"What makes the MyoStep project so compelling is that it's not just about the technology: it's about restoring confidence, function, and hope. This kind of innovation has the potential to dramatically improve quality of life, helping children move through the world with greater ease and dignity," said Francisco.

## NEXT STEPS

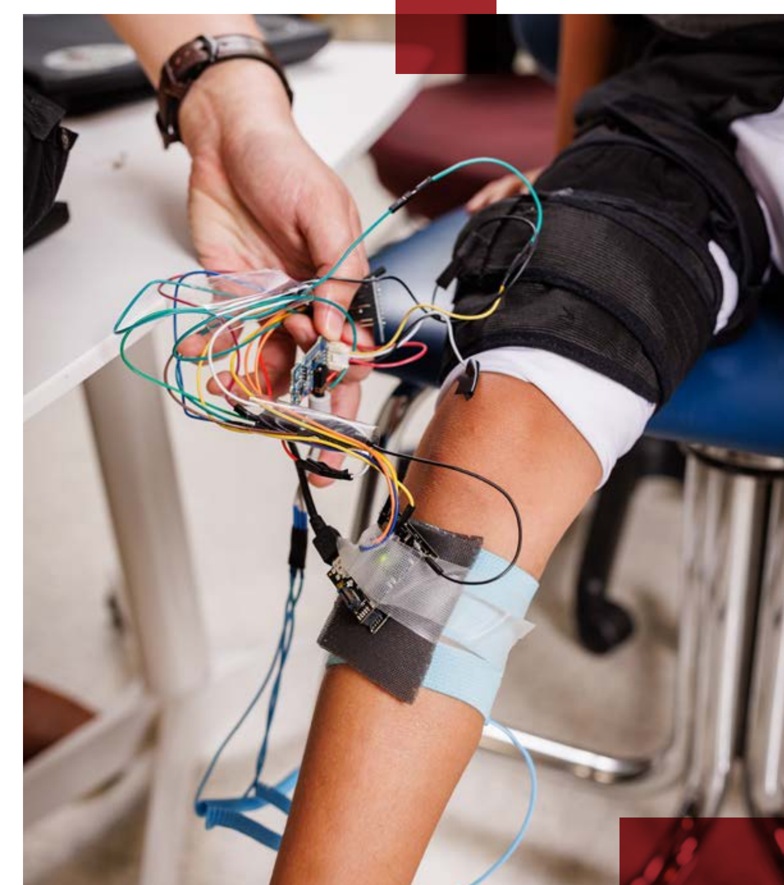
Coordination across the ankle, knee and hip was vital in producing the prototype. Continually improving how the ankle moves could make walking more efficient, allowing children to use less energy to walk.

"The team is currently focused on enhancing ankle movement control using artificial muscles made from advanced smart materials, such as shape memory alloys, which contract with temperature changes and dielectric elastomers which respond to voltage," said Contreras-Vidal. "These actuators work in conjunction with a multimodal sensor network, including EMG sensors to monitor muscle activations, and inertial measurement units to detect gait phases and joint angles."

Muscles have been investigated for decades, but their actual behavior has not been successfully replicated with lightweight systems.

"To make this possible, there is a need for interdisciplinary systems and disciplines to fully execute the physics of muscle gesticulations," said Contreras-Vidal.

This work has been supported in part by the IEEE Electron Device Society's Humanitarian Fund.



*A team of researchers in the lab of Jose Luis Contreras-Vidal installs sensors in a pediatric "SoftExo" device, designed in collaboration with Elham Morshedzadeh, director of the UH Health Design Lab.*

# CULLEN RESEARCH IMPACTS

# NATIONAL CODE PROVISIONS FOR HIGH-STRENGTH STEEL REINFORCEMENT

BY STEPHEN GREENWELL


Thanks to research work from a Cullen College of Engineering professor and his students, new standards for high-strength steel have been adapted by the Masonry Society (TMS), the organization that specifies building code requirements for Masonry Structures in the United States.

**Dimitrios Kalliontzis** is an assistant professor in the Civil and Environmental Engineering Department and the mentor of the Structural Performance & Fluid-Structure Interaction (SP-I) LAB. He said that after significant work in UH's structures lab and rapid dissemination of findings to committee meetings and national conventions, his group's proposal to permit the use of high-strength steel bars was approved by the TMS 402/602 Main Committee.

"My research group and I have been putting a lot of work over the past three years into raising the reinforcing bar standards in TMS 402/602, which is adopted by the IBC for structural masonry design," he said. "This is a huge first milestone in our effort toward high-strength steel reinforcement, and it all happened based on research work done at UH along with continuous professional service in TMS committees."

According to Kalliontzis, this code change would be the biggest for the current code cycle for TMS 402/602 Building Code Requirements and Specification for Masonry Structures. The code change concerns the first step toward a broader adoption of high-strength steel, a market that has grown from $29.6 billion in 2019 to $44.2 billion in 2024.

Initially, Grade 40 bars were the standard in the United States in the first quarter of the 20th century, but they were gradually, but not completely, replaced with Grade 60 bars in later years. Grade 80 bars were formalized by ASTM standards in 2009.

"Until the 2022 version of masonry design standards (TMS 402/602-22), practitioners were restrained from using high-strength steel bars," he said. "Based on research findings and experiments performed at the University of Houston, TMS 402/602 has recently approved the adoption of Grade 80 reinforcing bars in the axial and flexural design of structural masonry. The research program at the University of Houston continues the necessary experimental work to enable the use of Grade 80 bars for special shear walls and in shear design, among other usages and applications."

Research findings from Kalliontzis' group showed that the adoption of high-strength steel bars can reduce reinforcing material costs by up to 25 percent with a corresponding reduction of carbon footprint of 33 percent in masonry buildings.

> THIS IS A HUGE FIRST MILESTONE IN OUR EFFORT TOWARD HIGH-STRENGTH STEEL REINFORCEMENT, AND IT ALL HAPPENED BASED ON RESEARCH WORK DONE AT UH...
>
> – DIMITRIOS KALLIONTZIS

"This code adoption opens a new door for the masonry industry to modernize its construction practices by adapting to contemporary steel materials that are becoming more and more prevalent," he said. "As it has been done with Grade 40 bars, it is likely that future construction will slowly abandon Grade 60 bars, making high strength rebars the only available option in the market. Hence, the adoption of high strength rebars is both a requirement for modernization as well as a requirement for survival. And that has been made possible by research performed at the University of Houston."

Kalliontzis said the findings wouldn't have been possible without the help of several of his students — **Omar Khalid**, a Master's degree graduate, and current Ph.D. students **Waleed Khan** and **Samvid Parajuli**. John Hochwalt from the Seattle office of KPFF served as the industry advisor for the team's research.

Kalliontzis also served as the chair for the HSRB Task Group at TMS, and he wanted to thank those members for their input — Hochwalt, Lane Jobe, Andres Lepage and Steven Judd. The Task Group was supervised by the chair of the TMS Reinforcement & Connectors Subcommittee, Heather Sustersic.

Grants for the research came from the National Concrete Masonry Association Foundation, the Western States Clay Products Association, and the Brick Industry Association. They also received in-kind donations and support from the Texas Masonry Council, Nucor Rebar, BestBlock, Interstate Brick, BarSplice Inc., D'Ambra Construction, and Robert Kinchler from the Concrete Reinforcing Steel Institute.

*Figure. Flexural test of masonry wall reinforced with Grade 80 deformed bars.*

# NEW REACTION

## IMPROVES CARBON CAPTURE STABILITY, LONGEVITY

BY JONATHAN ADAMS

Each year, billions of tons of carbon dioxide and other greenhouse gases are released into the atmosphere by the burning of fossil fuels, certain industrial processes, construction and other human activities. This has contributed to a significant increase in the Earth's temperature, which is leading to a rise in natural disasters, elevated health risks and damage to our planet's biodiversity. There is an urgent need to find better solutions to reduce the levels of atmospheric carbon dioxide.

### KEY TAKEAWAYS

- UH and Rice scientists discovered a way to improve the CO2RR process, a newly emerging carbon capture and utilization technique.
- A big challenge with the process is salt build-up within the MEA reactor, which would impede the flow of reactant gases and could potentially damage the reactor.
- To solve this challenge, scientists reduced the concentration cations like sodium and potassium to slow the salt formation process.

A team of scientists led by **Xiaonan Shan**, associate professor of electrical and computer engineering at the University of Houston's Cullen College of Engineering, and Haotian Wang, associate professor of chemical and biomolecular engineering at Rice University's George R. Brown School of Engineering and Computing, have discovered simple yet elegant solutions to address a fundamental issue in carbon capture and utilization technology: carbon dioxide reduction reaction (CO2RR). The study was published recently in Nature Energy.

"This advancement paves the way for longer-lasting and more reliable (CO2RR) systems, making the technology more practical for large-scale chemical manufacturing," Shan said. "The improvements we developed are crucial for transitioning CO 2 electrolysis from laboratory setups to commercial applications for producing sustainable fuels and chemicals."

### SALT BUILDUP IS A MAJOR OPERATIONAL ISSUE OF CO2RR TECHNOLOGY

CO 2RR is a newly emerging carbon capture and utilization technique in which electricity – preferably generated by renewable sources like solar energy – and specific chemical catalysts are used to convert carbon dioxide gas into carbon-containing compounds like alcohols, ethylene, formic acids or carbon monoxide that can be used as fuels, chemicals or as starting materials to produce other compounds.

This technology is used in commercial membrane electrode assembly electrolyzers to convert carbon dioxide into valuable compounds. However, this technology has one major setback – over time, bicarbonate salt crystals accumulate on the backside of the cathode gas diffusion electrode and within the gas flow channels.

These salt precipitates block the flow of carbon dioxide gas through the cathode chamber, reducing the performance and eventual failure of the electrolyzers.

"Operational instability is a big hurdle in the wider adoption of this technology — the device functions normally for a few hundred hours after which it stops working due to the buildup of salt," Wang said. "Our goal in undertaking this study was to understand why and how bicarbonate salts form during this reaction, which we hoped would lead us to some preventive solutions that can extend the life of this device."

### IDENTIFYING THE CAUSE OF SALT BUILDUP IN DEVICES USING CO 2RR TECHNOLOGY

One of the primary challenges was understanding the mechanism behind salt formation and migration within the MEA reactor, Shan said.

"Salt accumulation is problematic because it leads to the formation of bicarbonate salt particles in the gas diffusion electrode and gas flow channels," Shan said. "These precipitates block CO 2 diffusion pathways, impeding the flow of reactant gases to the catalyst sites, and could potentially damage the membrane of the reactor as well."

To understand why these salt crystals form, Wang and his team at Rice collaborated with Shan and his team at UH who are experts in operando Raman spectroscopy, a powerful technique that allows researchers to study the structure of materials and any precipitates that adhere to it while the device is functioning.

"Our studies revealed that during this reaction, the microenvironment at the interface of the catalyst and anion electrode membrane is always alkaline (i.e., it has a high pH)," Shan said. "This allows the hydroxide molecules to easily react with the acidic carbon dioxide molecules to form carbonate ions, which can then bind with the positively charged ions (aka cations) like sodium or potassium present there to form the bicarbonate salt deposits as it migrates towards the cathode."

### FINDING SOLUTIONS TO REDUCE SALT BUILDUP IN DEVICES USING CO2RR TECHNOLOGY

Their next goal was to figure out ways to prevent these salt crystals from forming inside the gas flow channel.

"By utilizing operando Raman spectroscopy and optical microscopy, we successfully tracked the movement of bicarbonate-containing droplets and identified their migration pattern," Shan said. "This provided us the information to develop an effective strategy to manage these droplets without interrupting system stability."

The first idea they tested was whether lowering the concentration of cations like sodium or potassium in the electrolyte would slow down the salt formation.

Indeed, they found this was an effective solution. Reducing the concentration of the cations in the system prevented their crossover to the cathode, slowing down salt buildup and improving the reactor's long-term functional stability.

"As we visualized this reaction using optical microscopy, we saw an interesting phenomenon. The bicarbonate crystals formed and remained trapped in droplets initially. With time, the droplets would evaporate leaving the salt crystals behind," Wang said.

This simple but astute observation led them to think of another creative solution to solve this problem.

"Inspired by the waxy surface of the lotus leaf which causes water droplets to bead up and roll off, carrying off any dirt particles with it and leaving the leaf's surface clean, we wondered if coating the gas flow channel with a non-stick substance will prevent salt-laden droplets from staying on the surface of the electrodes for too long and therefore, reduce salt buildup," Wang said.

To test this idea, they coated the cathode gas flow channels of the MEA electrolyzer with parylene, a synthetic polymer like Teflon, that repels water. They found that parylene-coated gas channels flushed out substantially higher amounts of cations like potassium compared to a non-coated system, which notably improved the stability of the CO2RR MEA electrolyzer.

*Xiaonan Shan*

*Haotian Wang*

# CRITICAL LEUKEMIA TREATMENT SHRINKS TO SUIT PEDIATRIC PATIENTS

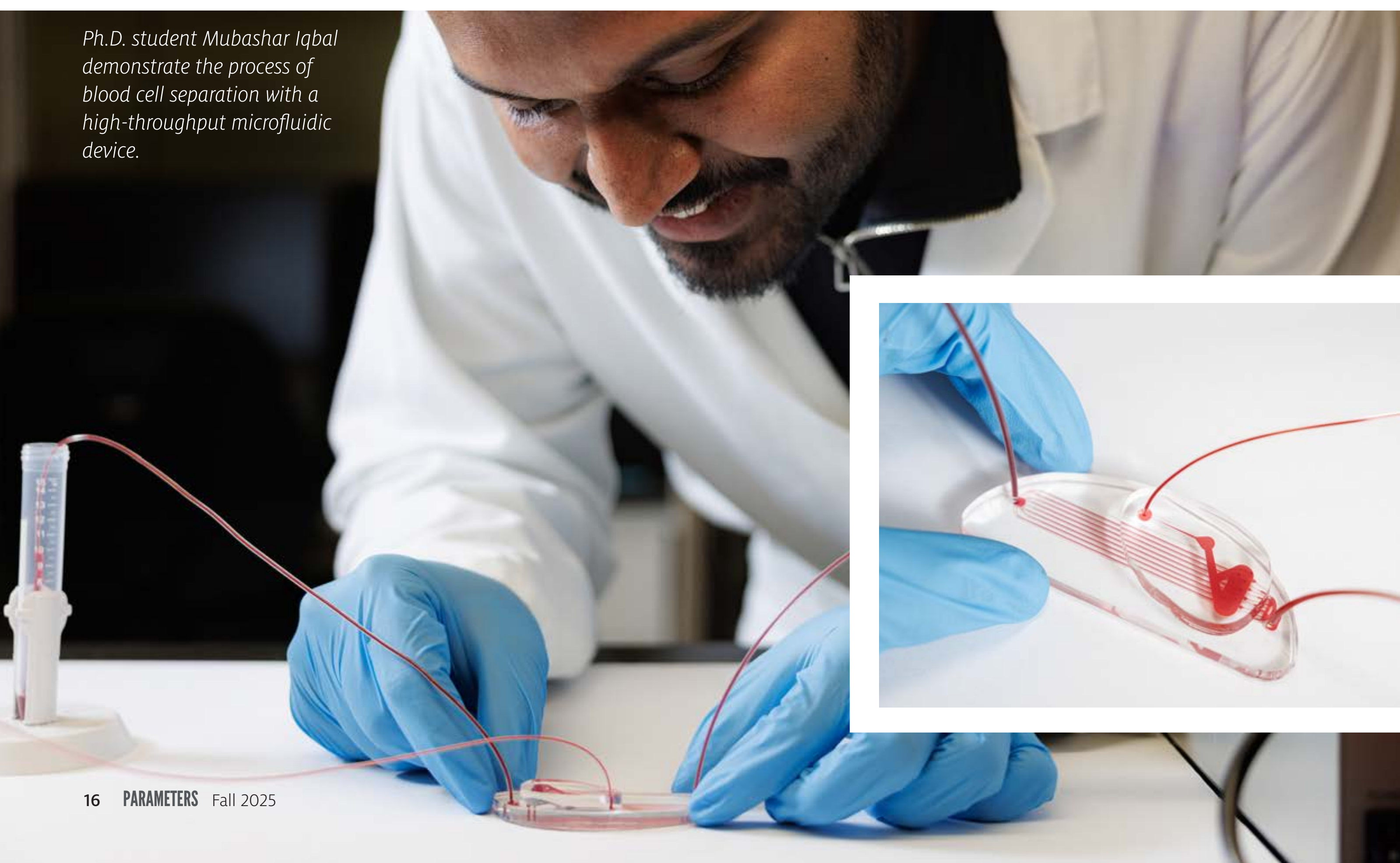
**BY LAURIE FICKMAN**

Researchers at the University of Houston, in collaboration with Baylor College of Medicine, are developing new devices for treating children with hyperleukocytosis, a condition that develops when the body has an extremely high number of white blood cells, often due to leukemia.

Leukemia is the most common type of cancer in children, with an annual incidence of about 5 per 100,000 children in the United States. Up to 20–30% of patients with acute leukemia develop hyperleukocytosis, placing them at risk for life-threatening complications.

Although definitive treatment for acute leukemia involves chemotherapy, leukapheresis — to urgently reduce dangerously elevated white blood cell counts — is a potentially life-saving therapeutic option. During leukapheresis, a large machine uses centrifugation to separate white blood cells, or leukocytes, from the rest of the blood, which is then returned to the patient.

But for children, these conventional blood-filtering machines can be dangerous for several reasons.



*Ph.D. student Mubashar Iqbal demonstrate the process of blood cell separation with a high-throughput microfluidic device.*



## DANGERS FOR CHILDREN

### HIGH EXTRACORPOREAL VOLUME OR ECV

This is the amount of blood that is outside the body during a medical procedure. Since children have much less blood than adults, removing too much at once can make them weak or cause serious problems.

### HIGH FLOW RATES

The machine moves blood very quickly through the system which can be risky because it requires the use of large-bore central catheters and puts stress on the body, especially for children who have smaller blood volumes.

### LOSS OF PLATELETS

Losing too many platelets can make it harder for blood to clot, increasing the risk of bleeding.

## FINDING ANOTHER WAY

On one particularly difficult night in the intensive care unit, Dr. Fong Lam, an associate professor of pediatrics at Baylor College of Medicine and a pediatric intensive care physician at Texas Children's Hospital, thought, "There has to be a better way!"

It was a night he had no choice but to perform leukapheresis on a young infant with leukemia. "The ECV of the apheresis machine is nearly as large as the child's total blood volume!" he remembers thinking.

Lam partnered with **Sergey Shevkoplyas**, a professor of biomedical engineering at UH, to test whether performing cell separation with a high-throughput microfluidic device could alleviate these limitations. The results of their groundbreaking study, led by **Mubasher Iqbal**, a Ph.D. candidate in biomedical engineering at UH, appear in the journal Nature Communications.

## A NEW WAY FORWARD

The new microfluidic device uses a large number of tiny channels, about the width of a human hair, designed to quickly and efficiently separate blood cells by size in a process called controlled incremental filtration.

"In vitro, our microfluidic devices removed ~85% of large leukocytes and ~90% of spiked leukemic blasts from undiluted human whole blood," reports Shevkoplyas. Leukemic blasts are cancerous white blood cells that don't develop properly. Instead of growing into healthy cells that help fight infections, they multiply too fast and crowd out normal blood cells.

When tested in vivo, the device demonstrated a similar leukocyte collection efficiency without platelet loss or any other adverse effects, while recirculating undiluted whole blood for more than three hours, a typical duration of a leukapheresis procedure.

"Continuously and efficiently separating leukocytes from recirculating undiluted whole blood — without device clogging and cell activation or damage — has long been a major challenge in microfluidic cell separation," Shevkoplyas said. "Our study is the first to solve this problem."

"As a practicing physician, I was particularly excited that our multiplexed device could operate at clinically relevant flow rates but with ECV ~1/70th of the typical leukapheresis circuit. Such a dramatic reduction of ECV would be particularly important in leukemic infants with hyperleukocytosis who are often too small on which to perform centrifugation-based leukapheresis safely," said Lam.

"Overall, our study suggests that microfluidics leukapheresis is safe and effective at selectively removing leukocytes from circulation, with separation performance sufficiently high to ultimately enable safe leukapheresis in children," said Shevkoplyas.

*Sergey Shevkoplyas, professor of biomedical engineering*

UNIVERSITY OF HOUSTON AWARDED

# $3M TO LAUNCH CANCER BIOMARKER FACILITY

FOR IMMUNOTHERAPY RESEARCH

BY LAURIE FICKMAN

As part of a $93 million grant package, the Cancer Prevention and Research Institute of Texas, known for funding ground-breaking projects, has awarded the University of Houston $3 million to set up a Cancer Immunotherapy Biomarker Core. This state-of-the-art facility will offer researchers in Texas the most comprehensive targeted proteomic cancer biomarker screens currently feasible, particularly in the field of cancer biology and immunotherapy.

UH CIBC will be the first such facility in Texas to offer targeted proteomics, which is the technology that makes it possible to study thousands of proteins at once and will offer its services at a minimized cost partly subsidized by CPRIT funding.

"Identifying better biomarkers for cancer will accelerate early diagnosis and better prognostication of cancer, better monitoring of disease progression and treatment response possibly leading to the identification of better medications for treating cancer," said **Chandra Mohan**, Hugh Roy and Lillie Cranz Cullen Endowed Professor of Biomedical Engineering and project director. "All of these will lead to reduced cancer associated morbidity and mortality."

Rather than targeting cancer cells directly, immunotherapy treats cancer by training the immune system to find and attack the cancer cells.

"Cancer immunotherapy is experiencing a meteoric rise, and this new chapter in oncology demands a new array of biomarkers, including blood and tissue biomarkers that predict who might respond best to immunotherapy, and biomarkers that help researchers identify the best targets for immunotherapy," said Mohan.

To meet these needs the CIBC will offer four unique platforms that include a 11,000- plex targeted proteomic screen that allows 11,000 specific proteins to be screened in any single body fluid sample, representing the largest proteomic coverage possible, as well as 21,000-plex protein array platform that allows scientists to assess the specificity of autoantibodies/ligands against the entire human proteome.

Weiyi Peng

Chandra Mohan

### THE CORE IS DESIGNED TO MEET THESE OBJECTIVES:

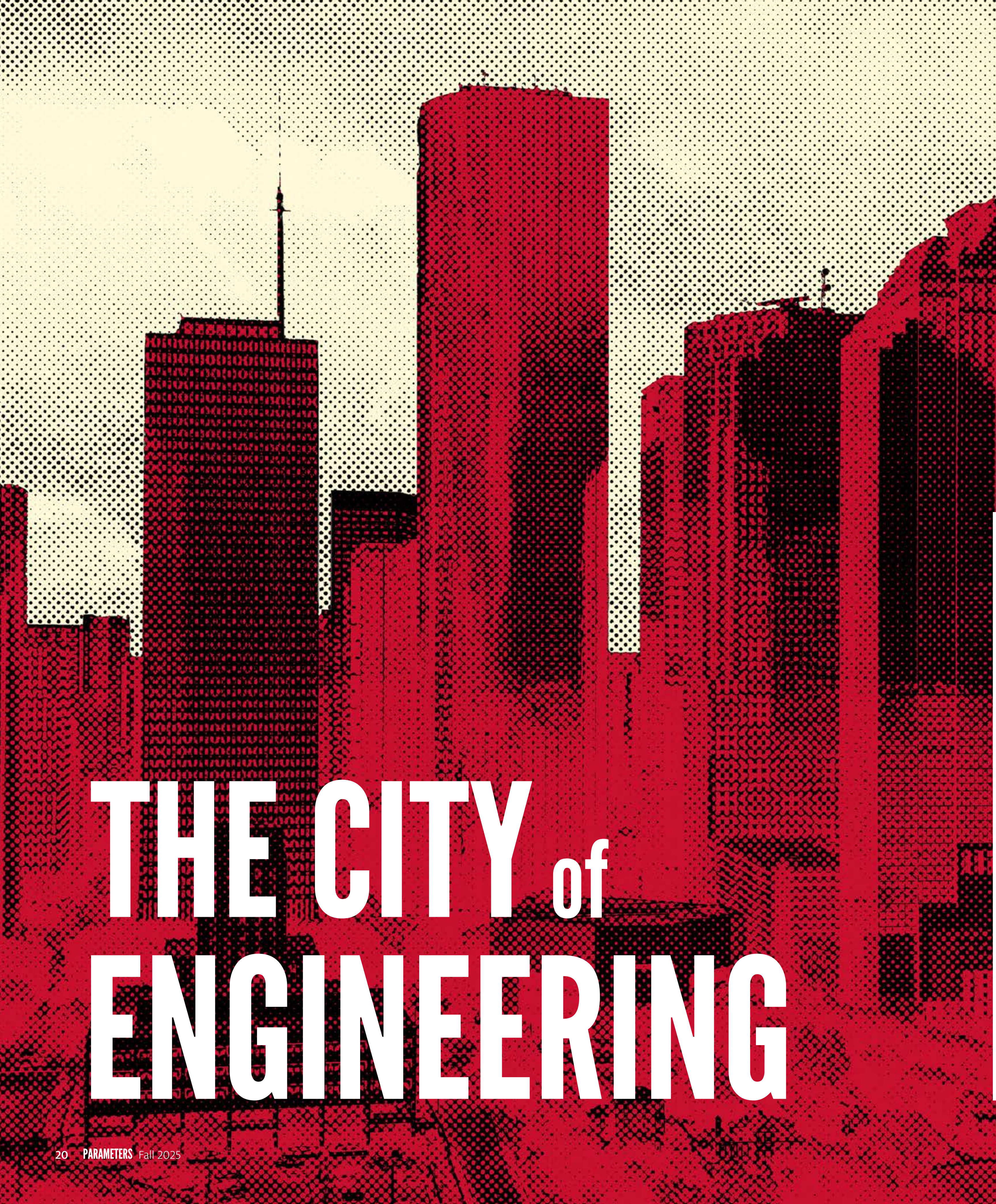
- To offer targeted exploratory proteomic technologies for protein biomarker discovery
- To offer targeted exploratory technologies for identifying novel autoantibodies, neoantigens and binding ligands
- To educate and promote the adoption of contemporary proteomic technologies among Texas researchers

Mohan, an MD/PhD, has over two decades of expertise in engineering diagnostic arrays and using the platforms offered and is a member of the UH Drug Discovery Institute. He has reported novel biomarkers for colorectal, bladder, prostate, stomach and pancreatic cancers. **Weiyi Peng**, also an MD/PhD, an immunologist and associate professor of biology and biochemistry, will co-lead the CIBC. She directs the Drug Discovery Institute Immunology Core, with more than 100 UH faculty members. Peng has long-standing expertise in immunoassays and has led projects on T cell-mediated anti-tumor immune response pathways using genetic screens and preclinical models.

"We are thrilled that Drs. Mohan and Peng received this award. The core is dedicated to immunology research, which aligns with our research priorities," said **Claudia Neuhauser,** University of Houston vice president for research. "It will add a critical component to our research infrastructure and synergize with the University-wide Drug Discovery Institute that supports immunology research."

CPRIT is considered a national model for a state-based, voter-approved cancer research and prevention initiative. All CPRIT grant applications undergo rigorous, independent, unbiased, merit-based peer review.

> IDENTIFYING BETTER BIOMARKERS FOR CANCER WILL ACCELERATE EARLY DIAGNOSIS AND BETTER PROGNOSTICATION OF CANCER...
>
> – CHANDRA MOHAN



# THE CITY of ENGINEERING

The Cullen College of Engineering is uniquely positioned, literally and figuratively – to offer students and faculty world-class experiences in research and industry with its location in the city of Houston.

Known worldwide for its major energy, logistics and medical science presences, as well as its area proximity to the famous Johnson Space Center ("Houston, Tranquility Base here. The Eagle has landed."), Houston is both a historic and future-focused hub of research innovation and high-ranking industry activity.

This vibrant relationship between city and university is visible from the moment students first step foot on campus and throughout their years at Cullen, from available internships and research opportunities to unique insights shared by faculty members who stay in the loop – though not necessarily inside The Loop – with new developments in labs across the city, but it doesn't stop when they walk the stage at Commencement. The college's relationship with the city and the greater Houston area remains both a positive influence and a vital resource for recent grads and alumni as they navigate an ever-changing job market.

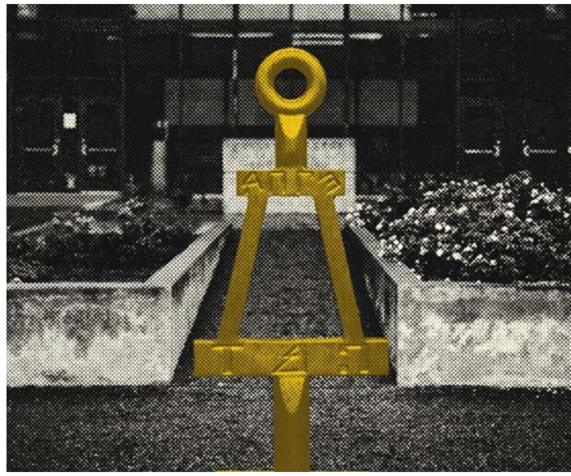
From oil and gas to vaccine development, human resources to logistics, Cullen College continues to stay one step ahead in research, innovation and opportunity thanks to its thriving connections to the Houston community.



## Research & Innovation in Houston:

# HOW UH RESEARCHERS ARE USING SPACE CITY TO CHANGE THE WORLD

From the world-renowned Texas Medical Center – a cluster of institutions so grand its become its own neighborhood – to NASA's famous Lyndon B. Johnson Space Center just off the Gulf Freeway to our growing business presence in Fort Bend County, Cullen researchers are constantly innovating to improve the lives of Houstonians and the world in ways that are only possible here in H-Town.



# ONE-OF-A-KIND

## OPPORTUNITIES IN THE TMC

**BY ALEX KEIMIG**

M.D. Anderson Professor **Navin Varadarajan** of the William A. Brookshire Department of Chemical and Biomolecular Engineering is using biomolecular research to fight for Houston's health on multiple fronts: recent breakthroughs have included enhanced cancer immunotherapy approaches as well as nasal vaccines that can help stop the spread of SARS-CoV-2 and other coronaviruses.

"[Our] department emerged as one of the strongest departments of chemical engineering in the country about four decades ago," says Varadarajan. As UH has grown and the department and its research have risen in prominence, both have become "tightly integrated with our prestigious neighbors."

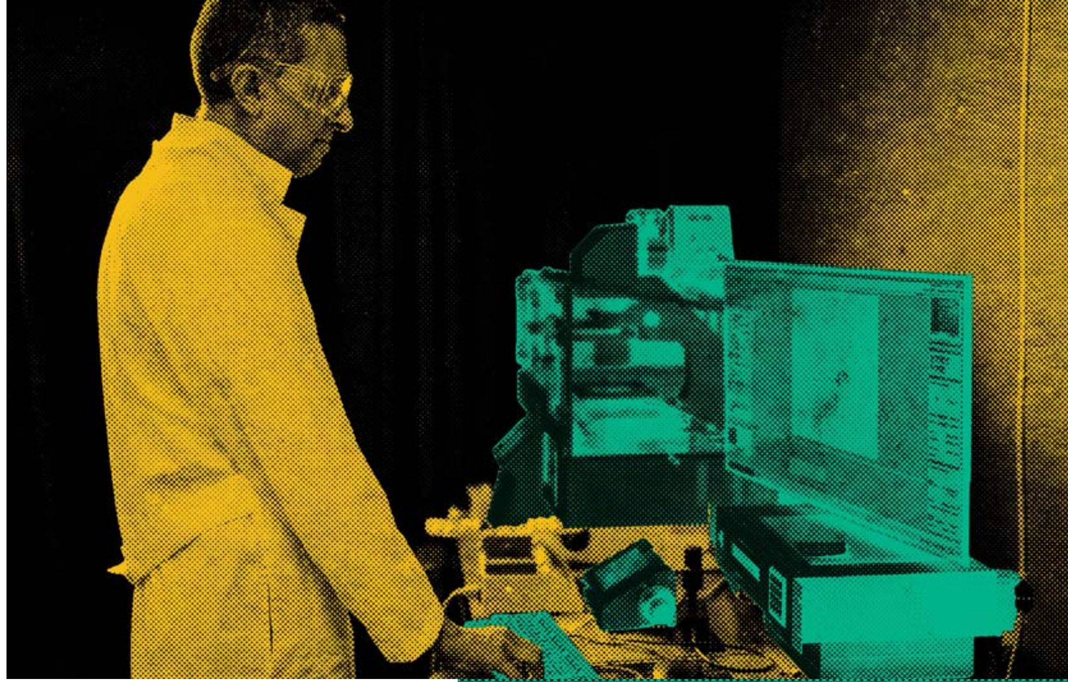
"Members of our department have formal affiliations with MD Anderson, Baylor College of Medicine, the Methodist Hospital Research Institute, etc., and we serve actively in the governance of a variety of interinstitutional programs, including the Gulf Coast Consortia, the new Clinical and Translational Science Award (CTSA) program with Baylor, and Cell Therapy Consortia funded by the Cancer Prevention and Research Institute of Texas (CPRIT). The ability to integrate engineering with medicine takes advantage of the complementary strengths between our department and TMC," he adds.

Varadarajan's team focuses on developing technologies for human benefit, so MD Anderson has been a natural partner for their efforts in translation in cancer immunotherapy. Immunotherapy is a major breakthrough in cancer treatment. It works by harnessing the power of the immune system, and one of the core technologies they've developed allows for visualization of interaction dynamics between immune and tumor cells.

"Texas has been a great place for cancer research thanks to funding from CRPIT," he says. "This has enabled us to investigate immunotherapy in several different kinds of cancer, including blood, skin, breast and liver cancers. Advances in cancer immunotherapy directly benefit Texans and their families, and it is rewarding to work at the interface of engineering and medicine."

During the COVID-19 pandemic, the team shifted their focus to nasal vaccines. They published the first intranasal vaccine in July 2020 and have subsequently developed and validated vaccines against other respiratory pathogens like respiratory syncytial virus (RSV) and mycobacterium tuberculosis (Mtb) in preclinical models.

"Our research is focused on developing treatments [for diseases] and vaccines against pathogens that cause a huge burden to society both locally and nationally. UH and TMC provide a great environment for collaborative translational research," says Varadarajan.



"THE ABILITY TO INTEGRATE ENGINEERING WITH MEDICINE TAKES ADVANTAGE OF THE COMPLEMENTARY STRENGTHS BETWEEN OUR DEPARTMENT AND TMC"

– NAVIN VARADARAJAN

# MACRO TO MICRO:

## TRAILBLAZING WITH NASA

**BY ALEX KEIMIG**

**Nicole Guinn** is a Geosensing Systems Engineering and Sciences Ph.D. candidate whose work has been featured by NASA and ScienceAlert, among others. She studies the intersection of remote sensing and volcanology, and NASA's Earth-observing satellites are crucial to her work.

In volcanology, carbon dioxide ($CO_2$) is a key predictor gas for imminent eruption activity. While other gases can be measured remotely, the $CO_2$ naturally present in Earth's atmosphere makes it difficult to differentiate via satellite.

"My initial motivation was to find a way to characterize volcanic $CO_2$ from space; I wanted to do that by using trees as a proxy. Since trees take in $CO_2$ through photosynthesis, and we can measure the health of trees from space, then volcanoes letting out more $CO_2$ should be reflected in the photosynthesis of trees around them. We can measure how green the trees are from space and how that changes over time," says Guinn.

There are many confounding factors affecting what Guinn can see from space, so she carefully considers long-term trends and how numbers fluctuate over time.

"UH is one of the only universities in the country with a graduate Geosensing Systems program, and with that kind of title, we're able to meaningfully connect with other agencies doing remote sensing, like NASA and USGS," she adds.

Guinn's research began with Mount Etna in Italy, but she has no plans to stop there.

Volcanoes vary enough from place to place that it's difficult to fully extrapolate findings from one location. Guinn is currently studying Yellowstone, doing similar work and comparing it to other activity like seismicity and deformation.

"Next, I want to streamline the process to apply to any volcano. We need more case studies and more research, but I think we could be able to establish a potential new monitoring technique," she says.

**Saikiran Anugam** completed his master's thesis, Suppression of Shear Flow in Microgravity Strengthens Non-zSpecific Protein Contacts to Enhance Aggregation, earlier this year. In collaboration with NASA and Frank Worley Professor **Peter Vekilov**'s team, Anugam's research sought to understand the duration and diffusion of protein aggregation in the human body.

Proteins are essential components of life on Earth. Their shape and function are inextricable, meaning these chains of amino acids must fold into particular configurations to fulfill the specific roles they play in the body. Misfolding can lead to aggregation, which can in turn lead to brain and eye cancers as well as life-threatening conditions like Alzheimer's and Parkinson's Disease.

Vekilov's team wanted to better understand the dynamics of these aggregating proteins, and they had to go out of this world – literally – to find just the right conditions: samples were given to NASA and launched by rocket in December 2018 to the International Space Station, where the experiments took place.

Two minutes of video were taken every 30 minutes via microscope for several weeks to observe the behavior of three different proteins; that's five terabytes of data for earth-side analysis.

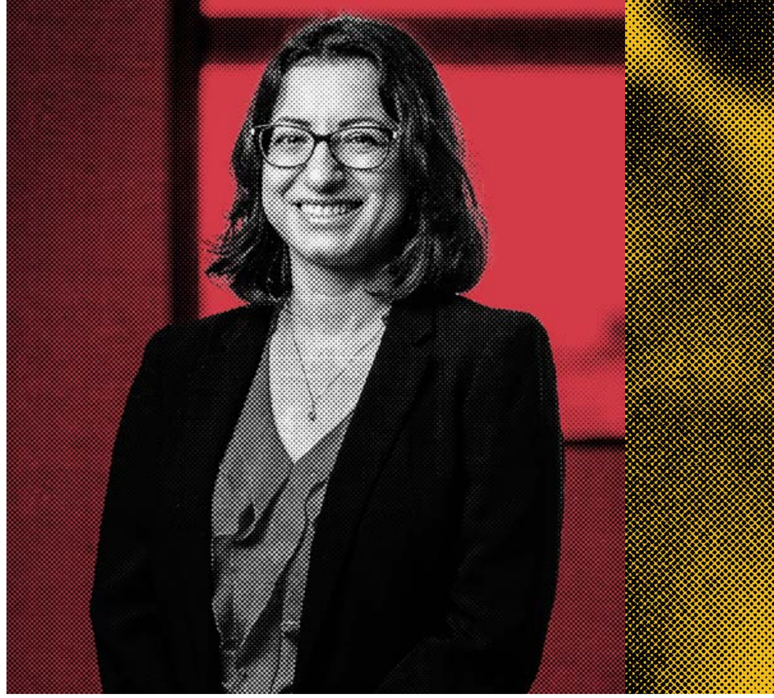
As a data scientist, Anugam processed all of the images collected on the ISS. This was a multi-step process that included making use of mathematical analyses like Fourier Transform as well as chemistry- and physics-based assessments.

"On Earth, it's very difficult to maintain a zero-gravity environment for long periods of time," he says. "Our need for a suitable environment is what led us to collaborate with NASA, which allowed us to see the true dynamics of the protein clusters without any other forces in effect."

The results may offer new insights into protein aggregation diseases and their management, and how to use this information to optimize healthcare and pharmaceutical industry protocols.


# AN INNOVATIVE APPROACH TO PEOPLE

**BY ALEX KEIMIG**



Assistant Professor and Human Resource Development (HRD) Graduate Program Coordinator **Melika Shirmohammadi's** research examines all angles of humans at work, from immigrant experiences to remote work during the 2020 lockdowns.

"Houston's unique mix of industries – energy, healthcare, education, nonprofit, and tech – requires adaptable leaders with strong people skills and strategic thinking. Our program cultivates graduates who are not only job-ready, but change-ready," she says.

"The HRD program has always had a deeply embedded relationship with the city of Houston, largely because our mission – developing people and organizations – aligns closely with the city's dynamic workforce needs. Over the past two decades, that connection has evolved from being a traditional academic program to a talent development pipeline for the region."

Alumni are currently serving organizations like MD Anderson, NRG Energy, Chevron, GE, Halliburton, Deloitte, and Phillips 66. Their Advisory Board also includes senior HR leaders from Houston Methodist, Memorial Hermann, and Tramontina.

Shirmohammadi describes HRD as "an incredibly transferable discipline" – one in which students learn to improve leadership and performance across all organizational levels. Innovation is central to how the program's faculty teach and how its students apply what they learn.

"Our program is project-based and experience-driven. Beyond classroom-based innovation, our faculty also actively engage in research in partnership with industry."

One current study explores how open and shared office spaces influence employee well-being and performance – a topic of growing importance as organizations rethink post-pandemic work arrangements.

Other ongoing research projects examine the role of AI in learning and development, the reintegration of older adults into the workforce after retirement, and organizational strategies for improving employee retention in a shifting labor market.

"Our research areas are purposefully aligned with emerging trends and needs in Houston's evolving workplaces, ensuring our work remains both timely and impactful," Shirmohammadi says.

"One thing that sets the UH HRD program apart is our commitment to an outside-in approach. We are guided by industry trends and practices, and we don't just teach theory; we guide students to use that theory to improve organizational systems in real time.

"We're also expanding: a fully online format of the MS in HRD is launching soon, and a new MS in Organizational Development is on the horizon. These changes reflect both our adaptability and our continued focus on serving a diverse, working professional population across Houston. As we move to the UH Sugar Land campus in Fall 2025, we're deepening our commitment to serving the growing professional communities in Fort Bend and beyond."

> "OUR RESEARCH AREAS ARE PURPOSEFULLY ALIGNED WITH EMERGING TRENDS AND NEEDS IN HOUSTON'S EVOLVING WORKPLACES, ENSURING OUR WORK REMAINS BOTH TIMELY AND IMPACTFUL"
>
> – MELIKA SHIRMOHAMMADI

> FULL-TIME IN THE CORPORATE WORLD, THERE'S NEVER ONE WAY TO SOLVE A PROBLEM, AND UH TEACHES YOU HOW TO DO THAT.
>
> – NOUR HOELSCHER

# FROM CAMPUS TO CAREER

Networking in Houston paves the way for Scarbrough and Hoelscher

**BY STEPHEN GREENWELL**

If you're examining the ranks of the largest engineering companies in the world with Houston offices, it's impossible not to notice the Cullen College of Engineering graduates in each of those buildings.

Each year, these companies are active at events like the Career Center job fairs and the networking events held by individual departments. They're looking first for potential interns, and then for the next class of graduates that'll become skilled entry level employees, before promotions to more senior roles.

**Joel Scarbrough** and **Nour Hoelscher** were both brought on by ExxonMobil shortly after finishing their respective degrees in Industrial Engineering and Chemical & Biomolecular Engineering. Scarborough is now a lubrication engineer, while Hoelscher is a process engineer. The nature of learning at Cullen with its industry connections lent itself well to a quick, successful tradition to industry.

"In the Industrial Engineering program, they did a good job of having a lot of team-based projects and opportunities to work with different companies," Scarbrough said. "Not just our capstone project, but other classes that I took, I worked directly with companies and I was able to pivot directly into commercial and professional based roles."

Hoelscher added, "The classes are going to give you the fundamentals of engineering and that really sticks with you, but they also were really difficult and gave you a feel for problems that you needed to solve. Full-time in the corporate world, there's never one way to solve a problem, and UH teaches you how to do that."

When it came to picking a college, proximity to the Houston metro area and opportunities were key reasons for Hoelscher and Scarbrough.

"I grew up in Sugar Land, so UH was always on my radar," Hoelscher said. "It was really close and I had a lot of family who went there. They also had really good scholarships and financial aid, so that made it really attractive to go there."

Scarbrough was a standout high school football kicker for Langham Creek, and he wanted a chance to continue playing at the Division I level while also studying engineering.

"I did grow up in the Houston area, but at UH I was able to get both an engineering degree and the opportunity to play football," he said, noting that several other schools he looked at offered one but not the other. "UH was attractive with their engineering program, and everything they had to offer."

Both stressed the importance of using the networking opportunities available at UH to land their internships and later their jobs at ExxonMobil.

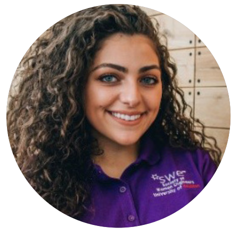
"I learned about the company through the career fairs at UH," Hoelscher said. "As a sophomore I went to my first career fair, and Exxon always had the longest lines. I did an internship there after my sophomore year, and I learned with the company and I've been committed ever since."

Scarbrough and Hoelscher stressed the importance for students to explore available opportunities – whether it was looking for a job at career fairs, joining campus organizations or taking advantage of group research projects at Houston area companies.

"Put yourself out there, and go to every little event you're interested in," Hoelscher said. "Learning about the company helps you learn about yourself too."

"Utilize the industry and the career center. [Director] **Janice [Quiroz Perez]** has been very helpful in preparing students when it comes to resume critics or mock interviews," Scarbrough said. "Build your network. I learned a lot from upperclassmen, and reviewed their resumes and learned from them about companies I could talk to and companies out there. Start freshman and sophomore year, don't wait until your senior year."

*Joel Scarbrough*



*Nour Hoelscher*

# GROWING TOGETHER

## Cullen and ExxonMobil continue to collaborate

**BY STEPHEN GREENWELL**

**For more than a decade, the largest oil and gas company in the United States has valued the excellent research credentials and the work ethic of the graduates from the Cullen College of Engineering as it has expanded and grown in the Houston metro area.**

ExxonMobil is the third-largest oil and gas company in the world, and the largest non-state owned one by yearly revenue. As of 2024, that revenue neared a staggering $350 billion, about $150 billion more than the next closest U.S. company. And each year, the company hires a significant amount of UH graduates for high paying jobs in a variety of departments.

For 2025 graduates, ExxonMobil was once again among the Top 10 hiring companies, and the corporation has been a long-time presence at college events and career fairs.

**Richelle Rosenbaum** is an Americas Business Manager in Environmental and Property Solutions for the company, as well as the ExxonMobil University Engagement Manager for the University of Houston. She is also a graduate of the University of Houston, earning her MBA in International Business from the C.T. Bauer College of Business.

"ExxonMobil has been recruiting at University of Houston for over a decade and values the strong candidates we recruit from the university," she said. "University of Houston students have the combination of grit and academic excellence that pairs well with our company values and needs."

In addition to its recruiting presence, ExxonMobil has also taken in active role in supporting initiatives at the college and university levels. This ranges from multi-year research agreements for petrochemical products and providing matching gifts for contributions, to high level executives like Darrin Talley serving on advisory boards.

The company also regularly hires UH students for internships and hosts workshops at its facilities. And outside of the labs, former UH basketball star and current NBA player Jamal Shead made headlines when he became the first athlete to sign a NIL deal with company. The College of Education at UH is also part of the STELLAR program, a partnership with the ExxonMobil Foundation to provide high-quality STEM development for middle and high school teachers in Houston ISD, Spring ISD and KIPP Texas Public Schools.

Rosenbaum noted that UH and Cullen students were typically attractive because of their knowledge base.

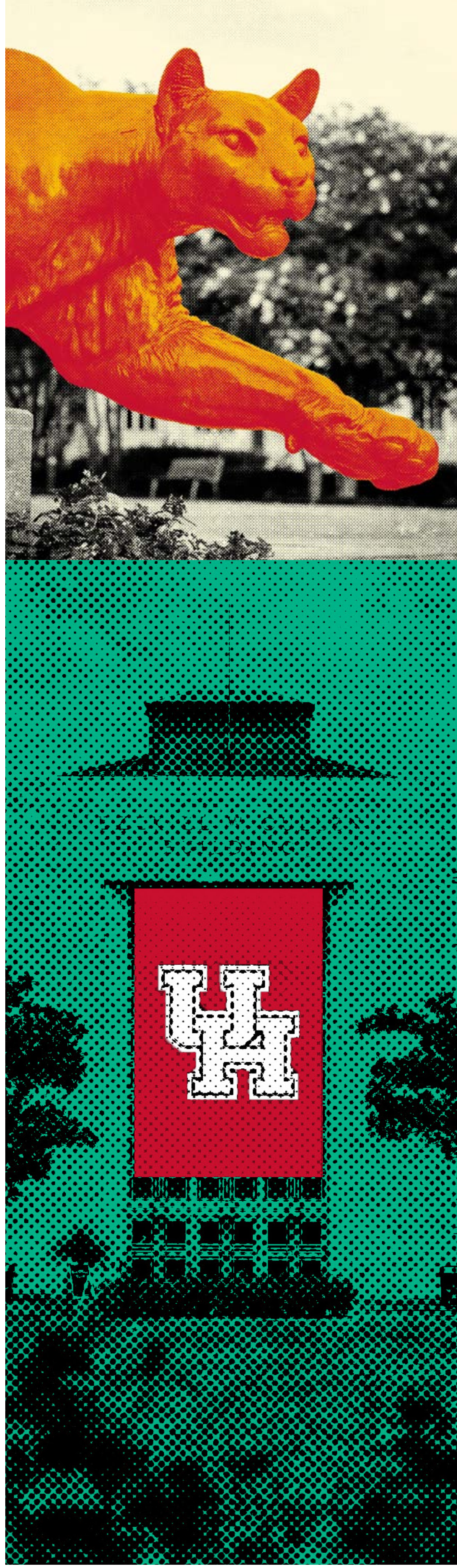
"University of Houston students come to us very well versed and experienced in the Oil and Gas industry," she said. "Students at the University of Houston understand the importance of O&G products in industry and in improving the quality of life for people across the world, and the underlying challenges it takes to deliver these products globally."

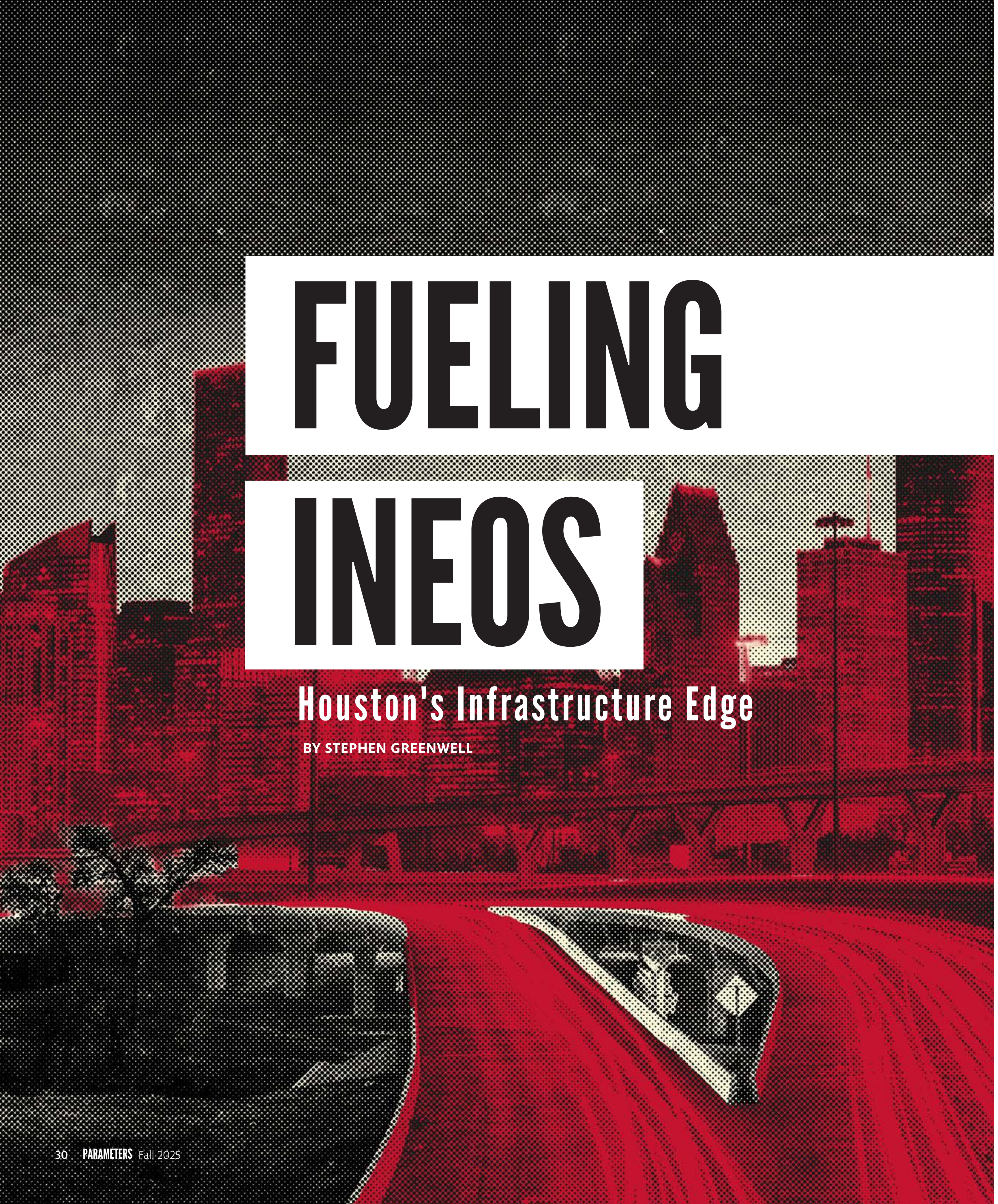
As part of their commitment to the Houston metro area, ExxonMobil has made significant capital and infrastructure investments. The company earned international headlines in 2014 when it opened its new campus on 385 acres in Spring, Texas. The campus hosts more than 10,000 employees and visitors daily, and most of its workers are hands-on in their offices and facilities.

"ExxonMobil believes in the power of in-person collaboration paired with programs that allow people to have workplace flexibility when they need it. Most of our operating locations consist of roles that can only be done at the plant or on-site," Rosenbaum said.

"Houston is the hub for the U.S. O&G industry and it's important to be with our industry peers, near the port of Houston, in proximity to our Gulf Coast operations, and a quick plane flight to our strategic assets in the Permian basin. For these and many other reasons, we have consolidated our headquarters operations at our primary campus in Spring."

> “STUDENTS AT THE UNIVERSITY OF HOUSTON UNDERSTAND THE IMPORTANCE OF O&G PRODUCTS IN INDUSTRY AND IN IMPROVING THE QUALITY OF LIFE FOR PEOPLE ACROSS THE WORLD”
>
> – RICHELLE ROSENBAUM





# FUELING INEOS

## Houston's Infrastructure Edge

BY STEPHEN GREENWELL

**When one of the world's largest petrochemical companies is looking to fill its openings for engineers, the graduates being produced by the University of Houston's Cullen College of Engineering are the ones often being brought in.**

**Matt Abraham** is the Business Development Director for INEOS Olefins & Polymers USA, as well as a graduate of Cullen's Department of Electrical Engineering and UH's MBA program. At INEOS, he negotiated and executed the $1.4 billion transaction for the Chesapeake South Texas Oil asset – an incredible example of the impact Cullen alumni are making.

"The University of Houston's Cullen College of Engineering has been a strong and consistent source of talent for INEOS over the years. Since 2008, we've hired 21 engineers from UH, many of whom continue to build long-term, successful careers within our organization," he said.

"This partnership has proven to be a fertile ground for recruiting – not just because of the technical strength of the program, but because UH graduates bring a strong work ethic, a practical approach to problem solving, and a commitment to delivering results. They align well with the INEOS culture of ownership, accountability and high performance."

Ineos has had a presence at Cullen career fairs and networking events for more than a decade. Abraham said it was a reflection of the importance of the relationship, and how many UH alumni remain "key contributors" to their business today.

"While we value candidates from a wide range of universities, graduates from Cullen often bring a distinct blend of qualities that make them especially strong contributors at INEOS," he said. "Many UH graduates are local to the region and demonstrate a deep-rooted commitment to staying and growing in the Houston area – this contributes positively to long-term retention and cultural alignment within our teams. They also tend to have real-world experience through co-ops, internships or part-time work, giving them a practical, grounded perspective when entering the workforce."

He added, "UH engineers are known for their grit, adaptability, work ethic, and they bring a strong sense of determination and focus to their careers. We've found them to be eager to learn, humble in their approach, and capable of thriving in our fast-paced, performance-driven environment."

The recruitment of skilled engineers and other employees from the University of Houston also ties into Ineos' strong presence in the region as a whole. While the corporation is headquartered in London, it has sites throughout the Houston metro region.

> "THE UNIVERSITY OF HOUSTON'S CULLEN COLLEGE OF ENGINEERING HAS BEEN A STRONG AND CONSISTENT SOURCE OF TALENT FOR INEOS OVER THE YEARS"
>
> – MATT ABRAHAM

"Manufacturing sites are located from Texas City in the south through Bayport, to the ship channel corridor in the north in Pasadena, and La Porte," Abraham said. "In the southwest INEOS owns one of its flagship sites, called the Chocolate Bayou site in Alvin. Mechanical, chemical and electrical engineers are employed at all these sites, and we also provide summer internship opportunities at these sites. A corporate center for these Houston area businesses is located at our Marina View building in South Shore Harbor area in League City."

The convergence of available storage, pipelines and chemical manufacturing plants, along with transportation options, gives Houston a truly "unique infrastructure advantage globally," according to Abraham.

"It is important for INEOS to have a physical presence in Houston because of our manufacturing investment in the greater Houston area. INEOS has piloted remote work options for its engineers and corporate staff, but our continuously operating manufacturing sites depend on teamwork and the active involvement of its engineers," he said.

"The city of Houston and its neighboring communities continue to meet our needs and provide ample opportunities for our employees outside of work. The University of Houston Cullen College of Engineering is a key partner for our recruiting efforts to maintain our global competitive advantage."

# CULLEN COLLEGE OF ENGINEERING WELCOMES 13 New Faculty to its Ranks

## HEBA ALY

**Instructional Assistant Professor in the Information Science Technology Department**. Aly joins Cullen after earning her doctorate in computer science from Clemson University. She is an active member of the Association for Computing Machinery, serving as associate chair for several of its meetings.

## MUHAO CHEN

**Assistant Professor of Aerospace Engineering in the Mechanical and Aerospace Engineering Department**. Chen makes his way to Cullen from the University of Kentucky, where he was an assistant professor in the Mechanical and Aerospace Engineering Department. He also completed postdoctoral research at Texas A&M, which is where he earned his doctorate.

## XIN JIANG

**Assistant Professor of Energy Transition Innovations in the Industrial and Systems Engineering Department.** Jiang comes to Cullen after conducting postdoctoral research at Cornell and Lehigh universities. He earned his doctorate from the University of California, Los Angeles. He has five authorship credits already, and he has served as a journal reviewer for several IEEE publications.

## NIRATHI KEERTHI GOVINDU

**Instructional Assistant Professor of Systems Engineering in the Industrial and Systems Engineering Department**. Govindu first joined UH as a lecturer for the Fall 2024 semester. Prior to UH, she worked in various roles for eight years at NRG Energy. She earned her doctorate in Industrial and Systems Engineering from Mississippi State University.

## VINOD KUMAR

**Assistant Professor of Biomanufacturing for Health and Environmental Enhancement in the Engineering Technology Department**. Kumar has served as a lecturer, adjunct professor and editor at Cranfield University in the United Kingdom for the past eight years. His research expertise is in the development of low cost, energy efficient and sustainable bioprocesses for the production of biofertilizers, biopesticides, biofuels and biochemicals.

## CHANGQING LUO

**Assistant Professor in the Information Science Technology Department**. Luo moves to Cullen after serving as an assistant professor in the Department of Computer Science at Virginia Commonwealth University. The holder of two patents, he is currently lead or co-PI on 15 research grants with $1.6 million in funding attached. Lao is an associate editor of the IEEE Internet of Things Journal.

## KHIRUL BASAR MIM

**Assistant Professor of Retailing and Consumer Science in the Human Development and Consumer Sciences Department**. Mim earned his doctorate in Hospitality and Retail Management from Texas Tech University. He is the 2024 winner of the Joan M. Laughlin Fellowship Outstanding Continuing Doctoral Student Award from the International Textile and Apparel Association.

## BLAKE MUDD

**Assistant Professor of Retailing and Consumer Science in the Human Development and Consumer Sciences Department**. Mudd has been a lecturer at the University of Houston since 2019, after earning his M.S. in Global Retailing from the school. He earned his doctorate from Iowa State University. He holds professional affiliation with National Retail Federation, the American Association of Family and Consumer Sciences, the International Textile and Apparel Association, and Lambda Next-Gen Houston / Greater Houston LGBT Chamber of Commerce.

## HUSSEIN NASSAR

**Assistant Professor of Aerospace Engineering in the Mechanical and Aerospace Engineering Department.** Nassar comes to Cullen from the University of Missouri, where he was an assistant professor. He was named an American Society of Mechanical Engineers Rising Star in 2024, and he earned an NSF CAREER award for his research in 2021.

## VIVEK KUMAR

**Associate Professor of Digital Health Diagnostics and Monitoring in the Biomedical Engineering Department**. Kumar joins the Cullen faculty from the New Jersey Institute of Technology, where he had a dual appointment as an associate professor in the Biomedical Engineering Department, and the Chemical and Materials Engineering Department. He has more than 65 paper credits, as well as three patents and eight patents in adjudication. His dentistry research on "Angiogenic and anti-microbial supports for pulp regeneration" has received about $2 million in funding.

## TEJASREE PHATAK

**Instructional Associate Professor of Structural/Geotechnical Engineering in the Civil and Environmental Engineering Department.** Phatak is a distinguished graduate of Cullen, earning her Ph.D. and M.S. in Civil Engineering from the college. She has been a lecturer at the college since 2022.

## JACOB SMITH

**Assistant Professor of Applied Artificial Intelligence (AI) and Large-Scale Machine Learning (ML) in the Electrical and Computer Engineering Department.** Before Cullen, Smith was a postdoctoral researcher for the Oak Ridge National Laboratory. He earned his doctorate from North Carolina State University. He is a member of the Microscopy Society of America, the Microanalysis Society and the Materials Research Society.

## MENG WANG

**Associate Professor in the Civil and Environmental Engineering Department**. Wang comes to Cullen from the University of Pittsburgh, where he was an assistant professor for five years. He earned his doctorate from the University of California, Los Angeles. In 2025, he earned an NSF CAREER award for his proposal, "Advancing Biodegradation Through Protein Nanocompartment-Based Cargo Encapsulation for Organic Contaminant Removal."

# TAMEST NAMES THAKUR AS PRESIDENT, A FIRST FOR UH

BY JONATHAN ADAMS

**For the first time in its history, the Texas Academy of Medicine, Engineering, Science and Technology has placed a University of Houston professor in its top leadership role.**

**Ganesh Thakur**, a professor of petroleum engineering at the Cullen College of Engineering, has led TAMEST as its president since February, a role he hopes will bring more visibility to UH's programs.

"I want to give the University of Houston — my colleagues, our professors — more exposure. I want to create an opportunity for them to be more visible," Thakur said. "This is where the best professors from UH, the best from the University of Texas at Austin, the best from Texas A&M University and the best from around the state get to collaborate."

TAMEST is the highest-level educational organization in the state, with 350 national academy members and eight Nobel laurates, many of whom are considered to be among the top in their fields of engineering, science and medicine.

The organization's goal is to bring these minds together to solve real-life problems impacting society, ranging from disease vaccinations to energy storage.

"Our professors get to see what our colleagues are doing in other universities," he said. "It really creates a positive motivation and inspiration for our professors."

As president, Thakur will oversee the daily operations of TAMEST and is responsible for hosting the organization's annual conference, which invites researchers from across the country to discuss opportunities on a particular topic.

The next conference will be hosted in San Antonio in February 2026 and focused on climate change and climate-related information.

Ganesh Thakur

"I was a champion of this topic," Thakur said. "It's important for people working in these fields to know what kind of impact climate issues have on our society and our people."

Thakur's tenure as president will end in 2027, and within that two-year timeframe his No. 1 goal is to showcase Texas — and Houston in particular — as a hub for the top scientists in the country.

"Ganesh's role at TAMEST will give UH's scientists and professors the exposure they deserve," said Pradeep Sharma, dean at the Cullen College of Engineering. "Our faculty rank among the best in the world, and together the members of TAMEST will achieve great things."

TAMEST Texas Academy of Medicine, Engineering, Science & Technology



## Coog Cubed: Three-Time Cullen Grad

# MAGYARI'S LATEST QUANTUM CRYPTOGRAPHY RESEARCH

BY ALEX KEIMIG

Quantum cryptography researcher Alexander Magyari has completed his bachelor's degree, his master's degree and, as of May 2025, his Ph.D. from the Cullen College of Engineering.

Quantum cryptography researcher **Alexander Magyari** is completing the hat trick: at the end of this semester, he will have earned his bachelor's degree, his master's degree and his Ph.D. from the Cullen College of Engineering. Now, he's devoting his time and talents to strengthening available security resources in the face of the rapidly changing landscape of quantum computing.

Though he initially hadn't planned to stay at the University of Houston after completing his bachelor's degree — at first, he wasn't even planning to pursue graduate school at all — a research project offer from his mentor, associate professor **Yuhua Chen**, D.Sc., in his senior year of undergraduate studies set everything in motion.

"She continued to mentor me through my master's program, and she's my mentor now, so she's ultimately the reason I stayed at UH – it was for her guidance. The value of a graduate program comes not just from the program itself, but from your advisor. You could end up at a top school like MIT, but if you don't have a good mentor, then that could be practically worthless, especially if you're investing a lot of time in research," said Magyari.

"I think that a lot of my success — not just in academics but in my career as well — has been guided by Dr. Chen. In fact, she's the one who pushed me to work full-time and gain career experience while studying. She's probably the biggest reason why I stayed at UH."

As an undergraduate, Magyari was involved with Sigma Nu fraternity and served as chapter president for two years. He then completed his accelerated master's degree in one year, graduating with a 4.0 GPA. Most recently, he was recognized with a Best Paper award at an IEEE conference on the Internet of Things in Taiwan.

"I've had quite a few publications, and I'm proud of each of those," he said. "Individually, they all represent a tremendous amount of work."

One recent publication in Electronics, "Hardware Optimized Modular Reduction", sets the stage for a tumultuous decade ahead in the field of quantum computing and cryptography.

Quantum computers can facilitate the acceleration of a variety of applications, like statistical analysis and DNA research, but they also have one major downside: they enable operators to crack modern encryption methods. This has significant implications for data security in areas like healthcare, propriety research and financial services.

"Something that everyone knows is on the horizon is a cryptographically relevant quantum computer, or CRQC. That is going to enable both foreign adversaries and anyone with the capability to get their hands on one to recover information that's supposed to be secured, which is obviously a problem," Magyari said. "Encryption as we know it wasn't designed to withstand attacks from quantum computers. We're expecting a CRQC to be viable within the next ten years — that's right around the corner." >>

"My work specifically seeks to address that in a field called post-quantum cryptography — new cryptographic methods that can withstand quantum attacks," he continued. "All of my research is looking at implementing those algorithms on hardware and reducing area and power consumption by that hardware, as well as looking into how we can make these algorithms faster. This field is evolving quickly."

Magyari's current focus concerns translating modular reduction — a common cryptographic mathematical operation — from software, to which it's optimized, to hardware.

"The issue with [existing cryptographic algorithm] options that were presented to me is that they're designed for software, so moving them into a hardware environment is not just challenging — it's inefficient. So I offered this new method, which is designed specifically for hardware and is a lot more efficient than the other two methods. It's also very fast," he explained.

"There's a lot of uncertainty about where the field's going to go," Magyari continued. "The typical tools that we use to secure our data today have been tested over decades. The new algorithms that we're standardizing and designing haven't been tested the same way. I think we're going to see a lot of rapid change over the coming years. It's hard to say where things will be in five to ten years, but it's pretty safe to say that they won't be where they are now because the field is changing so rapidly."

"I think there's a lot of value in furthering post-quantum cryptography," he concluded. "I don't just think it's something that's interesting; I think it's something that's necessary."

*UH grad Magyari's recent publication in Electronics, "Hardware Optimized Modular Reduction", sets the stage for a tumultuous decade ahead in the field of quantum computing and cryptography.*



# MAE Capstone Group DESIGNING ADAPTER FOR NASA

**BY STEPHEN GREENWELL**

For their capstone project, a group of students in the Mechanical and Aerospace Engineering Department at the University of Houston's Cullen College of Engineering is designing, fabricating and testing a dynamic adapter that attaches to a device being developed by NASA's Marshall Space Flight Center (MSFC).

According to the group, H.O.R.I.Z.O.N.S. aims to deliver a dynamic connection between NASA's experimental Domed-Shaped Device (DSD) and an UR-series robotic arm that will allow the DSD to dynamically tilt 30 degrees circumferentially to account for irregular terrain.

The team consists of **David Whaley**, **Cory Crow**, **Ashton West** and **Charity Golleher**. All four are MAE students at Cullen. Their advisors for the project are **Karolos Grigoriadis**, Hugh Roy and Lillie Cranz Cullen Endowed Professor & Department Chair, and the Director of the Aerospace Engineering Graduate Program; **Farah Hammami**, Instructional Assistant Professor in Mechanical Engineering; and Brandon Phillips, the team lead for the NASA MSFC Electrostatic Levitation Lab.

As part of the Capstone Experience, students are tasked with identifying problems and designing a viable solution. Funding isn't provided, so students are heavily encouraged to network with external groups and companies to secure support for their projects.

*From left to right: Chairty Golleher, Cory Crow and David (Ben) Whaley working in the NASA MSFC Electrostatic Levitation Lab.*

H.O.R.I.Z.O.N.S. was able to pursue this opportunity by leveraging the connections that Whaley made with his previous NASA internships. Thanks to the support of Grigoriadis and Phillips, the team was able to receive sponsorship for this capstone project and the opportunity to test it at MSFC's Lunar Terrain Field.

The objective of the capstone project is to develop an adapting mechanism between the UR-Series arm and DSD to deliver circumferential actuation by utilizing Shape Memory Alloys (SMAs). This technology was chosen in collaboration with our advisors.

Additional objectives included conducting Finite Element Analysis (FEA) on the design to identify and mitigate stresses at critical design locations; fabricating a scaled 3D-printed and machined prototype of the adapting mechanism; and testing the prototype for operational dynamic performance in dusty environments at UH and MSFC.

Engineering analyses for the project started during the Fall 2024 semester. Since the start of the spring semester and phase II of the capstone, H.O.R.I.Z.O.N.S. has successfully demonstrated benchtop SMA control and actuation, as well as completing fabrication of both the 3D-Printed and Machined 6061 Al Prototypes.

During UH's spring break, the H.O.R.I.Z.O.N.S. team travelled to NASA's MSFC in Huntsville, Alabama. There, the team successfully validated the adapting mechanism's ability to integrate to a UR5e robotic arm mounted to a NASA MSFC owned mobile ClearPath Robotics Husky Rover.

Since returning, the team has finished constructing a dusty chamber to examine and validate the mechanism's ability to withstand the presence of abrasive particles and upgraded the controllability of the device by implementing a wireless Bluetooth controller. The team has also completed their validation requirements and are set to present the project during the Capstone II Poster Session.

*From left to right: Brandon Phillips - NASA MSFC ESL Lab Lead, Charity Golleher, David (Ben) Whaley, Ashton West, Cory Crow and Irene Prado - NASA MSFC ESL Technician*

# TRANSFORMING HOUSTON AND BEYOND

## ELIZA PAUL HONORED AS DISTINGUISHED UH ALUMNA

BY ALEX KEIMIG

**Described as "a trailblazer in civil engineering," former TxDOT Houston District Engineer Eliza Paul (M.S. '88) has spent the better part of the last four decades directly shaping Texas and Houston-area infrastructure. Paul was recognized this year with the UH Alumni Association's Distinguished Alumni Award, which honors individuals whose professional accomplishments bring credit to the University of Houston.**

"I was totally surprised – really shocked," she said. "There are a lot of deserving alumni out there, so I feel really honored, and at the same time, humble. I still don't know why they picked me, but I'm very grateful and glad to accept the honor."

Perhaps it was the several multibillion-dollar projects Paul oversaw in her time with TxDOT, including the $11 billion I-45 North Houston Highway Improvement Project – the largest in TxDOT history – that caught their attention, or perhaps it was her overall lifelong dedication to the betterment of Houston's communities.

### FROM THE GROUND UP

"I started out in what they call the lab. They do a lot of materials testing for the highways, but also the geotechnical design of things like bridge foundations and stability analysis. After a couple of years, I wanted to go out into the field to learn more about the projects we build and get involved in the day-to-day construction part of things," she said.

Working in the Greater Houston area presented unique challenges in contrast with Paul's oversight in Houston proper. In Harris County, she worked most closely with the City of Houston: one mayor, one city manager, one city engineer. In Brazoria County – which is geographically smaller yet more complicated due to the density of communities like Pearland, Alvin and Sweeney each having their own mayor and city manager – a great deal of coordination was required to complete similar large-scale projects.

Paul went on to serve as Director of Construction and then Deputy District Engineer for the Houston Area, comprising Brazoria, Fort Bend, Galveston, Harris, Montgomery and Waller counties, where she oversaw operations during Hurricane Harvey, Winter Storm Yuri, the 2024 derecho and Hurricane Beryl.

"During all of those events, we had to deal with both the constituent cities and counties as well as CenterPoint Energy, the US Coast Guard and FEMA to try to bring the region back to what we needed. It's not just one person," she said. "We had a really good team at TxDOT; I had a good team of people helping me in each of our counties, areas, and groups. There are a lot of people working together to make this whole engine work. It's a team effort, and everybody is putting in their fair share of work to make TxDOT successful."

### THE VIEW FROM THE TOP

To pursue her master's degree in civil engineering, Paul came to Houston from the UK after completing her bachelor's degree at the Imperial College of Science and Technology at the University of London. Growing up in Hong Kong, she " always wanted to build things – building was always on [her] mind."

"My parents originally came from Mainland China, and they escaped communism during the Cultural Revolution in the 60s. They went to Hong Kong with very little – only what they could carry with them. They left everything to build a home for me and my brothers and sisters," she said. "I will always remember – my mom told me that you cannot carry everything with you, but you can always keep your education with you, and nobody can take that away.

"When you're coming from overseas, you come in not expecting too much," she continued. "You try to do the best you can in a totally new land, and here the university gives you that opportunity to excel, and to get a good education – which is the foundation of getting a good job – and contribute to Houston and the surrounding area, wherever you go. There's a lot of community involvement and want to try to give back to UH, and the city of Houston, and to Texas as well.

"When I first came here, I never could have imagined that I was going to be the District Engineer of TxDOT, overseeing six counties and all the billions of dollars of projects that we do. [But] UH is a university that really helps their students. The environment is geared to allow people to work and to study, to continue their education and get something good out of that."

Paul credits that design for the number of successful Cullen College alumni who are eager to give back to the university and to their community, as well as for her own success.

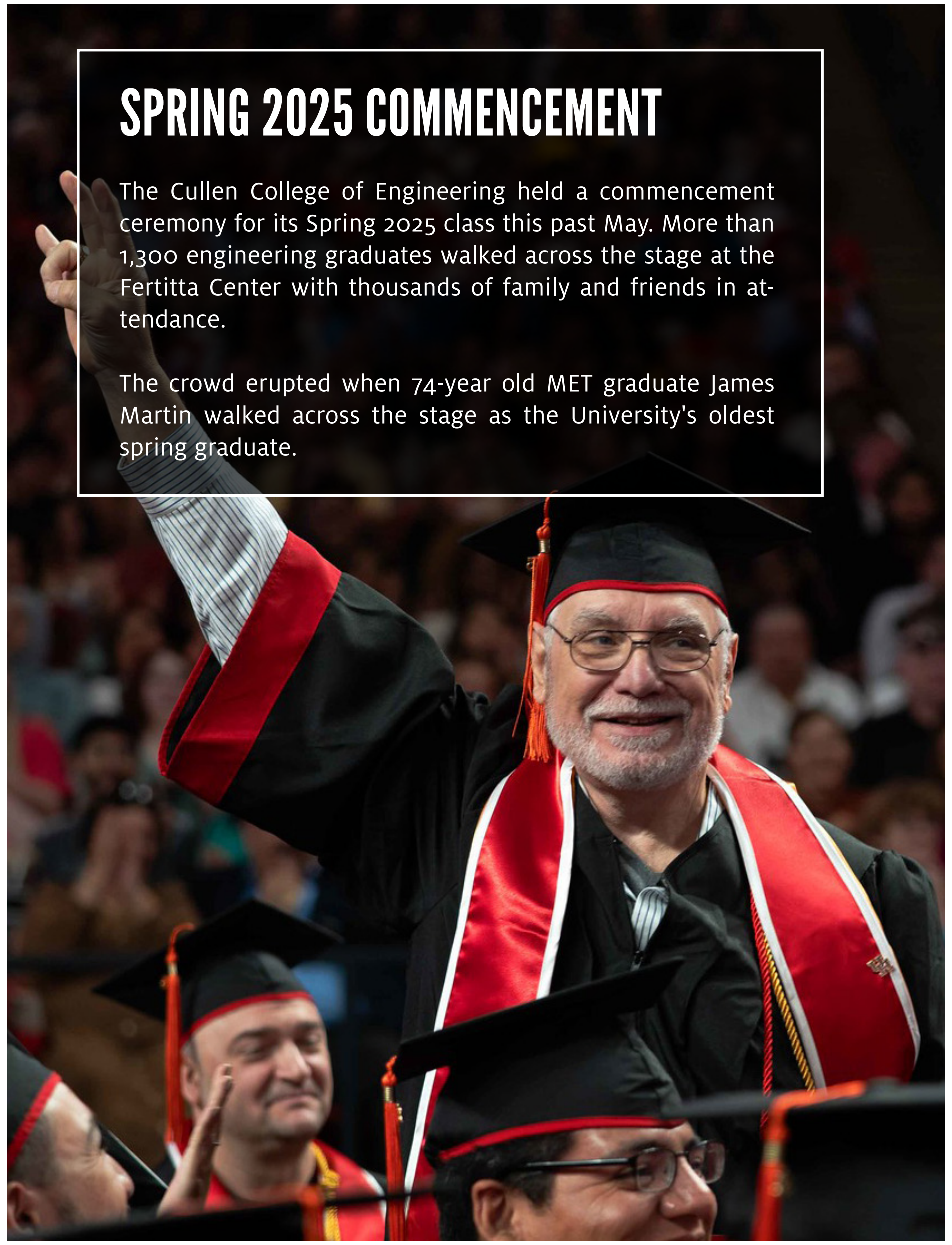
In fact, in addition to her professional history helping to build today's Houston, Eliza Paul and her husband Dennis Paul – a fellow Cullen alum as well as a Texas state representative – have enjoyed finding additional ways to nurture their Houston engineering community. In their spare time, they've visited middle and high schools to encourage students – especially girls – to pursue an education or career in STEM.

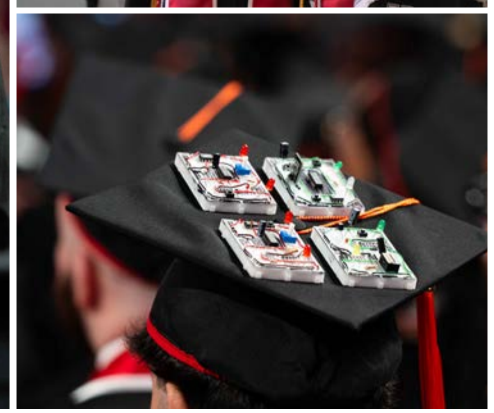
"Dennis ended up being a politician, and I ended up working for on infrastructure for the state with TxDOT, but we both continue to want to develop the next generation of engineers. Both of us are very grateful to UH and Cullen College, and we want to give back to the community that helped us grow."

# SPRING 2025 COMMENCEMENT

The Cullen College of Engineering held a commencement ceremony for its Spring 2025 class this past May. More than 1,300 engineering graduates walked across the stage at the Fertitta Center with thousands of family and friends in attendance.

The crowd erupted when 74-year old MET graduate James Martin walked across the stage as the University's oldest spring graduate.



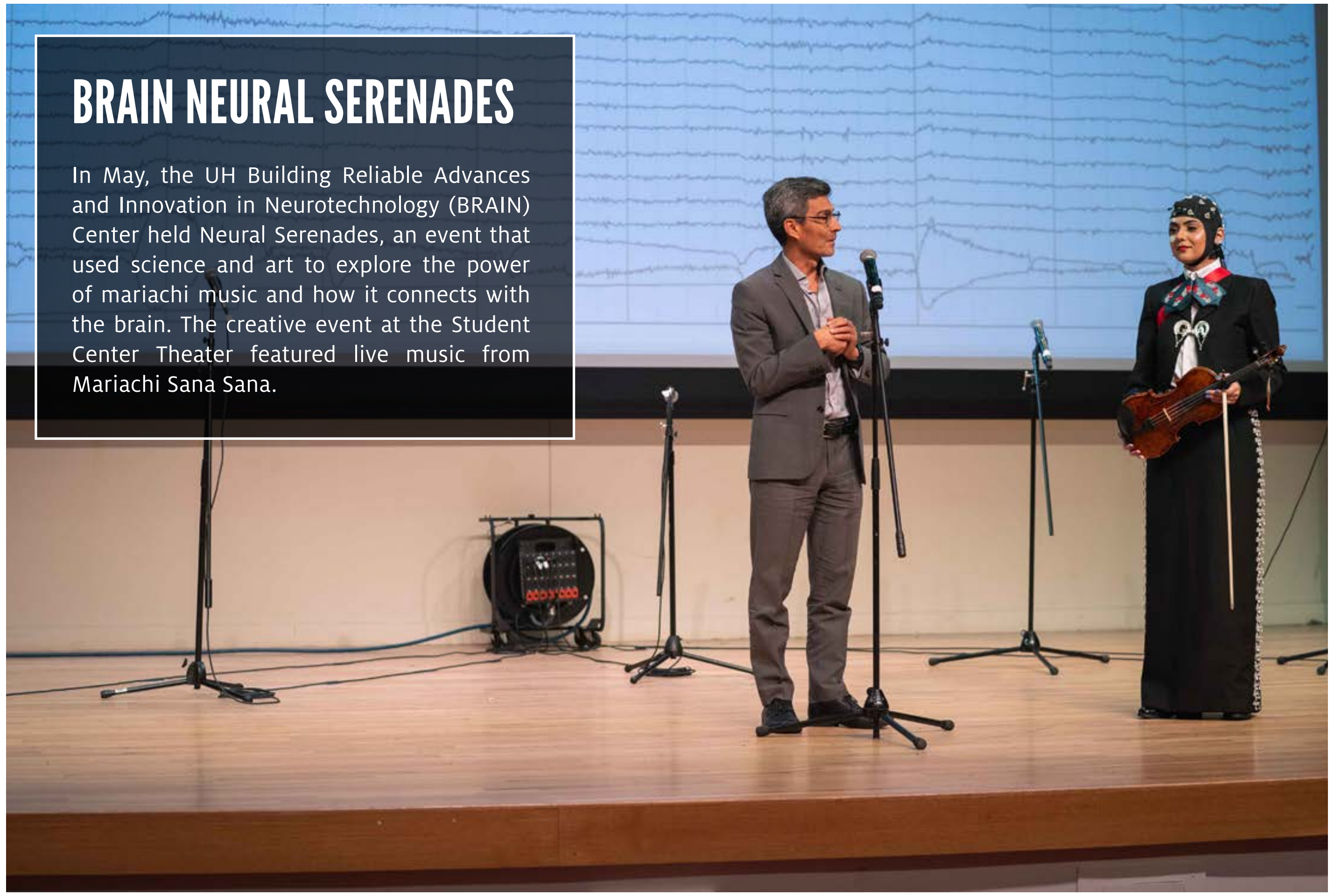



# EAA INDUSTRY AWARD NIGHT

A total of 25 students from different organizations received more than $13,000 in scholarships and awards at the 2025 Industry Awards Night. The event was hosted by the University of Houston's Engineering Alumni Association at the Athletic/Alumni Center in March.

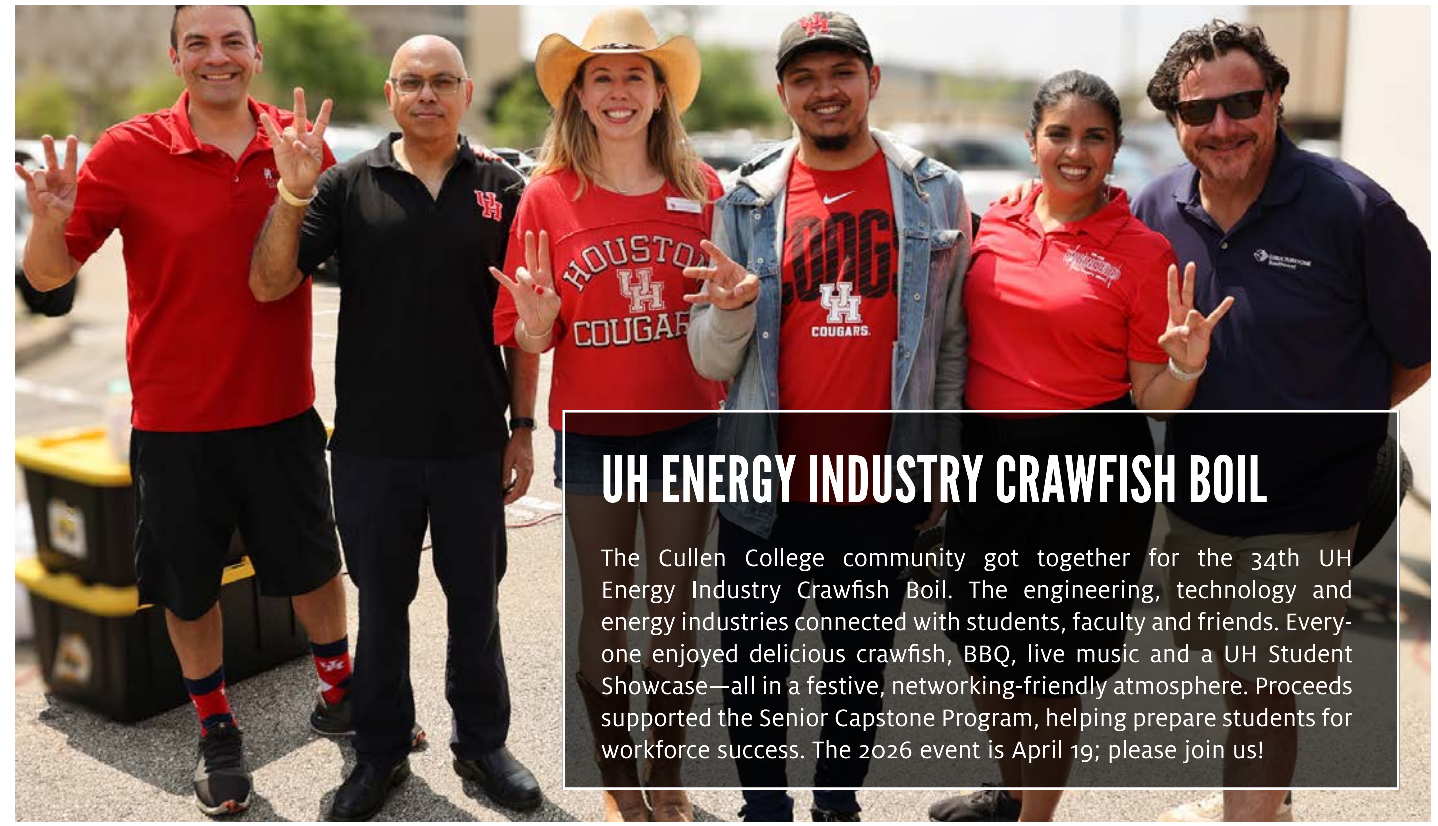
# BRAIN NEURAL SERENADES

In May, the UH Building Reliable Advances and Innovation in Neurotechnology (BRAIN) Center held Neural Serenades, an event that used science and art to explore the power of mariachi music and how it connects with the brain. The creative event at the Student Center Theater featured live music from Mariachi Sana Sana.




# UH ENERGY INDUSTRY CRAWFISH BOIL

The Cullen College community got together for the 34th UH Energy Industry Crawfish Boil. The engineering, technology and energy industries connected with students, faculty and friends. Everyone enjoyed delicious crawfish, BBQ, live music and a UH Student Showcase—all in a festive, networking-friendly atmosphere. Proceeds supported the Senior Capstone Program, helping prepare students for workforce success. The 2026 event is April 19; please join us!



# THE ADVENTURE OF RESEARCH

## *THE ENGINES OF OUR INGENUITY*

Today, let's think about research. The University of Houston presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

Oh, how we misuse that word! We learn something on the Internet and we call that research. Research is so much more. The word comes from the Latin word for circus. That meant circle. Researchers must circle around a subject – try this, fail and succeed, until they finally know something wholly new.

Research has an odd kinship with the word error – from the Latin errant, which meant "to wander" – to deviate from the path – to circle about, until we arrive. Error has to lie on our path to understanding.

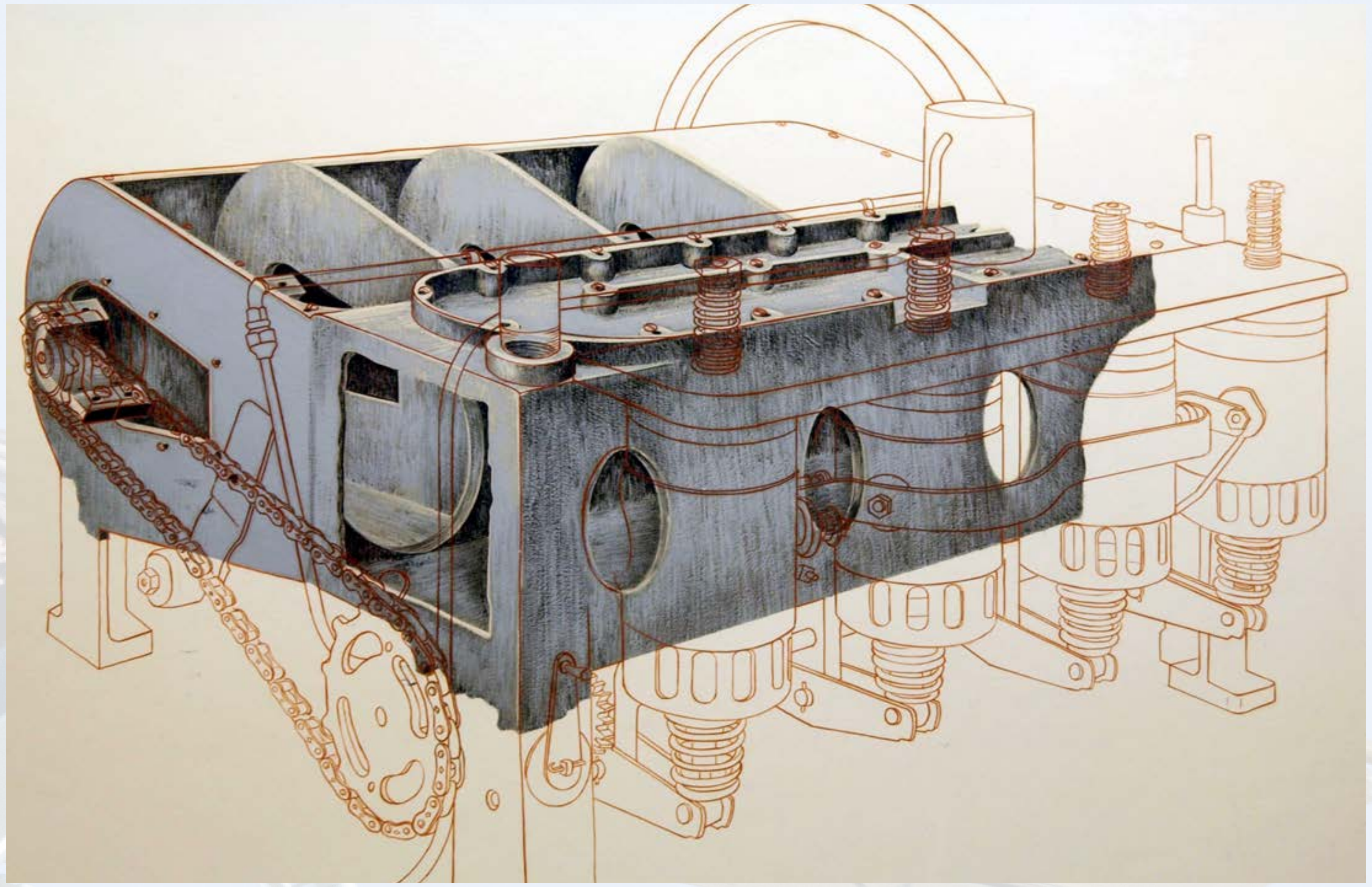
Research and universities are fit companions. This is where we learn that the truth is complex – that the shortest path is rarely a straight line. We cannot know the route to truth ahead of time. The whole reason for having universities is to equip us to ask the second question.

Think about flight: Engineering design must be served by research. Example: I recently rode in a Fieseler Storch – Germany's WWII liaison airplane. Our armies, like Germany's, needed to ferry supplies, messages, wounded, and more. So, we simply pressed our small private planes, like Piper Cubs, into service.

But the Germans had started from scratch before the war. Their trained engineers did their research as to how such airplanes must be built. So, their Storch could take off and land on a dime. It could hover at very low speed. It even looked like a skinny, long-legged stork.

War is not friendly to research. We need answers right now in wartime. So, we make quick, imperfect decisions. Germany already had the better liaison airplane. But we had no time for research. We had to make do with what we already had. Of course, each side had war machines that were carefully thought out.

And, speaking of flight, I give you the Wright Brothers. They weren't college-educated. But they did understand research.



They spent five years studying the mechanics of flight before they went to Kitty Hawk to build their airplane. Then they spent an-other three years doing research on site. They failed, studied, and eventually succeeded.

And that was just the beginning. Flight feeds on constant academic research. All my life I've been surrounded by that work. And by so much more.

Here in Houston, our university research serves a vast world at large. But it's also shot through our own medicine, space program, energy industry, art, music, and so much more.

Research is an adventure. We enter a terra incognita. We seek out our ignorance. And, finally: We find means for knowing what no one knew before.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

*John Lienhard*

*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.*

*Watch this edition of Engines Of Our Ingenuity on our YouTube Channel:*

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