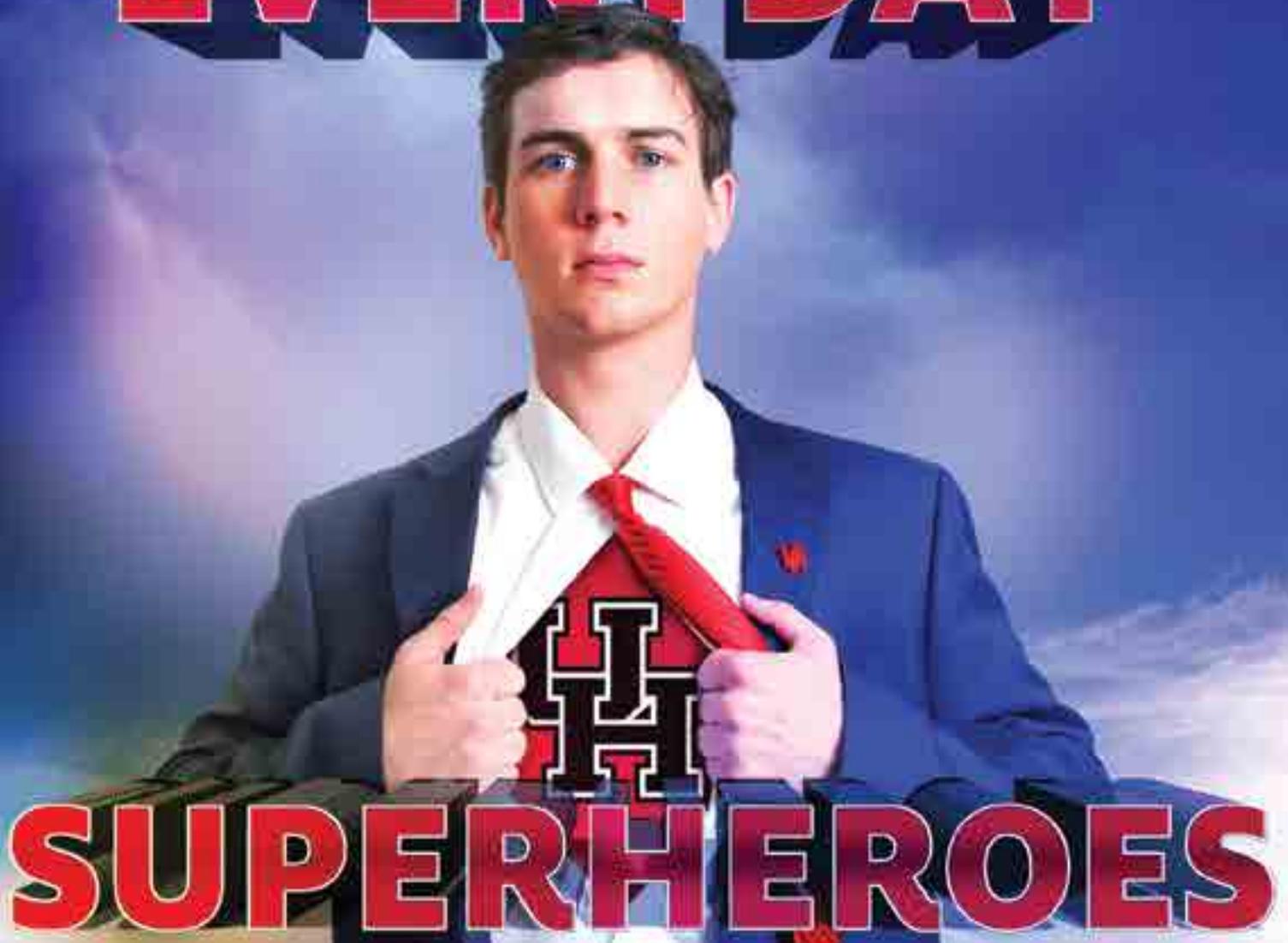


UNIVERSITY of HOUSTON | ENGINEERING

PARAMETERS

Cullen College of Engineering Magazine • Fall 2018

EVERYDAY



SUPERHEROES

THE LEAGUE OF EXTRAORDINARY ENGINEERS



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EVERYDAY SUPERHEROES:

THE LEAGUE OF EXTRAORDINARY ENGINEERS

Standing Strong



PG. 50

Power. Grace. Wisdom... and Water

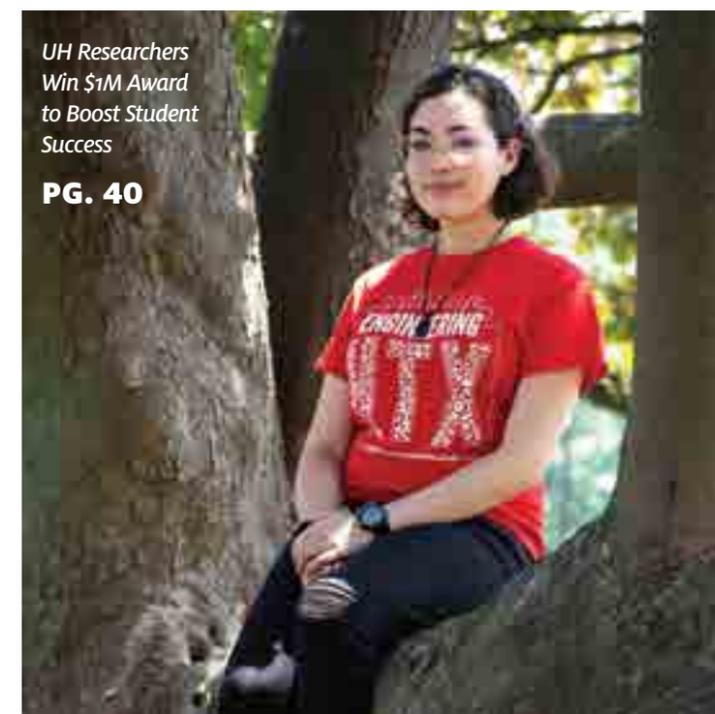


PG. 54

Breaking Down Walls to Build Futures

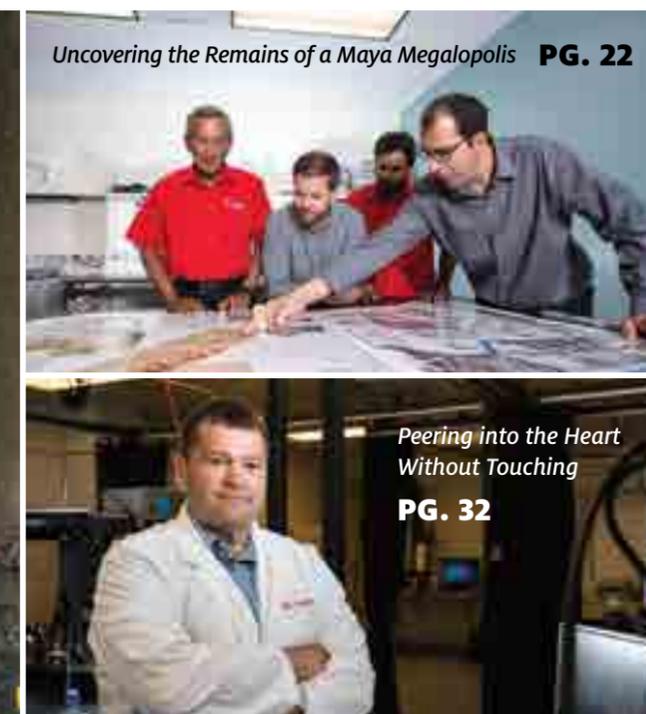


PG. 60



UH Researchers Win \$1M Award to Boost Student Success

PG. 40



Uncovering the Remains of a Maya Megalopolis

PG. 22



Peering into the Heart Without Touching

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DEAN'S LETTER

It was in the midst of the Great Depression, during the early years of World War II, when their names were first engraved into the American psyche: Superman, Batman, Wonder Woman and Captain America.

In the late 1930s through the 1940s, when the American Dream may have seemed more like an illusion to many, these comic book superheroes embodied the hopes of millions of Americans suffering from loss, starvation and the effects of war. They captivated the minds and imaginations of a desperate nation, eager to envision a light at the end of dark times – a future that was worth fighting for.

Comics offered just the kind of fantasy we could escape into: heroes taking a stand against villainy, helping those who need it most and restoring justice to an unjust world.

But it wasn't just the fantasy of comic books that captivated our attention. Superheroes were real people with average jobs and lives: Wonder Woman is military secretary Diana Prince; Batman is businessman Bruce Wayne; Captain America is frail U.S. soldier Steve Rogers; and Superman is introverted journalist Clark Kent.

If you're like me, you probably feel more like Clark Kent than Superman – but the bespectacled and ordinary Clark Kent could find the strength to overcome incredible challenges, to rise above his fears and accomplish extraordinary feats.

This notion of heroism – born more than 70 years ago during the Golden Age of Comics – remains alive and well to this day, inspiring one big screen blockbuster after another. And the most enduring message of

the superhero fantasy remains: That the superhero isn't fantasy at all.

Heroes exist everywhere, all around us. And the University of Houston Cullen College of Engineering has a superhero lineup that could rival any comic book universe.

These heroes – ordinary people who choose to do extraordinary things – embody the best qualities we all share as humans: morality, strength and a determination to protect the shared values of society.

They don't don capes, masks or spandex, but they do have superpowers. They are guardians of the megalopolis of Houston, protectors of humankind and inventors of tools and technologies that give them super-human abilities.

In this issue of *Parameters*, we introduce you to the everyday superheroes who are using the power of science to save lives, make the impossible possible, forge a better future and inspire others to do the same.

Warm regards,

Joseph W. Tedesco

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

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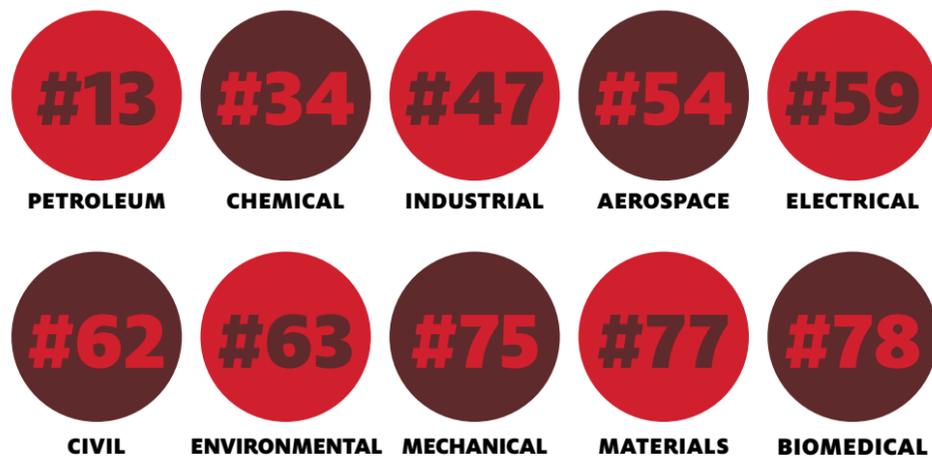
UH ENGINEERING BY THE NUMBERS



#69

BEST ENGINEERING SCHOOL IN THE NATION

TOP RANKING GRADUATE PROGRAMS IN:



(Source: U.S. News & World Report)

1,153 graduate students



3,061 undergraduate students



DEGREES AWARDED IN 2018

714 B.S.
+
378 M.S.
+
84 Ph.D.
=
1,176 TOTAL



15

National Academy of Engineering faculty members



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



1377

average SAT score of entering freshman



139 total faculty

\$26M+

annual research expenditures



\$104,640

average annual salary for engineers in Houston, Texas
(Source: U.S. Bureau of Labor Statistics, May 2017)

2018 AVERAGE ANNUAL SALARIES IN ENGINEERING

| | Median entry-level salary ¹ | Mean annual salary ² | Top 10% ³ |
|--------------------------|--|---------------------------------|----------------------|
| Aerospace | \$72,175 | \$115,300 | \$162,110 |
| Biomedical | \$62,170 | \$92,970 | \$142,610 |
| Chemical & Biomolecular | \$68,360 | \$112,430 | \$169,080 |
| Civil | \$58,838 | \$91,790 | \$138,110 |
| Computer | \$72,629 | \$119,650 | \$176,900 |
| Electrical | \$67,404 | \$99,580 | \$150,340 |
| Environmental | \$58,512 | \$91,180 | \$134,060 |
| Industrial/Manufacturing | \$62,063 | \$90,340 | \$130,930 |
| Materials | \$68,349 | \$98,610 | \$149,860 |
| Mechanical | \$64,695 | \$91,500 | \$133,900 |
| Petroleum | \$93,094 | \$154,780 | \$250,000 |
| Subsea | \$93,829 | \$106,347 | \$300,000 |

¹ Figures from payscale.com, June 2018

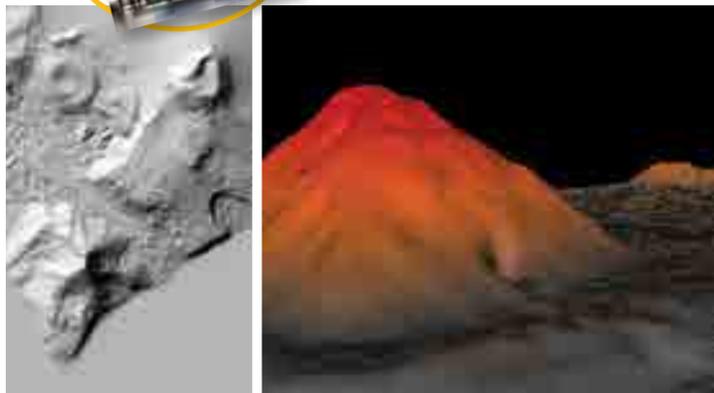
^{2,3} Figures from National Occupational Employment and Wage Estimates, U.S. Department of Labor, 2017

IN THE MEDIA **SPOTLIGHT**    

THIS UH RESEARCH CENTER IS REVOLUTIONIZING ARCHAEOLOGY



Published in *Houstonia Magazine's* May 2018 Issue



Houstonia.

In an article titled “This UH research center is revolutionizing archaeology,” *Houstonia* magazine shines the spotlight on the University of Houston’s National Center for Airborne Laser Mapping (NCALM) and its director, **Ramesh Shrestha**. The two are responsible for unearthing archaeological treasures hidden for centuries.

NCALM, jointly operated by UH and the University of California at Berkeley, is the only U.S. center of its kind that uses LiDAR (light detection and ranging) technology – laser pulses – to create detailed Earth renderings. Using these LiDAR-generated maps, NCALM researchers and archaeologists worked together to interpret the findings and uncover new discoveries, such as the ruins dubbed the “City of the Monkey God” in Honduras and the ruins of a megalopolis connected to the Mayan Snake Kings in Guatemala. Both of those discoveries generated worldwide media attention.

As seen in *Nature Outlook* | 08 March 2018



natureOUTLOOK

About 3.5 million people in America are living with some degree of paralysis related to stroke, multiple sclerosis or cerebral palsy. *Nature* magazine published an article in March about scientists developing technological solutions, such as neural prostheses or devices that read brain signals and help restore movement in paralyzed patients.

The article, titled “The mind-reading devices that can free paralyzed muscles,” prominently features **Jose Luis Contreras-Vidal**, professor of electrical and computer engineering, for his work to improve prostheses using brain-machine interfaces, or BMIs. It also mentions his role as director of the Building Reliable Advances and Innovation in Neurotechnology (BRAIN) Center, a collaboration between the University of Houston, Arizona State University and industry partners. The center is funded by a National Science Foundation grant.



The Cullen College’s “Lab to Market” video series spotlights the latest discoveries and inventions of its professors and students, as well as their journeys to take their ideas out of the laboratory and into the consumer marketplace.

UH mechanical engineer **Hadi Ghasemi** invented a new adaptive anti-icing material inspired by wood frogs, an animal that can freeze without dying. After years of testing and perfecting the material, Ghasemi and his students are ready to tackle their next challenge – getting their product into stores across the country.

“Our goal is to put this material on the shelves of stores like Home Depot so every consumer can buy and apply it themselves,” said Ghasemi, who founded the startup company SurfEllent at the UH Cullen College of Engineering based on his technology.

SurfEllent’s better than state-of-the-art coatings are able to repel ice for at least two years and can withstand critically low temperatures.

Anti-icing surfaces play a critical role in a wide range of industries, from transportation to energy. Planes skid off runways, cars slide across freeways and frozen power lines cause power failures – all potentially catastrophic events caused by ice.

“We have a solution that can address all of these problems and more,” said Ghasemi.

Ghasemi and his team are seeking funding to grow SurfEllent and its ability to manufacture the icephobic material.



National Geographic explores the brilliance and creativity of Pablo Picasso in an article titled “How Picasso’s journey from prodigy to icon revealed a genius.” A trailblazing, legendary artist, Picasso revolutionized the art world during his lifetime and continues to awe and inspire to this day.

The article mentions **Jose Luis Contreras-Vidal**, Hugh Roy and Lillie Cranz Cullen Distinguished Professor of electrical and computer engineering, who is conducting groundbreaking research at the intersection of art and neuroscience.

With funding from the National Science Foundation, Contreras-Vidal studies what happens inside of the brain as individuals create and contemplate art. In connection with this ongoing research, Contreras-Vidal and his team have recorded the brain waves of various artists – painters, dancers, chefs and musicians – while they created and performed to understand unique brain activity. His team has also peered into the minds of museum-goers while they viewed art exhibits and children while they played the popular computer game “Minecraft.”

Above: *Girl with a Mandolin* (Fanny Tellier, 1910) by Pablo Picasso



By the time students graduate from the UH Cullen College of Engineering, they have acquired the skills and training necessary to take on a variety of leadership positions across industry, academia and government.

But until then, UH engineering students can be found in leading internship and fellowship positions at top companies across the city of Houston.

A new video produced by the Cullen College’s Office of Communications showcases three UH engineering students who are working their dream jobs while earning their undergraduate degrees.

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



TOP 50 BY 2020

UH Engineering Rises in U.S. NEWS RANKINGS

BY RASHDA KHAN

The UH Cullen College of Engineering is several steps closer to landing a spot among the top 50 engineering colleges in America.

The latest *U.S. News & World Report* rankings place the Cullen College on the list of the Best Engineering Schools of 2019. It moved up from No. 73 in the year before to No. 69. The ranking is shared by Clemson University, Colorado State University, Tufts University and the University of Iowa.

Several UH engineering programs also earned the distinction of “Best Engineering Program of 2019.” The petroleum engineering program ranked No. 13, chemical engineering ranked No. 34, the industrial program was No. 47, the aerospace program was ranked No. 54, electrical engineering ranked No. 59, civil engineering ranked No. 62, environmental engineering No. 63, mechanical engineering No. 75, materials program was No. 77 and biomedical engineering ranked No. 78.

“The UH Cullen College of Engineering is experiencing and celebrating the most significant transformation in its history. This upward momentum is a testament to the quality of our faculty and students,” said



Named one of the

BEST ENGINEERING SCHOOLS IN THE NATION

BEST GRAD SCHOOLS
USNews
ENGINEERING 2019

Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College. “By 2020 the Cullen College will be ranked among the top 50 engineering schools in the country and will be known as a premier destination for engineering education and research.”

Over 4,200 students are enrolled in engineering courses – 3,061 undergraduates as well as 1,153 master’s and doctoral students in biomedical, chemical, civil, computer, electrical, environmental, geosensing systems, industrial, mechanical and petroleum engineering. The college also offers interdisciplinary graduate programs in subsea, aerospace, space architecture, materials, and computer and systems engineering.

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

Cullen College Celebrates LARGEST GRADUATING CLASS in History at Spring Commencement

BY INEZ HUTCHINSON

Nearly 700 world-class UH engineers walked across the NRG Arena stage to accept their diplomas at the Cullen College of Engineering spring 2018 commencement ceremony on Friday, May 11. The proud graduates included 463 bachelor’s, 174 master’s and 33 doctoral students.



Distinguished chemical engineer Heidi Alderman, senior vice president of chemical intermediates in North America at BASF Corporation, delivered the keynote address, offering words of wisdom and heartfelt career advice to the new engineers.

“Every job you have, make it uniquely your own,” she advised. “Don’t be in a hurry to jump from one job to another. Learn the job, make it better than the person who had the role before you, and find a way to make an impact there however you can.”



Other graduation speakers included UH Cullen College of Engineering Dean Joseph W. Tedesco; Fritz Claydon, director of the division of undergraduate programs and student success; and UH System Board of Regents member, the Honorable Durga Agrawal.

The Cullen College is home to a diverse community of students from a wide variety of backgrounds and cultures. Graduates at the spring commencement hailed from 43 different countries and ranged in age from 20 to 61 years old.

Marco Esteban Avendano Lopez was the youngest graduate to earn his degree. Lopez, age 20, graduated summa cum laude with a bachelor’s degree in petroleum engineering. At 61-years-young, Keith C. Lancaster earned his doctoral degree in electrical engineering – his third degree from the Cullen College. He received both his bachelor’s and master’s in electrical engineering in the 1990s. ✨

Biomedical Engineering Leaders Converge on UH for 5TH ANNUAL ‘BME DAY’

Leaders and pioneers in the biomedical engineering (BME) field gathered at the University of Houston this April for the fifth annual “BME Day,” hosted by the UH Cullen College’s biomedical engineering department.



The event, which was held at the UH Health and Biomedical Sciences Center, drew renowned speakers from academia and industry, including Ann Tanabe, CEO of BioHouston; Celeste Fralick, chief data scientist at McAfee; and keynote speakers Ted Berger, David Packer Professor of engineering at University of Southern California, and Colin Brenan, founder and chief commercial officer of HiFiBiO.

“BME Day” also provided senior BME undergraduate students the opportunity to present the results of their capstone projects and network with industry professionals, current faculty and BME graduate students.

Metin Akay, founding chair of the UH biomedical engineering department, said the purpose of the event is to “support, promote and strengthen the biomedical and healthcare engineering research and educational programs at UH and across the state of Texas.” ✨

Award-Winning ‘Parameters’ Magazine TAKES HOME CRYSTAL AWARD

The UH Cullen College of Engineering’s biannual *Parameters* magazine earned the American Marketing Association’s (AMA) Crystal Award for best public relations/communications newsletter. Finalists in the category included UH’s Bauer College of Business and Houston Methodist Hospital.



The AMA Crystal Awards are given to Texas’ top marketers in categories ranging from print and radio to website design and social media.

The Cullen College’s Office of Communications was recognized this May at the AMA Crystal Awards Gala – the largest marketing event in Houston, attracting more than 650 marketing professionals from almost every industry. ✨



University of Houston

BREAKS GROUND

on New UH Katy Campus

BY INEZ HUTCHINSON

SCHEDULED TO OPEN FALL 2019



After years of planning and anticipation, the University of Houston broke ground on its new campus in Katy this May. The UH Katy Campus, located at the northeast corner of the Grand Parkway and Interstate 10, will offer programs in high demand throughout the region – engineering and nursing.

“If you’re going to be University of Houston, you have to own Houston and the greater Houston area,” said **Renu Khator**, Chancellor and President of the University of Houston System.

The 80,000-square-foot building is slated to open its doors in fall 2019 as a direct extension of the UH main campus, but sporting its own modern look and feel. The flagship campus will offer undergraduate programs in computer engineering, construction engineering and systems engineering as well as graduate degrees in subsea, petroleum, environmental, power systems and corrosion engineering.

Roughly 600 undergraduate and 480 graduate engineering students are expected to enroll at the Katy campus next fall. The UH Cullen College is planning to increase its program offerings at the Katy campus in direct response to industry and workforce needs across the region.

“
If you’re going to be University of Houston, you have to own Houston and the greater Houston area.”

- RENU KHATOR, UH PRESIDENT & CHANCELLOR



 UH supporters and industry leaders gathered to break ground at the new UH Katy campus last May

“Given the demand for engineering talent across the greater Houston area, the expansion of UH engineering programs in Katy is both imperative and inevitable. The city of Houston needs a homegrown workforce trained to take on the engineering jobs of the future while filling in the skill gaps of today,” said **Joseph W. Tedesco**, Elizabeth D. Rockwell Dean of the UH Cullen College of Engineering. “That’s precisely what brings us here.”

Due to overwhelming demand for engineering programs in the area, the UH Cullen College began offering courses at the Houston Community College (HCC) Northwest campus in 2016. More than 15 graduate-level courses in subsea, petroleum, electrical, environmental and mechanical engineering are currently offered at HCC in Katy.

“The Cullen College has continued to grow in the Katy area thanks to the support of our partners at the Houston Community College Northwest Campus,” said Tedesco. “We are continuing to develop a relationship with HCC, because they will be important to us in being successful in offering courses that this community truly needs.”



DIVING DEEP

to Launch UH Subsea Engineering to New Heights

Q&A

With Subsea Engineering Program Director

BY RASHDA KHAN



When it comes to subsea engineering education, the University of Houston Cullen College of Engineering has a tradition of taking the lead.

UH started the country's first academic program in the discipline in 2011 and offered the first subsea engineering master's degree in 2012. In 2013, the Cullen College spearheaded the establishment of the Global Subsea University Alliance.

Now, seven years later, the subsea program is bigger, better and stronger than ever. Leading the charge is **Phaneendra Kondapi**, director of the program and a renowned pioneering instructor in the field. Here he shares his thoughts about the direction of the field and educating the next generation of subsea engineers.



PK: Subsea engineering in our context is petroleum engineering, but under the sea. It started out maybe 50 feet below the water around 60 years back, but now we're talking about 10,000 feet below the water and 20,000 to 25,000 feet below the seabed. That's where we're trying to bring the oil and gas up from and it's very challenging. In fact, subsea engineering is a multidisciplinary field. It involves mechanical, chemical, petroleum, electrical and civil engineering disciplines integrated together.

We're not talking about rocket science where you can see everything as it launches into the sky. You cannot see anything on the ocean floor, so the technology has to be very precise to avoid accidents. Engineers who create these technologies and work with subsea systems have to understand and appreciate the dynamic and unique challenges involved in the subsea environment.

Why did the UH Cullen College launch the subsea engineering program?

PK: The offshore industry has been waiting a long time to have such a program in the U.S. There was a strong need to develop subsea skills in potential engineers and there was no such program until the UH Cullen College of Engineering made it a reality in spring 2011.

Engineers and executives throughout the industry helped formulate the curriculum and joined the program's staff and advisory board. The University of Houston has become a pioneer in subsea engineering education and research because of the support from the industry. This program, developed by industry professionals and taught by industry experts, is designed to meet current and future industry needs and requirements.

It started with one course, "Flow Assurance," in 2011, and has grown into 14 courses over the years. In fall 2017, we started offering a new course called "Guide to Engineering Data Science" and a graduate-level certificate in data analytics because, again, there is an industry need for them.

In the oil and gas industry, they look at a lot of data from each and every aspect. Industry professionals study data collected during seismic surveys to decide where to drill; from equipment read-outs to ensure reliability, productivity and safety; and during the drilling process.

While the courses lean toward subsea engineering in terms of examples and problems used, the basics are the same, so any engineer can take the course. All engineers could benefit from knowing data analytics.

Being in Houston, we're right in the heart of the Energy Capital, and now we're also offering courses in Katy, which is right next to the Energy Corridor, so UH is the school best situated to offer a subsea engineering program. After all, we are Houston's Energy University.

UH is proud to partner with the oil and gas industry to create a program that is relevant and serves the needs of the industry.

“ I want to make the UH subsea engineering program the most relevant, comprehensive, dynamic and robust program in the world. ”

- PHANEENDRA KONDAPI

Who is the UH subsea engineering program geared toward?

PK: The program can benefit engineering students from any discipline who want to enter the field as well as working professionals who want to advance their knowledge and skills. We offer a master's degree in subsea engineering and two graduate certificate programs.

Students can take courses in Katy, at the UH main campus or online. We are a very flexible program.

What's next for the subsea engineering program?

PK: Our program is very successful, but the industry has changed its direction in the last three years and we have to respond to that. Our curriculum needs to change to reflect the industry dynamics and fit the current and future needs of the subsea market. It's our responsibility to stay ahead of the curve. The subsea engineering program prepares students to be industry-ready and



I'm proud to say we're the first such program to do so.

I want to reach a global audience in terms of students and working professionals with our offerings – someone sitting in Australia can earn their degree or certificate with our online classes. I also want to partner with corporations around the world and offer our students more knowledge and opportunities.

There are some exciting things we are planning to include in the program:

We are proposing three new dual master's degrees – petroleum engineering and subsea engineering, mechanical engineering and subsea engineering, and electrical engineering and subsea engineering.

We will also add two more graduate certificates to the program – a flow assurance certificate and a SURF (subsea umbilical risers and flowlines) certificate.

And we will offer a subsea engineering minor for undergraduates. Any undergraduate engineering student can opt for the subsea minor as long as the student qualifies for a minor.

All of these should be offered by spring 2019, pending approval from the University.

I want to make the UH subsea engineering program the most relevant, comprehensive, dynamic and robust program in the

world. And I want to make it available to every qualified prospective student across the globe.

Why should someone consider earning a master's degree, certificate or minor in subsea engineering from UH?

PK: 1. We are right in the Energy Capital of the World, so our students have access to plenty of job and internship opportunities.

2. Salaries are relatively higher than other engineering disciplines.

3. Now that the oil and gas industry is coming back up and prices are stabilizing, companies are looking for people with knowledge and skills in subsea engineering. UH is offering that skillset. Our subsea engineering graduates are prepped to enter and succeed in the industry upon earning their degrees.

The subsea engineering minor and certificates give students an edge when they are seeking jobs as fresh graduates. Companies will prefer them as candidates because it means those students already have some background knowledge and it'll reduce on-the-job training time.



ABOUT PHANEENDRA KONDAPI

With more than 20 years of experience managing engineering projects at energy industry giants FMC Technologies and KBR, Phaneendra "Phani" Kondapi brings a unique and invaluable skillset to his role as director of the subsea engineering program.

After serving as director of subsea engineering at Texas A&M University, Kondapi returned to UH in 2017 as the founding director of engineering programs in Katy. He is spearheading the expansion of UH engineering programs that are in high demand in Houston's Energy Corridor, including petroleum, subsea, civil, electrical and environmental engineering.

Kondapi, who was instrumental in developing the subsea program, also led efforts to standardize global subsea education through the University's Global Subsea Education Alliance. One of the pioneering instructors in the college's subsea engineering program, Kondapi began teaching the inaugural "Flow Assurance" course at UH in 2011.

He received the 2013 Teaching Excellence Award from the Society of Petroleum Engineers (SPE) International, which recognizes petroleum engineering faculty who have demonstrated innovative teaching techniques and creative pedagogy methods in the classroom. Most recently he received both the SPE Gulf Coast Region 2017 Projects, Facilities and Construction Award and the Distinguished Achievement Award for petroleum engineering faculty.

Kondapi holds a B.S. and an M.S. in chemical engineering from Andhra University in India and a Ph.D. in chemical engineering from Tennessee Technological University. ⚙️



NEW NATURAL GAS CATALYST

Would Boost Clean Transportation

BY JEANNIE KEVER

Thanks to advances in drilling technology, there is enough natural gas in the U.S. to last well into next century and beyond. This has renewed the idea of using inexpensive, domestically produced natural gas as a transportation fuel.

Primarily made up of methane, natural gas is a cleaner burning fuel than gasoline or diesel when it comes to hydrocarbons and nitrous oxides, but the undesired “slip” of unreacted methane can reduce that advantage because methane is a potent greenhouse gas.

The U.S. Department of Energy has chosen a team led by a UH chemical engineer for a \$2 million project to develop and optimize a lower cost, more efficient catalyst to eliminate unreacted methane.

Michael Harold, chairman of the department of chemical and biomolecular engineering, will work with **Lars Grabow**, associate professor of chemical and biomolecular engineering, and researchers from the Oak Ridge National Laboratory, the University of Virginia and CDTi Inc., an emissions technology company based in Oxnard, California.

Natural gas combustion produces far less carbon dioxide than gasoline or diesel combustion. Methane – the primary component of natural gas – wasn’t considered a concern until recently, partly because it hasn’t been associated with the health risks linked to carbon dioxide. But it is a much more powerful greenhouse gas than CO₂, making an effective catalyst crucial for wider adoption of natural gas vehicles.



MICHAEL HAROLD AND LARS GRABOW ARE HEADING A \$2 MILLION PROJECT TO DEVELOP A LOWER COST, MORE EFFICIENT NATURAL GAS CATALYST

Harold, an expert in catalytic reaction engineering, said the team will focus on the so-called “four-way catalyst,” building on the three-way catalysts used with gasoline and diesel engines. Those simultaneously convert nonmethane hydrocarbons, carbon monoxide and nitrogen oxides. The new catalyst will also convert methane.

A critical aspect of the work is to reduce the use of precious metals, lowering the cost. Traditional vehicle exhaust catalysts rely on platinum, palladium and rhodium, which are effective but expensive.

The new four-way catalyst will test the use of metal oxides containing lower cost elements iron, cobalt, copper, manganese, nickel and others. Those metals are less effective, as well as less expensive, and Harold said the design may still require the use of a small amount of precious metals to meet emission control targets. CDTi’s Spinel™ technology will be a key element in developing a new class of high-performance catalysts with low levels of precious metals for natural gas engine emissions control.

The process is likely to involve the development of a new material, work Grabow will pursue using atomistic computational

“We’re working on something that’s important for the country.”

- MICHAEL HAROLD

modeling, while CDTi’s Steve Golden will lead the catalyst development and commercialization effort.

“The project brings together a significant market opportunity with our innovative Spinel materials, coupled with the state-of-the-art characterization and testing capability of the University of Houston and the other key partners,” Golden said.

Once a prototype has been synthesized and tested with simulated exhaust, Harold said it will be tested at the Texas Center for Clean Engines, Emissions & Fuels – a research, development and testing center based at the UH Energy Research Park.

“We’re working on something that’s important for the country,” Harold said. “We have a surplus of natural gas, and we are helping break down barriers for its expanded use.”

From Exploding Hoverboards to TOMORROW’S BATTERIES:

UH Engineering Research Lands Journal Cover

BY RASHDA KHAN

A paper about safer batteries made with organic materials written by a team of researchers at the UH Cullen College of Engineering made the cover of one of the world’s most prestigious chemistry journals – *Angewandte Chemie International Edition*, published by German publisher Wiley-VCH.

The paper, “Tailored organic electrode material compatible with sulfide electrolyte for stable all-solid-state sodium batteries,” is authored by **Yan Yao**, associate professor of electrical and computer engineering. The primary authors of the paper are two post-doctoral researchers in Yao’s group, Xiaowei Chi and Yanliang Liang.

“It’s gratifying that our paper was selected by the editor to highlight,” Yao said. “In this work we demonstrated an all-solid-state sodium battery using organic electrode materials for the first time.”

The project was inspired by exploding hoverboards – technically more of a self-balancing two-wheeled scooter – from a few years ago. Hoverboards are powered by conventional lithium-ion batteries, which use a flammable liquid electrolyte that can overheat, causing the boards to burst into flames. Yao was interviewed by Houston’s KHOU 11 News on this topic in 2015.

Yao and his team have embraced the challenge of creating better, safer and cheaper batteries. The team specializes in the creation of next-generation batteries that use abundant, low-cost organic materials. In the cathode, the team used quinones – which can be synthesized from plants and food like maize or soybean – to increase energy density, chemical stability and overall safety. For the anode, they’re using sodium, a material

“We’re proud that we can show these materials are not just novelties, but are actually even better than the materials we use today.”



- YANLIANG LIANG

that’s more readily available in the Earth’s crust than lithium.

“I think most people in the battery community see these kinds of materials as novel materials,” Liang said. “We’re proud that we can show these materials are not just novelties, but are actually even better than the materials we use today. These are materials that people should care more about.”

The team is first to make solid-state sodium batteries with a demonstrated record of recharging stability. While most solid-state sodium batteries diminish rapidly after 15 charging cycles, this new battery has gone for about 400 cycles, Yao said.

These solid-state batteries could benefit a range of industries including renewable energy, transportation and personal electronics. However, Yao expects the new batteries will initially be used in high-end products like luxury electric vehicles – something that could happen in three to five years.

The project was funded by the Advanced Research Projects Agency-Energy OPEN 2015 and the Department of Energy’s Battery500 Consortium.

Other Cullen College students who contributed to the battery development are Fang Hao, Ye Zhang, Hui Dong and Pu Hu.

The team also includes collaborators from the University of Colorado Boulder.

Last year, Yao’s group published a technical breakthrough on aqueous batteries in *Nature Materials* using inexpensive quinone materials. To further explore the fundamental mechanism in aqueous batteries, Yao teamed up with Jahan Dawlaty of the University of Southern California and Puja Goyal of SUNY Binghamton. The team recently received a Scialog Award from the Research Corporation for Science Advancement (RCSA) to understand how protons behave within the crystalline lattice of organic crystals.

Learn more in *Angewandte Chemie International Edition*



Inspired by Hollywood's 'Deepwater Horizon,' Researcher Targets

EQUIPMENT FAILURE

BY RASHDA KHAN



Equipment failure in capital-intensive industries such as oil and gas has serious consequences – from loss of assets and production time to environmental impact and even loss of life.

The BP Deepwater Horizon blowout and oil spill of 2010 is often held up as an example of catastrophic disaster: 11 people died, millions of barrels of crude oil spewed into the Gulf of Mexico covering 68,000 square miles and innumerable birds and marine animals perished.

The devastation and the heroic accounts of the survivors of Deepwater Horizon inspired a movie of the same name in 2016.

Sitting in the dark and watching the big screen fill with explosions, roiling smoke,



“The movie motivated me to dive in deeper and think about how we could come up with a meaningful grant proposal.”

- QIANMEI (MAY) FENG

flames and fireballs as the backdrop for personal stories inspired by the accident had a big impact on **Qianmei (May) Feng**, an associate professor of industrial engineering.

“We are in Houston, where there’s always talk about energy, oil and gas, so I’d been

thinking about how to apply my knowledge and my research in that area for a long time,” Feng said. “But I hadn’t found that right connection.”

Feng realized that while risk couldn’t be eliminated entirely, it could be mitigated.

Feng’s research about failure analysis, failure time prediction, reliability modeling and maintenance work could be applied to drilling equipment that operate in harsh and dynamic environments.

“That movie motivated me to dive in deeper and think about how we could come up with a meaningful grant proposal,” Feng said.

The project

Her hard work paid off in the summer of 2017 when the National Science Foundation awarded Feng and her collaborator, Yisha Xiang, an assistant professor of industrial engineering at Lamar University, \$627,102 for a four-year research project.

Feng and her team will work with Schlumberger, American Bureau of Shipping and General Electric to explore equipment failures in capital-intensive industries, specifically the oil and gas industry, to come up with better models for maintaining equipment and reducing failures.

She is excited about applying the team’s efforts to real-world data sets.

“Hopefully by using the data we have from the industry and mathematical tools, we can come up with a solution to help with their maintenance decision-making,” said Feng, who specializes in statistics as well as quality and reliability research.

“Being in Houston with different connections to oil and gas companies, we have the access to people in those companies who have data and who have domain knowledge,” she added.

“I felt like I could do something important to help. We can’t eliminate human error, so we try our best to make the equipment as safe as possible.”

- QIANMEI (MAY) FENG



Impact

Feng hopes the research project will provide insights about:

- How to predict the failure time of equipment from signs of fatigue or other degradation signals so that the problem can be addressed before the equipment breaks;
- When and what preventive action – such as an inspection or a part replacement – should be taken.

All this information should help achieve greater efficiencies and help extend the equipment life while creating a safer work environment.

There will also be cost savings.

The energy industry invests heavily in high-cost, long-lived assets – oil fields or power plants – with lives measured in decades. As such, equipment failure, loss of assets and lost production hits the bottom line hard.

Investigations show that the majority of accidents and economic losses in these industries were caused by equipment failures, Feng said.

“We would be making equipment more efficient and taking preventive actions in a timely manner, which would reduce all the related costs,” she said. “Instead of fire-fighting and dealing with a critical failure cost, they would be dealing with minor inspection and replacement costs... so that should dramatically reduce the companies’ expenses.”

To Feng, a piece of equipment is just like a car – one has to maintain it to keep it reliable and make it last. She wants companies to stop “fire-fighting,” or addressing issues reactively, and instead take proactive measures that head off major problems.

“You want to take care of your car before it breaks down somewhere,” she said. ⚙️

UH Researchers Help Archaeologists Find the Remains of a

MAYA MEGALOPOLIS

BY JEANNIE KEVER



Aired Tuesday, Feb. 6, 9/8c



From left: NCALM director Ramesh Shrestha with researchers Darren Hauser, Abhinav Singhania and Juan Carlos Fernandez-Diaz



Archaeologists and adventure junkies are buzzing about the announcement of previously unknown ruins of a complex Maya settlement hidden for centuries amidst the jungles of Guatemala.

Researchers at the National Center for Airborne Laser Mapping, or NCALM, said the discovery of tens of thousands Maya structures (temples and houses), sophisticated agricultural systems and other human-made features as well as a huge increase in population estimates wasn't the result of luck or technological voodoo. It was instead the latest research-based reporting using airborne light detection and ranging technology, or LiDAR.

The findings, described in a documentary that aired on the National Geographic television channel, offer a vivid illustration of the ways in which LiDAR has expanded the discipline of archaeology, providing a bird's-eye view of ancient sites that are far more difficult to survey on the ground.



DID YOU KNOW?
LiDAR information was gathered

over **8** days
and **44** hours of flight,
covered over **2,100** square kilometers
and involved **38 BILLION** laser pulses

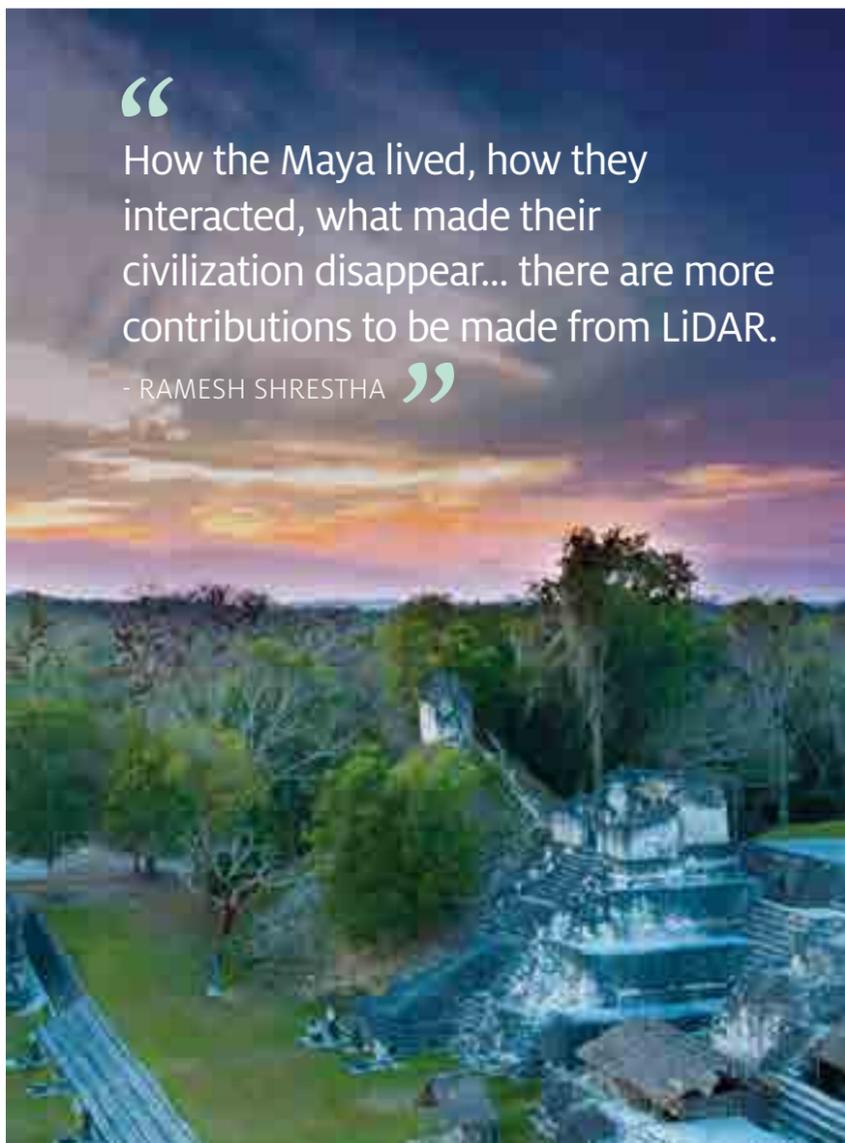
NCALM is based at the University of Houston and jointly operated by UH and the University of California at Berkeley.

Portions of the ruins showcased in "Lost Treasures of the Maya Snake Kings" had already been documented by archaeologists when the Guatemalan cultural and environmental nongovernmental organization Fundación Patrimonio Cultural y Natural Maya, or PACUNM, contracted with NCALM to map the region in 2016.

But previous explorations had found only pieces of the puzzle. "Archaeologists were working on the ground in the summers, kilometer by kilometer," said NCALM director **Ramesh Shrestha**. "If the work had continued in the classical archaeological method, they would not have finished in their lifetimes."

LiDAR provided a fast and far more comprehensive view.

Airborne LiDAR is a remote sensing technology used to produce high resolution, three-dimensional maps. It works by firing hundreds of thousands of laser pulses per second from an aircraft flying at a relatively low altitude;



“How the Maya lived, how they interacted, what made their civilization disappear... there are more contributions to be made from LiDAR.”
- RAMESH SHRESTHA

a timing device measures the round-trip travel time, using that information to create detailed topographical maps.

It is used in a variety of applications, including archaeology, charting land erosion, mapping the sea floor and identifying levees in danger of failing. NCALM provides research-quality data for a variety of governments, agencies, scientists and private users.

The work in Guatemala wasn't NCALM's first archaeological survey; Bill Carter, chief research scientist and co-principal investigator for the center, said NCALM has provided archaeological data for about 20 other areas in Mexico and Central America since 2009.

“Little by little, we are putting together a picture of how the Americas were populated before the arrival of the Europeans, before Columbus,” said NCALM senior researcher Juan Fernandez-Diaz.

The Guatemalan project was the largest archaeological LiDAR project ever, covering about 2,100 square kilometers, or 811 square miles – more than one and a half times the surface area of the city of Los Angeles.

For the Guatemala project, the LiDAR information was gathered over the course of eight days and 44 hours of flight and involved 38 billion laser pulses. The plane was equipped with a state-of-the-art multispectral Titan MW LiDAR sensor, based on specifications requested by NCALM and developed by Teledyne Optech. It can emit up to 900,000 pulses per second.

Once the maps have been produced, NCALM researchers assist the archaeologists in interpreting the findings, including distinguishing between vegetation and other natural features and those that were built by humans, including ancient buildings, roads and agricultural systems. The Guatemalan project even showed evidence of water management systems used by the Maya, Carter said.

That interpretation, Shrestha said, “is the real magic.”

And he said there is more work to be done.

“How the Maya lived, how they interacted, what made their civilization disappear... there are more contributions to be made from LiDAR.”

BACTERIA-FUNGI INTERACTION

May Lead to Improvements in Crop Production, Sustainable Energy

BY RASHDA KHAN

While microorganisms like bacteria and fungi have coexisted for eons, there is still much to discover about them, their interactions and the benefits they offer the world.

“I'm an environmental scientist, so I want to tap existing natural resources, understand them and see how they can benefit us even more,” said **Debora Rodrigues**, associate professor of civil and environmental engineering at the UH Cullen College. “Such as the microbes that a lot of people don't actually appreciate – 99 percent of microbes are doing good things for us and we don't even know about them.”

Now, thanks to a research project funded by the U.S. Department of Energy, Rodrigues will have the opportunity to study bacterial-fungal fundamental interactions in soil.

Bacteria and fungi are integral to a healthy ecosystem. They can impact plant health, development and productivity, breakdown of contaminants, soil health, and sustainable agriculture and bioenergy production.

Rodrigues is part of an international team of researchers, including Patrick Chain and other researchers at Los Alamos National Laboratory; Jamey Young of Vanderbilt University; and Pilar Junier of the University of Neuchâtel in Switzerland.



“99%

of microbes are doing good things for us and we don't even know about them.”

”

- DEBORA RODRIGUES

“Science and engineering people tend to look at microorganisms separately and don't actually focus on their interactions,” Rodrigues said. “We're looking at a more cohesive picture because it's completely interconnected.”

The three-year grant is renewable and total funding for the project could add up to \$7.5 million. Rodrigues, who will be conducting related experiments in her laboratory, received \$508,286 of the funding.

Initially the team will be studying recently discovered bacteria that live inside fungal hosts as well as those that live separately, but in close association with each other.

She hopes to ultimately link these bacteria-fungi communities to plants and study those relationships.

“We want to understand how these interactions work and then how we can modify these functions to improve crop production and sustainable bioenergy production for our country,” Rodrigues said.

“This is a very novel field,” she added. “Any findings that we get will be very rewarding.”



SOLVING TEXAS-SIZED WATER PROBLEMS:

One Project at a Time

BY RASHDA KHAN

Texas has water issues.

Massive flooding caused by Hurricane Harvey nearly drowned Houston and other coastal areas. Over a year later, many residents across the Gulf Coast are still dealing with problems left in the wake of the floodwaters, such as contamination and damage. In West Texas, earth-cracking drought threatens the well-being of people and wildlife year after year. As the state's population continues to grow, the possibility of water scarcity becomes more and more tangible.

Researchers all over Texas are looking for ways to find solutions to these problems and stretch this precious resource. Three of them are University of Houston professors in the civil and environmental engineering department of the Cullen College of Engineering.

The Texas Hazardous Waste Research Center (THWRC) awarded the UH professors grants totaling \$32,650 to encourage alternative or innovative technologies that could improve the handling of hazardous wastes to better protect human health and the environment.



Devin Shaffer

Title: Enabling Reuse of Hydraulic Fracturing Wastewater Through Integrated Forward Osmosis and Reverse Osmosis Treatment

Amount: \$10,500

Water is already tight in Texas, and the growing shale gas development in the Barnett

(near Dallas/Fort Worth) and Eagle Ford (in South Texas) shale plays – two of the largest shale formations in Texas – are stressing limited resources even further, according to assistant professor Devin Shaffer.

“We’re looking at a way to potentially treat and reuse some of the produced water within the exploration and production framework instead of taking additional water,” Shaffer said.

Currently, the large quantities of wastewater produced from oil and gas operations are injected underground for disposal.

“In Oklahoma, disposal of this produced water underground has been linked to earthquake activity,” said Shaffer, who grew up in that state and clearly remembers experiencing seismic shifts in his parental home. “It was just a quick shake of the house, a sudden shifting, but it woke me up... that’s definitely a motivator.”

His research lab will build a mathematical model of a dual membrane treatment process targeting the wastewater from the Barnett and Eagle Ford shale regions. Shaffer is trying to understand the limitations on treating this water in terms of water quality as well as the efficiency of the treatment process.

Shaffer hopes the project will produce an economical way to treat and reuse produced water, which would make it attractive to the oil and gas industry, especially if water stress starts making water more expensive or less available in water stressed regions where they operate.

The THWRC grant provides critical seed money to start studying this area, Shaffer said. He hopes that as his team better understands the process and gains insights, this work can lead to further studies, experiments to validate the model and further exploration.

“It’s a topic that’s very relevant for Texas,” Shaffer said.



Cumaraswamy Vipulanandan

Title: Multiple Cathode Microbial Fuel Cell (MFC) with Integrated Nanotechnology and Solar Energy for Rapid Treating and Recycling Oily and Salty Wastewaters With the Production of Biosurfactant (Anode Chamber) and Algae Fuel (Cathode Chambers)

Amount: \$10,500

Professor Cumaraswamy Vipulanandan (Vipu), who invented the revolutionary “smart cement” designed to make offshore drilling and other construction safer, is also focusing on treating and recycling most of the wastewater produced by oil and gas operations and chemical companies.

Rapid development of unconventional natural gas resources in the deep shale is expanding in Texas and 28 other states in the U.S. with about 35,000 wells hydraulically fractured annually, according to Vipulanandan. This fracturing creates large volumes of wastewater contaminated with high concentrations of dissolved solids (like salt) and oil.

Vipulanandan wants to use the grant to develop an innovative multi-cathode microbial fuel cell (MFC) device integrated with nanotechnology and solar energy to rapidly treat the wastewater while producing useful marketable byproducts – biosurfactants (or soap), algae fuel and bioelectricity. The different chambers can hold different waste materials.

The project is based on previous UH research with promising results where the MFC technology reduced the salt content in the wastewater while also producing bioelectricity. Until now, the research team has worked on a two-chambered MFC device to rapidly treat salty water. The proposed device would have four chambers and takes a multidisciplinary approach.

Vipulanandan envisions there will be many future applications and said the end user could be industries, cities and even individuals.

“At the end of the day, waste is a big problem in our lives and you have to treat the waste in a cost-efficient way,” Vipulanandan said. “Basically you have to make the world better with your understanding. It takes time.”



Bill Rixey

Title: Impacts of Alternative Fuels on Groundwater Contamination and Vapor Intrusion

Amount: \$11,650

The use of ethanol (or alcohol) in gasoline has increased due to America’s renewable fuels program, and it comes with a growing concern about the potential for increased contamination of groundwater when spills or leaks happen, according to associate professor Bill Rixey.

“You have to make the world better with your understanding. It takes time.”

- CUMARASWAMY VIPULANANDAN

The THWRC grant-funded research will focus on higher ethanol content fuels than E10, the typical ethanol fuel currently in use, because the ethanol content in gasoline is expected to increase as the future ethanol renewable fuel use requirements increase.

Experts like Rixey expect the content change to potentially impact water quality because of increases in hydrocarbon concentrations and undesirable ethanol-related byproducts (such as volatile fatty acids and methane), as well as the potential for transport of methane and benzene to the soil surface. The generation of methane – if sufficient amounts of ethanol are released – brings the additional danger of potential explosions at the surface.

Rixey’s research will focus on spills of higher ethanol content fuels likely to occur at retail service stations. The goal of the study is to understand how the higher ethanol fuel content affects the release of ethanol into groundwater and the formation of byproducts, the impact on water quality, vapor intrusion and the possible risk of explosion.

The end results of the study will not only apply to ethanol, but will also be relevant to other alcohols being considered as alternative fuels.

This research is important to understand how ethanol impacts soil and groundwater, and to establish guidelines for appropriate corrective action for impacted sites. ⚙️

A SPARKLING CAREER:

UH Engineer Wins NSF CAREER Award to Study Crystal Formation

BY JEANNIE KEVER

Crystal formation is key to fields as disparate as drug design, biomedical diagnostics and petrochemical production, but significant questions remain about how that formation begins in the presence of soft materials. A chemical engineer from the University of Houston has received a \$500,000 CAREER Award from the National Science Foundation to increase understanding of crystal nucleation within polymers and other soft materials.

Jeremy Palmer, assistant professor of chemical and biomolecular engineering, uses computational methods to study the early stages of crystal formation, before the process can be viewed experimentally.

The formation can take time, and small crystalline clusters that form within liquids don't always grow into full-fledged crystals. Experiments show, however, that the presence of other materials such as polymers and proteins can change the likelihood of crystallization occurring.

"We don't fully understand how the presence of soft materials influences crystallization," Palmer said. A better understanding and the ability to control the crystallization process could prove helpful in all sorts of areas, including biological systems, pharmaceutical formulations, water and wastewater treatment plants, he added.

Most soft materials – the category covers a range of possibilities, from biological tissues to polymers – inhibit nucleation; Palmer's work will rely on a polymer matrix to learn more at the molecular level about how the materials inhibit or promote crystallization.

“If it can't be reproduced, it's not science.”

— JEREMY PALMER

"If you understand the process, you could design a polymer matrix to help precipitate a compound," a key to drug development, he said. In other cases, such as in processing biological tissues, stopping crystallization is important to avoid damaging the sample.

NSF CAREER Awards are granted to highly promising junior faculty members who exemplify the role of teacher-scholars through "outstanding research, excellent education and the integration of education and research." In addition to their research component, they also require educational outreach.

Palmer has proposed to continue his current outreach to students in kindergarten through high school, as well as to devise new outreach projects. He also will create a short course for graduate and undergraduate researchers addressing one of the hottest issues in science – whether findings by one research group can be reproduced by another.

The class will cover proper documentation and other steps to encourage reproducibility.

"It's a huge issue," he said. "Eighty percent of the work out there is not reproduced to the extent it should be." That may be due to a relatively simple error – forgetting to include a step in the process, or making a typo in computer code – but it is key to significant research.

"If it can't be reproduced, it's not science," Palmer said. 🌟

FUNDAMENTALS



HEALTH & MEDICINE



From left: Rose Faghih and students Rafjul Amin and Dilranjan Wickramasuriya are decoding whether wearable devices can detect mental illness

stock of skin, examining skin conductance data for arousal and cortisol data for fatigue. Arousal, in this sense, refers to activation and is a major component of an emotional response.

"With our measurement of cortisol we could see that a patient is at risk of developing chronic fatigue syndrome before it occurs, for example. This way instead of waiting to go see the doctor, the patient would have information that they need to be seen sooner," said Faghih.

Stress is skin deep

In familiar scenes played out wherever people exist, intimidating moments occur – perhaps when your boss calls you into their office, or a principal asks you to come talk about your child – stressful scenarios that trigger your skin to develop the tiniest sheen of perspiration. That symptom of the body's fight or flight response signals a change in the skin's electrical conductivity and provides a window into the brain's state of emotional arousal.

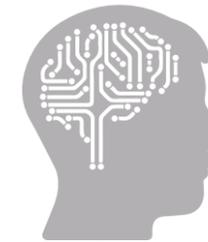
Faghih is developing the signal processing algorithms, or infrastructure, for a wearable device that would recognize the skin's reaction and interpret it.

"I'm building a navigation system for the brain. We can collect data from smart watches seamlessly to understand activity in the brain with wearable machine-interface (WMI) architectures related to mental stress and their potential applications for tracking fatigue and arousal states," said Faghih.

Faghih says the technology would not necessarily have to indicate medication as a solution but could add simpler measures, like relaxation techniques, into the mix.

"For example, if the data indicates they need to relax, maybe their phone could begin to play relaxing music or automatically call a loved one for support," said Faghih. 🌟

WEARABLE TECHNOLOGY



to Track Brain, Predict Illness

BY LAURIE FICKMAN

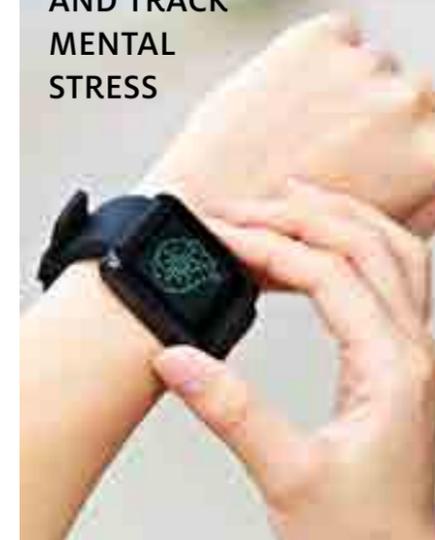
UH Cullen College electrical engineer **Rose T. Faghih** has been awarded \$175,000 by the National Science Foundation to examine whether wrist-worn wearable devices, like Fitbits or Apple Watches, can be used to peer into the brain. She thinks they can.

"Decoding brain states using wrist-worn wearables will transform how mental stress-related diseases are diagnosed and treated," said Faghih. Currently to track brain function, patients undergo electroencephalogram (EEG) testing, in which electrodes are attached to the scalp or a cap to measure brain activity. The convenience of measuring the brain on a smart watch improves the monitoring protocol immeasurably, said Faghih.

"Instead of getting information directly from the brain we can use skin conductance data collected by a smart watch," she said.

Unlike other wearable technology on the market that tracks heart rate as an indicator of stress, Faghih proposes to measure cognitive brain states related to stress by taking

ROSE FAGHIH IS BUILDING A NAVIGATION SYSTEM FOR THE BRAIN TO DETECT AND TRACK MENTAL STRESS



NSF CAREER WINNER



Sheereen Majd to Improve Drug Delivery

BY LAURIE FICKMAN

The National Science Foundation has awarded University of Houston biomedical engineer **Sheereen Majd** the CAREER Award and \$500,000 to improve nanoparticle drug delivery. Majd's research is focused on tailoring nanoparticle drug carriers to target a selected group of cells affected in different diseases while sparing other cells.

Decades ago it might have seemed like science fiction, but today this advanced medical application of nanotechnology promises efficient delivery of bioactive molecules to specific sites in the body. Still, there are limitations to the current nanodelivery vehicles, so Majd is setting out to improve these vehicles, to make them more robust and more precise in targeting their prey.

"In diseases like cancer where therapeutic drugs are designed to kill cells, systematic administration of drugs can severely damage healthy cells, leading to undesired side effects in patients undergoing treatment," said Majd, an assistant professor. "This problem can be eliminated if the drug is delivered by nanoparticles that only target diseased cells."

Nanoparticles are vehicles that can carry drugs through the body to the general location of tumors or other areas of illness. If tagged with appropriate recognition molecules, as Majd intends, these vehicles can deliver the drug only to tumor sites or diseased cells.

Combining the existing technology

In the world of nanodelivery vehicles, two systems are currently the most promising,



“We are hoping to use less medicine to get an effective dose where it needs to be. That’s efficiency.”

- SHEEREEN MAJD

and both can be compared to a car service. Nanoliposomes are like Uber and if targeted, they have a working GPS. They'll deliver the medicine to the neighborhood of illness. Polymer nanoparticles would be like Lyft, doing much the same thing. Both systems have shown great promise for efficient medicine delivery because liposomes mimic the membrane of cells in the body, and polymers offer more control over their mechanical and release properties.

"Our hope is to bring the two systems together, to marry the two, so we can overcome their limitations and have a truly tremendous delivery vehicle – robust, highly specific and highly efficient," said Majd. "We are hoping to minimize the off targeting – that's specificity – and to use less medicine to get an effective dose where it needs to be. That's efficiency."

To create a precise and targeted carrier, Majd said the vehicles have to be "decorated" with the proper ligands. Ligands are recognition

molecules that can actually recognize a target, like a receptor on a specific cancer cell, and attack it.

Majd hopes to create a toolbox where the right type of delivery system is created every time for the specific disease being targeted. In the meantime, she is positive that her team will conduct transformative work.

"We're hoping to improve the current nanodelivery systems. We will make a delivery system that provides more stability, control and precision," she said.

NSF CAREER Awards are granted to highly promising junior faculty members who exemplify the role of teacher-scholars through "outstanding research, excellent education and the integration of education and research." In addition to their research component, they also require educational outreach. ⚙️

Chemical Engineer Wins CPRIT to Improve Effectiveness of

CANCER IMMUNOTHERAPY



BY LAURIE FICKMAN

A Cullen College of Engineering professor who is working to improve treatments for battling cancer received a grant from the Cancer Prevention & Research Institute of Texas (CPRIT), the organization that funds groundbreaking cancer research and prevention programs in the state.

CPRIT awarded \$1,173,420 to **Navin Varadarajan**, associate professor of chemical and biomolecular engineering, to improve the effectiveness of T-cell immunotherapy for cancer patients.



Varadarajan will use his grant to bring consistent results to cancer patients undergoing T-cell immunotherapy by manufacturing programmed T cells to meet, recognize and destroy tumors.

That's what the immune system's T cells are for; by nature they fight invaders or infections.

And scientists have strengthened them to be even better warriors by taking them from a patient and injecting them with proteins (called receptors) that enable the T cells to recognize and attack every tumor cell they encounter. Despite the breakthrough this represents in the treatment of cancer, attaining predictable outcomes in patients is elusive – some patients respond to the T-cell therapy and some do not.

“We have to understand every single T cell and what each one is capable of.”

____ - NAVIN VARADARAJAN

This is Varadarajan's second CPRIT grant; he will use it to improve patient outcomes in T-cell therapy and is studying clinical T cell samples being used for treatment of patients at The University of Texas MD Anderson Cancer Center from two groups – those whose tumors regressed after treatment and those whose tumors were unaffected.

"We have to understand every single T cell and what each one is capable of," said Varadarajan, who is looking for the perfect cell composition in order to

manufacture only the ones that cure tumors.

"Once we know what is required to get a positive response, we can control the composition of the cells so that they all can work to fight cancer," he said.

This work will directly utilize an innovative suite of proprietary tools developed by Varadarajan during the first period of CPRIT funding. The tools deliver real-time profiling of T cells with a video component that almost looks like a video game, in which you watch T cells devour tumors.

After T cells are injected with receptors, they undergo a rapid expansion process where scientists add cytokines, or small proteins, to manufacture about 1 billion cells from 1 million. It is during this phase that Varadarajan can manipulate the cells and create those that will recognize tumors consistently.

He says that studying what makes better T cells will guide the development of the next generation of genetically modified cells, and all of immunotherapy in general, though he readily admits that working with T cells can be daunting.

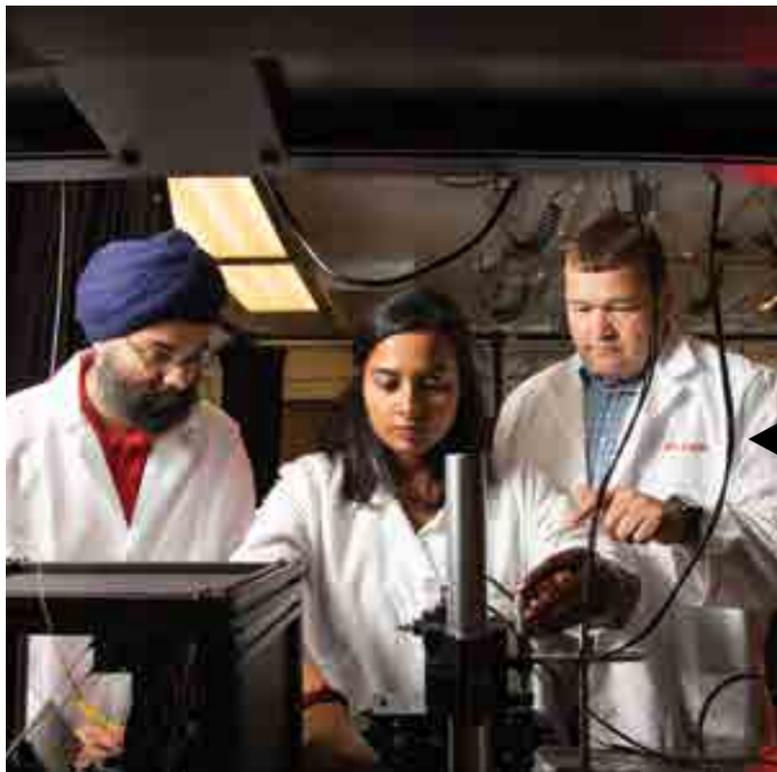
"The big challenge with T cells is that there isn't one single thing that can be used to define what a T cell is supposed to do. Because it's a living cell, it's capable of so many different things, but studying them at the single-cell level allows us to map all of these different things onto the same cell."

Varadarajan's CPRIT award also resulted in a recent feature article in *India-West*, a long-standing, prominent Indian American weekly newspaper serving the global Indian community. ⚙️

FIRST OF ITS KIND:

Peering into the Heart Without Touching

BY LAURIE FICKMAN



As the leading cause of death in the U.S., heart disease also occupies the minds of great researchers, who continue to develop breakthroughs to advance treatments and science.

That includes UH biomedical engineering professor **Kirill Larin**, who has developed what he describes as a “frontier technology” that can immediately assess if heart medicine is working and scar tissue is healing following a heart attack.

Kirill Larin is peering into the heart using high-resolution optical coherence tomography (OCT)



No biopsies needed, no invasive measures taken. Larin simply peers into the heart using high-resolution optical coherence tomography (OCT), a noninvasive imaging test that uses light waves to take cross-section pictures, usually of the retina. Larin has focused the machine on the heart, a method called optical coherence elastography (OCE), to deduce mechanical properties of tissue. It’s a new field he helped usher in over the past few years.

With Larin at the controls, OCT captures detailed biomechanical properties of heart tissue to determine if the organ is responding to therapies. It could eventually be used to develop and test new treatments for healing the damage after a heart attack. The work was described in the Optical Society journal *Biomedical Optics Express*.

“For the first time ever, without touching the heart, now we can measure its properties and scar tissue,” said Larin. The National Institutes of Health gave Larin and colleague James F. Martin from Baylor College of Medi-

.....
 It’s nothing like a game of “Operation” – the frontier technology is able to diagnose serious heart conditions without surgery or invasive testing

cine and the Texas Heart Institute more than \$2 million to continue exploring the science.

Most prominent under the OCE lens is a heart’s scar tissue, marking the first application of OCE for high-resolution mapping of mechanical properties of the heart muscle.

After the heart attack

Usually due to a blocked blood supply, a myocardial infarction, or heart attack, either damages or kills a part of the heart muscle, the myocardium.

While there is currently no cure for the scar tissue that occurs following a heart attack, Martin’s group is working on ways to stimulate adult heart tissue to repair itself. But when it came to the mechanics of examining the heart, the group turned to Larin.

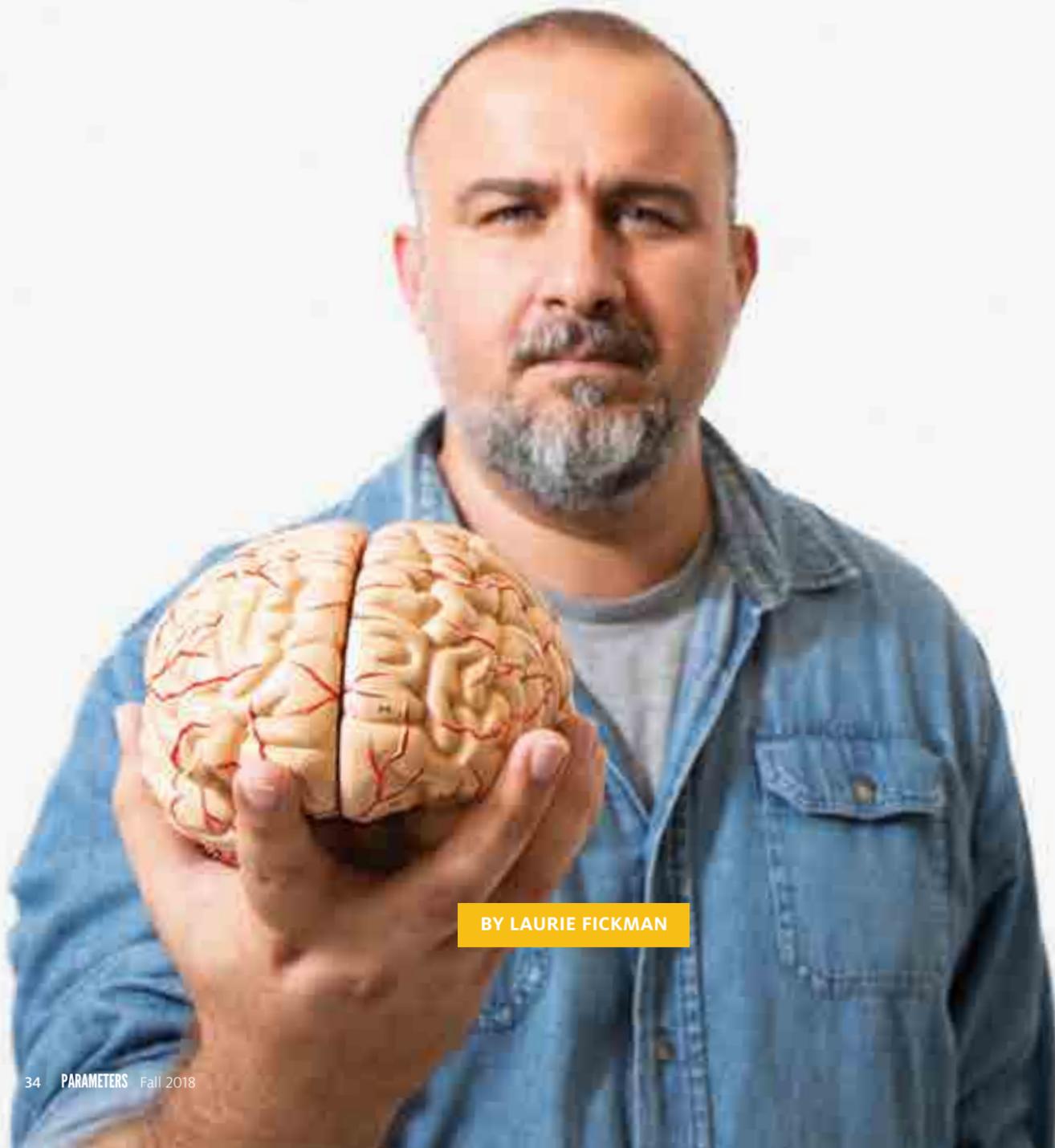
“Through our method to measure the heart’s mechanical properties, we hope to develop ways to regenerate heart tissue,” said Larin.

The OCE also delivers clues to refining the current state of treatment.

“We can see immediately if we should be applying treatment once or twice a day, or once a week. Our results are that immediate,” said Larin. ⚙️

UH Engineer Locates Brain's Seizure Onset Zone in

RECORD TIME



BY LAURIE FICKMAN

Nuri Ince's new method to locate the seizure onset zone could save patients weeks of hospitalization, reducing complications and medical costs

A University of Houston biomedical engineer is reporting a dramatic decrease in the time it takes to detect the seizure onset zone (SOZ), the actual part of the brain that causes seizures, in patients with epilepsy.

Nearly 30 percent of epilepsy patients are resistant to drug therapy, so they have the option of surgery to remove their seizure onset zones. Most of them opt in, according to assistant professor **Nuri Ince**, noting the improved quality of life for sufferers.

Rather than observing seizures as they happen, Ince locates the seizure onset zone in one hour by detecting oscillating brain waves. Current treatment protocols for detecting the zone require prolonged monitoring in the hospital for up to 10 days. Ince's new method to locate the seizure onset zone, reported in *Brain, A Journal of Neurology*, could save patients weeks of hospitalization, reducing complications and costs associated with what has traditionally been an arduous and often painful procedure.

"We observed that the high frequency oscillations in the SOZ form random, repetitive waveform patterns that identify their location," said Ince, who compares the process to a broken bike or car that makes the same sound randomly, yet repetitively. "In a car it's a sound; in a brain it's the oscillatory patterns that are almost screaming, 'I am here!'"

“
Can you imagine
monitoring a
patient for just
one hour, as
compared to
before when
it took days or
weeks?”

”
- NURI INCE

ing algorithms to interpret the brain waves, and after two years his algorithm identified the pattern.

"We got goosebumps when we saw it," said Ince, recalling the moment he realized that the patterns could not only be found quickly, but also could add to the medical community's understanding and knowledge of how seizures start.

Critical to Ince's discovery is delineating between the high frequency oscillations that signify the SOZ from the ones ignited by normal functioning, like movements or talking. The regions can be located very close together, and the overlap between physiological and pathological oscillations are seemingly indistinguishable. That, along with difficulties associated with visual inspection of prolonged invasive recordings, is why current detection protocol ignores the oscillations, tracking only the seizures themselves. The current method – which includes prolonged patient hospitalization – also requires a patient and medical team to wait for seizures to occur to identify their onset location.

"Can you imagine monitoring a patient for just one hour, as compared to before when it took days or weeks?" Ince asked, still marveling at the savings of both time and money this translational project will bring to patients and their families. ⚙️

Exploring the brain

Ince and his former graduate student, Su Liu, studied pediatric and adult brain patterns provided by collaborators at Texas Children's Hospital, Baylor College of Medicine, University of Texas MD Anderson Cancer Center, Istanbul University and University of Minnesota.

Ince developed a pipeline of machine learn-

DECONSTRUCTING LUPUS –

Could Some of its Makeup be Part of its Cure?

BY LAURIE FICKMAN



Chandra Mohan, Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering, has received a \$600,000 Target Identification in Lupus grant from the Lupus Research Alliance to address fundamental questions in lupus research, remove barriers to new treatments and possibly find a cure for lupus and its complications.

Only seven lupus researchers across the country were asked to carry out these tasks.

It's a big ask. Lupus is a complex autoimmune disease that is difficult to diagnose, treat and defeat. Only one treatment has been approved in nearly 60 years.

But Mohan knows exactly where to start. He will examine a protein called ALCAM (activated leukocyte cell adhesion molecule), which is important for activating T cells. ALCAM is also present in several kidney diseases and in the urine of patients with lupus kidney disease. He likens it to a bad guy being caught at the scene of several crimes.

"Lupus patients may have increased ALCAM in both their immune systems and their kidneys, and this probably plays a major role in activating the immune system and causing the kidney disease in lupus patients," said Mohan.

While healthy people need ALCAM to activate their T cells to fight off foreign microbes in the body, in patients with an autoimmune disease the activated T cells end up just fighting the patient's own healthy tissues rather than a foreign body.

Mohan will continue tracking ALCAM to confirm its presence in the kidneys of lupus patients rather than just the urine, while also investigating whether the increased ALCAM is indeed driving the disease. His research will also include treating lupus by testing an antibody that blocks ALCAM.

If the antibody does block lupus, then he could move onto translational studies and clinical trials, said Mohan, alluding to possible new drug therapies for the disease.

"We began this study looking for biomarkers and we think ALCAM is a good biomarker, meaning we may be able to track the disease by looking at the levels of ALCAM in the urine. But now we are finding that ALCAM may be a therapeutic target, too," he said.

Also involved in the project are two doctoral students working in Mohan's lab, Samantha Stanley and Sanam Soomro, senior staff member Kamala Vanarsa and research assistant professor Yong Du. 🌟

Chandra Mohan is one of

7

researchers in the U.S.

to win a grant from the Lupus Research Alliance to address fundamental questions about the disease



Taking a New Approach to

ANTIBIOTIC TOLERANCE

BY LAURIE FICKMAN

With a perfect score on his research proposal, chemical and biomolecular engineering assistant professor **Mehmet Orman** received the National Institute of Allergy and Infectious Diseases (NIAID) Career Transition Award, meant to help initiate a successful bioengineering career as an independent research scientist. Orman will use the \$250,000 prize to investigate cells that are resistant to antibiotics.

"A small fraction of cells in bacterial populations enter a dormant state. Once these cells become dormant, they intrinsically become tolerant to extraordinary levels of antibiotics," said Orman.

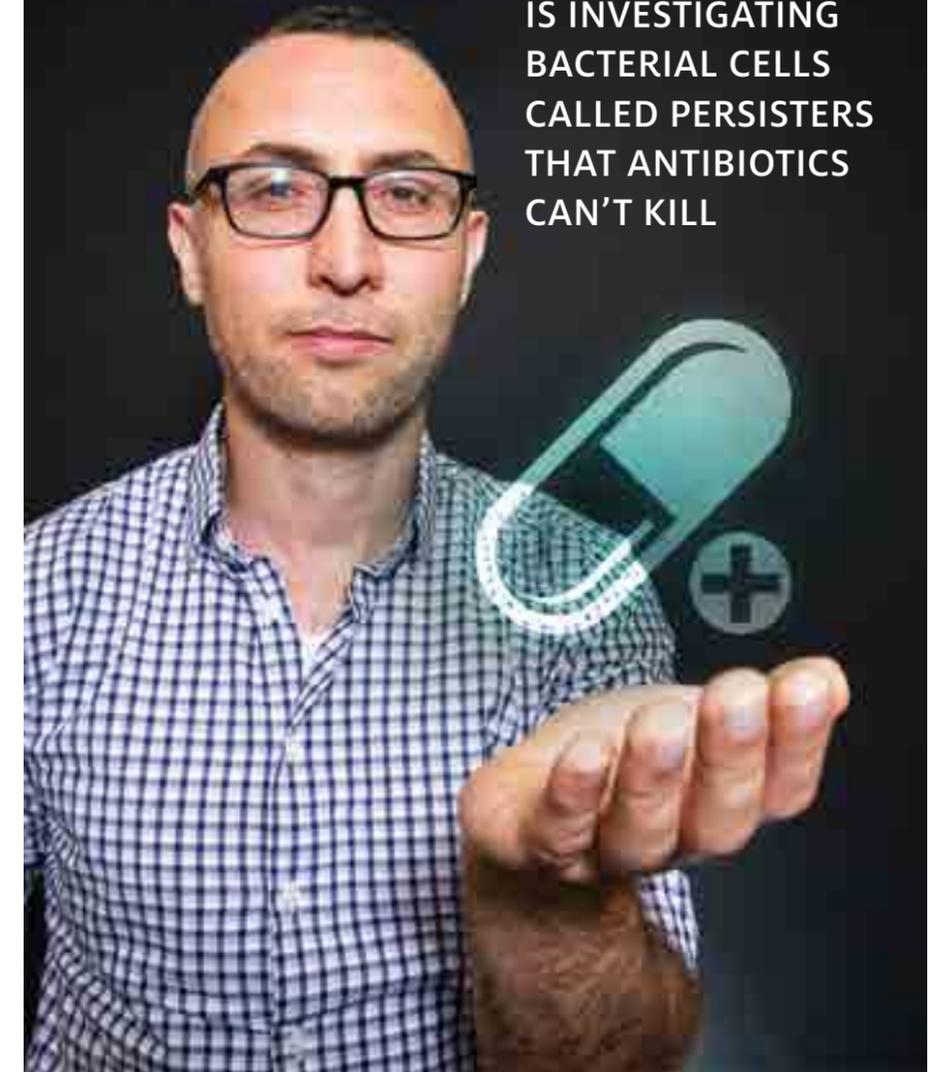
Conventional antibiotics function by targeting the mechanisms that enable the rapid growth of bacterial cell populations, but since the cells don't grow while dormant, the antibiotics have little chance to work.

Eventually, these persister cells, as they are called, wake up and regain their ability to proliferate. Because of this, persister cells are thought to facilitate the recurrence of infections, and they serve as a reservoir for the emergence of drug resistant mutants.

Recurrent infections are generally associated with biofilms, a slimy bacterial film in which persister cells are significantly enriched and can evade the host immune system. Biofilm infections – such as airway infections in cystic fibrosis patients, chronic obstructive pulmonary diseases, chronic wound infections, or infections caused by medical devices or prostheses – pose a significant healthcare problem in the United States.

Using *E. coli* as a model organism, Orman is aiming to identify and explore the mechanisms in bacterial cells that lead to dormant cell formation to discover new therapeutic

MEHMET ORMAN IS INVESTIGATING BACTERIAL CELLS CALLED PERSISTERS THAT ANTIBIOTICS CAN'T KILL



strategies that eliminate bacterial persisters.

"I'm going to perform a high-throughput screening to identify candidate genes that regulate the cell dormancy in bacteria," said Orman. "Then, I can focus on those genes individually and see how they impact the persister levels of the bacterial cells." The high-throughput screening process allows Orman to screen a large number of genes rapidly.

Orman has been dogged in the study of

these stubborn cells. Previously he developed the first methods to directly measure the metabolism of these rare and transient persister cells. He has also developed cell sorting strategies to segregate persisters from highly heterogeneous bacterial cell populations. He will be using these methods in his current research project.

"The physiology of persisters has remained elusive and hindered progress toward eliminating them," said Orman. 🌟

UH Engineers, Chevron Introduce Houston-area Girls to

STEM Fun

BY RASHDA KHAN



About 1,000 Houston-area girls participated in hands-on engineering experiments and demos led by Cullen College students and faculty at this year's "Girls Engineering the Future: A STEM Event"



The Cullen College of Engineering at the University of Houston was a happening place last March – rockets launched into the sky with great puffs of smoke, robots performed amazing feats and propeller-powered cars raced down corridors as happy shrieks filled the air.

Nearly 1,000 Houston-area fourth through eighth grade girls flooded the Cullen College on Saturday, March 24 for the third annual "Girls Engineering the Future Day: A STEM Event," sponsored by Chevron.

“I thought I’d bring them since Chevron is sponsoring this and it’s good to expose them to more STEM fun.”

- SARIKA GANDHI ”

“Is it going to explode? They always explode in the movies,” asked Isabella Tinnin, 12, watching a carbon-dioxide-based oil recovery demonstration involving two jars, marbles, tubing, oil and water, and denture-cleaning pills.

The denture cleaner turned the water a frothy sea-foam green as it released the carbon dioxide, which eventually pushed out drops of oil into a waiting cup.

“No, no... in the movies, yes, but not here. That would be very bad if

they did,” said Tony Nowak, a UH engineering student volunteer and president of the student chapter of the Society of Petroleum Engineers. Then he launched into an explanation of the chemical reaction, pressure at work and the importance of petroleum in today’s world.

Tinnin, who wants to be a NASA engineer, was part of Girl Scout Troop 28030 brought to the event by troop leader Meaghin Sliman, who graduated from the UH Cullen College with a bachelor’s degree in chemical engineering in 2010.

“This was a great opportunity to bring our girls back to my old school and get them more interested in STEM fields,” Sliman said, pausing to look around the engineering courtyard with a fond smile. “This is where I met my husband. We both went here.”

About 150 volunteers – representing Chevron, UH Cullen College of Engineering student organizations, and individual Cullen College students, professors and alumni – worked the different stations at the event.

Minuri DeSilva, a petroleum engineering junior, decided to wrap up a stressful week of midterms by volunteering at the event.

“This was a fun opportunity to work with kids and the experiment is fascinating,” said DeSilva, who was helping girls with the non-Newtonian fluid station, also known as the “slime” experiment. She and the girls were mixing up an electric blue cornstarch concoction and enjoying scraping and squishing it with gloved hands to demonstrate how pressure tended to harden the fluid.

“There are not a lot of girls in my classes,”

DeSilva said. “So it’s good to be out here inspiring girls to get interested in engineering.”

Sarika Gandhi, a computer engineer with Chevron, brought her daughter and two of her daughter’s friends to the event.

“I thought I’d bring them since Chevron is sponsoring this and it’s good to expose them to more STEM fun,” Gandhi said. She was impressed by the number and diversity of activities all around.

Her 11-year-old daughter ran off to test drive her propeller-powered car.

“It’s amazing how they’re making this car with just popsicle sticks, rubber bands and some plastic,” Gandhi said, holding up her own. ⚙️

“Girls Engineering the Future: A STEM Event” is sponsored by



www.egr.uh.edu/girls-engineering-the-future



UH Researchers Win \$1 Million to Boost

STUDENT SUCCESS

BY RASHDA KHAN

The National Science Foundation (NSF) awarded a \$999,029 grant to a team of University of Houston researchers for a new program aimed at studying the impact of scholarships, engagement and other support on low-income students and their academic success.

The program, titled “Engineering/NSM student success program serving low-income academically talented students,” is a collaboration of two existing UH STEM programs – the Program for Mastery in Engineering Studies (PROMES) in the Cullen College of Engineering and the Scholar Enrichment Program (SEP) in the College of Natural Sciences and Mathematics (NSM). It is funded through the NSF’s S-STEM program.

“Low-income students often don’t have

the time nor can they often afford to be engaged,” said **Diana de la Rosa-Pohl**, instructional assistant professor at the UH Cullen College of Engineering. “We want to give them a little bit of a breathing room and support to get more engaged on campus because we know that’s really what moves the needle on student success.”

De la Rosa-Pohl is familiar with the challenges faced by low-income students. As a high school student, she worked at a restaurant in South Padre Island, almost an hour’s drive from her home in Brownsville. She juggled the long commutes, school responsibilities and work on a regular basis.

She went on to earn two master’s degrees – in physics and electrical engineering – and a doctorate in education. Now she wants to help other students in their journeys.

The project will fund 80 two-year scholarships over five years for students pursuing undergraduate degrees in the Cullen College of Engineering and NSM.

“This is going to give a lot of money to a large number of deserving students. About 64 percent of the grant money will go straight to student scholarships,” said **Stuart Long**, Cullen College professor of electrical and computer engineering and associate dean of the Honors College and Undergraduate Research at the University of Houston.



 Principal investigators Stuart Long and Diana de la Rosa-Pohl

But the program goes beyond providing financial help, emphasizing long-term support through college and beyond.

“We’re trying to do something different with the scholarship program,” de la Rosa-Pohl said. “Instead of focusing on the financial side of it, we wanted to focus on the engagement side of it and use the financial piece as an incentive to attract the students.”

There is growing evidence indicating that students from low-income backgrounds have lower graduation rates and are less likely to find jobs in their respective fields compared to their peers from higher-income families.

“We find that a lot of low-income students are missing social capital in their backgrounds,” de la Rosa-Pohl said. “Social capital is comprised of a lot of things; it’s those things you expect the wealthier students to have – more connections, more emphasis on education in their social circles, their parents

Lisette Montemayor, a high school graduate from Pasadena, is part of the first S-STEM cohort



“ I have connections already before the school year starts. I’m really glad I was chosen to be part of the first S-STEM cohort. ”

- LISETTE MONTEMAYOR

are probably better educated and have higher degrees, and also higher economic status. Just many things that give [the students] that support structure when they get to college.”

“We want to fill those gaps,” she added.

The research aspect of the project aims to show that increasing access to such factors will help students be more successful.

The principal investigators on the project are de la Rosa-Pohl and Long. Andrew Hamilton, associate dean for student success in the College of Natural Sciences and Mathematics, and Jerrod Henderson, PROMES director, are collaborators on the project.

How will the program work?

The collaboration between the two colleges allows them to pool resources and best practices.

“We’re bringing the best parts of two programs together that have already shown a lot of successes,” de la Rosa-Pohl said. “We had some great pieces – like the First Year Experience in PROMES and the Summer Bridge aspect of SEP – that we’re bringing together. Instead of reinventing the wheel, we just joined forces.”

The Summer Bridge Program will give accept-

“ I can’t wait to write those first checks for the scholarships. I just love the idea of possibly changing somebody’s family tree, their trajectory. I don’t think money or socioeconomic status should be the reason why somebody doesn’t do this degree. ”

- DIANA DE LA ROSA-POHL

ed students an early introduction to college life, easing the transition from high school to higher education. “Our participants will come to UH the summer before they start their regular classes to attend this bridge program,” Long said.

Lisette Montemayor, a high school graduate from Pasadena, is part of the first cohort and the Class of 2022. The daughter of an electrician, she’s interested in electrical

engineering. If she hadn’t been accepted to the program, she’d be working during the summer to help pay for college.

“Instead of getting a summer job at some place in Pasadena doing whatever I could get, I can actually do something meaningful and productive that’s furthering my career and my academics,” she said.

Her time on the UH campus is spent learning about and registering for future classes and identifying research topics. She’s also met some of her classmates and professors.

“It’s nice because I get to know these people from S-STEM and SEP so I kind of have connections already before the school year starts,” Montemayor said. “I’m really glad I was chosen to be part of the first S-STEM cohort.”

The First Year Experience will allow accepted freshmen to engage in hands-on, project-based learning designed to help students learn and work in teams. The second year is going to focus on leadership and community development through workshops and social activities. S-STEM will emphasize networking, team building and professional development.

The scholarship will pay for the first two years, and after that students will be encouraged to apply for co-operative education opportunities, internships and research positions to help pay for the third and fourth years.

“That’s part of what we do. We’re getting

them ready and involved in career building by helping them with résumés, helping them with social skills, encouraging them to attend job fairs,” de la Rosa-Pohl said. “We help them get prepared so they can start earning their own money.”

By financing only the first two years through scholarships, the grant funds will be stretched to impact more students.

Aiming high

The UH researchers hope to use the S-STEM program in many different ways to change lives.

Long considers it a tool for both recruitment and retention. “It gives students another reason to come to UH and choose to major in engineering, natural sciences and mathematics,” he said. “It’ll also give them the support to continue and have them graduate. I’m looking forward to graduating 80 additional students in engineering at the end of five years.”

Then there is the research component.

“By the end of five years, we hope to be able to prove – with data – that we have increased the students’ level of engagement, not in just one measure but multiple measures and on different levels,” de la Rosa-Pohl said. “Engagement with their classes, engagement in research and engagement with the campus community.”

However, she’s excited about the more immediate goals as well.

“I can’t wait to write those first checks for the scholarships. I just love the idea of possibly changing somebody’s family tree, their trajectory. I don’t think money or socioeconomic status should be the reason why somebody doesn’t do this degree. If they have a passion for it, we want to give them every means to do it. We want to remove every obstacle that we can so they can be successful.”

The grant award started April 1 and ends March 31, 2023. ⚙️



STUDENT SUCCESS TAKES MORE THAN GOOD GRADES.

Learn more about ways to give online at giving.uh.edu/gift/



RESEARCHERS DESIGN 'SOFT' ROBOTS

That Can Move on Their Own

BY JEANNIE KEVER

If R2-D2 from “Star Wars” is your idea of a robot, think again. Researchers led by a University of Houston engineer have reported a new class of soft robot – composed of ultrathin sensing, actuating electronics and temperature-sensitive artificial muscle – that can adapt to the environment and crawl, similar to the movement of an inchworm or caterpillar.

Cunjiang Yu, Bill D. Cook Assistant Professor of mechanical engineering, said potential applications range from surgery and rehabilitation to search and rescue in natural disasters or on the battlefield. Because the robot body changes shape in response to its surroundings, it can slip through narrow crevices to search for survivors in the rubble left by an earthquake or bombing, he said.

“They sense the change in environment and adapt to slip through,” said Yu.

These soft robots, made of soft artificial muscle and ultrathin deformable sensors and actuators, have significant advantages over the traditional rigid robots used for automation and other physical tasks.

The researchers said their work, published in the journal *Advanced Materials*, took its inspi-

ROBOTS OF THE FUTURE WON'T LOOK ANYTHING LIKE WHAT WE'VE SEEN IN SCIENCE FICTION



ration from nature. “Many creatures such as inchworms that have completely soft, compliant bodies without any rigid components (like bones) exhibit unprecedented abilities in adapting their shapes and morphologies and unique locomotion behaviors,” they wrote.

Traditional soft robots lack the ability to adapt to their environments or move on their own.

The prototype adaptive soft robot includes a liquid crystal elastomer – doped with carbon

black nanoparticles to enhance thermal conductivity – as the artificial muscle, combined with ultrathin mesh shaped stretchable thermal actuators and silicon-based light sensors. The thermal actuators provide heat to activate the robot.

The prototype is small – 28.6 millimeters in length, or just over 1 inch – but Yu said it could easily be scaled up. That’s the next step, along with experimenting with various types of sensors. While the prototype uses heat-sensitive sensors, it could employ smart materials activated by light or other cues, he said.

“This is the first of its kind,” Yu said. “You can use other sensors, depending on what you want it to do.”

In addition to Yu, co-authors include Chengjun Wang, Kyoseung Sim and Zhouyu Rao, all from UH; Hojin Kim and Rafael Verduzco of Rice University; Jin Chen of Beijing University; and Yuhang Li, Weiqui Chen and Jizhou Song of Zhejiang University.

This work was funded by the National Science Foundation and the American Chemical Society Petroleum Research Fund Doctoral New Investigator Grant. ⚙️



UH Researcher Developing Smart Artificial Skin Inspired by

UNDERWATER MASTERS OF CAMOUFLAGE



BY RASHDA KHAN

Imagine U.S. Navy divers wearing camouflage “skin” suits and gathering intelligence. They could swim undetected in enemy waters as their suit changed color and texture to blend in with the environment – whether it be in the deep sea below a naval destroyer or a rocky, marshy river bottom.

Cunjiang Yu, Bill D. Cook Assistant Professor of mechanical engineering at the UH Cullen College, wants to create smart, artificial skin that mimics the natural abilities of cephalopods – creatures like cuttlefish, squid and other related marine life – to perform incredible feats of camouflage.

The proposed research has won Yu a 2018 Office of Naval Research Young Investigator Award (ONR YIP). He is among 31 scientists

selected from more than 340 applicants. The award comes with a three-year grant of \$510,000 to use for Yu’s project, “Cephalopod inspired camouflage skins: Adaptive color changing, pattern tuning and texture morphing.” Yu, known for his work with stretchable semiconductors and electronics, was inspired to pursue this latest project during a visit to an aquarium.

“Cephalopods are well known masters of camouflage. They have the most amazing camouflage abilities – they can change their color, their texture,” Yu said. “I got inspired by these marine animals and started thinking: Could we build a similar ‘skin’ or device to mimic those abilities? Something that could be scaled up for important real-world applications?”

He expects this proposed flexible skin to be a complex system of sensors, circuits and activators, combining materials, mechanical design and electronics.

“It has to be an extremely smart skin to be able to do so many things like understanding the environment and then changing to blend in,” Yu said.

While the work would definitely have defense industry applications, Yu believes it can also be useful to other industries such as health-care, cosmetics and textiles.

Yu, who is 34, has an extensive record for innovative skin technology work and recognition. Last year he reported a breakthrough in stretchable electronics that would allow users of wearable robotics (such as artificial limbs) to actually feel the sensation of touch.

In 2017 Yu made *MIT Technology Review’s* “35 Innovators Under 35” list of researchers and earned the Junior Faculty Research Excellence Award from the Cullen College. He received the National Science Foundation CAREER Award and the Doctoral New Investigator Award from the American Chemical Society Petroleum Research Fund in 2016 as well as the Paul Holloway Young Investigator Award from the American Vacuum Society in 2015.

The ONR’s Young Investigator Program is one of the nation’s oldest and most selective science and technology based research programs. Since 1985 the program has sponsored early career academic researchers whose scientific pursuits show outstanding promise for supporting the Department of Defense while also promoting their professional development.

“To meet the demand signal from the 2018 National Defense Strategy, we must attract the best and brightest minds to work on naval warfighting challenges,” said Rear Adm. David Hahn, chief of naval research. “The Young Investigator Program does just that.” ⚙️

UH Engineer Part of Team Awarded

\$7.5 MILLION

to Analyze Social Behavior and Predict Outcomes

BY RASHDA KHAN

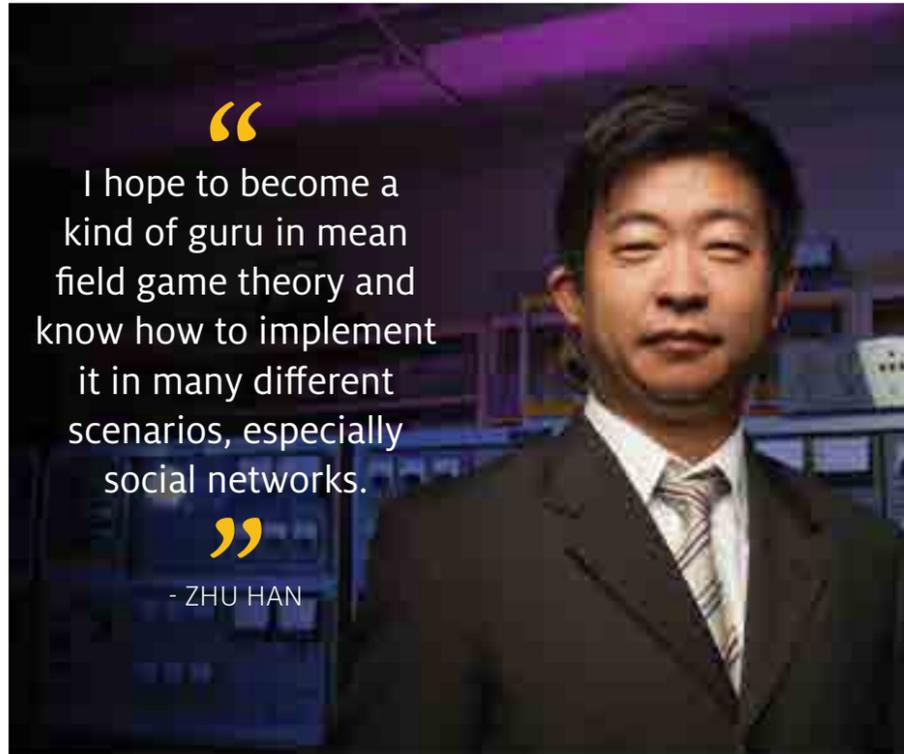
It's no secret that data is everywhere today – endless streams of information are constantly being collected through our smartphones and mobile devices, by sensors placed on bridges and in buildings and even through our smart thermostats and refrigerators.

Finding ways to harness these enormous data sets into useful tools that can aid in decisions and policymaking is now the focus of researchers across the country. Among them is UH electrical and computer engineering professor **Zhu Han**, who is part of a team awarded \$7.5 million through the Department of Defense (DoD) Multidisciplinary University Research Initiative (MURI) grant.

Four universities – University of Houston along with the University of California, Los Angeles, University of Maryland at College Park and Princeton University – are joining forces on the five-year project titled “Innovation in Mean Field Game (MFG) theory for scalable computation and diverse applications.” UCLA is the lead on the project.

The project is one of 24 MURI awards totaling \$169 million announced this year. It brings together a multidisciplinary team of eight experts specializing in a myriad of areas – math, optimization, artificial intelligence, game theory, electrical engineering and psychology.

Han will receive \$1.2 million of the award. His research focus includes wireless resource allocation and management, wireless networking and communications, wireless multimedia, security and game theory.



“ I hope to become a kind of guru in mean field game theory and know how to implement it in many different scenarios, especially social networks. ”

”
- ZHU HAN

“UH research serves as the bridge between the UCLA theoretical part and the University of Maryland social network part,” Han said. “I’m the translator that can talk with both of them.”

The team will study the use of advanced game theoretical approach – a set of mathematical concepts, theorems and algorithms – to analyze social behavior in the context of large-scale, ultra-dense wireless systems, such as social networks.

“The mean field game, or MFG, is a type of dynamic game that can quantify the behavior of multiple users – billions of users – and analyze it,” Han said. The impact on future networks, including the future of the Internet of Things, could be huge. “It’s difficult to have some type of centralized control, but some kind of theoretical approach may provide guidance on how to have optimal control over future networks.”

The team’s efforts are geared toward accurate modeling of knowledge evolution and opinion formation in social networks, social and culture norm dynamics, socioeconomic

dynamics in energy consumption and crime modeling, election modeling and psycho/socio/mathematical models of rational and irrational agents. Results of the study will be used for modeling and predicting game outcomes.

According to the project abstract, the researchers hope insights gained will allow the use of MFG theory in diverse applications, such as crowd control, evacuation planning, urban planning, policymaking and more.

In addition to the overall project goal, Han also has a personal goal. “I hope to become a kind of guru in MFG and know how to implement it in many different scenarios, especially social networks,” he said.

The highly competitive MURI program complements other DoD basic research efforts by supporting multidisciplinary teams with larger and longer awards in carefully chosen research topics identified for their potential for significant and sustained progress in areas related to national security and military capabilities. ⚙️



Venkat Selvamanickam is working to develop a new tool that will improve roll-to-roll continuous manufacturing processes

Researchers Seek to Improve Quality Control for **NANOMANUFACTURING**

BY JEANNIE KEVER

Researchers from the University of Houston are developing a new quality control tool for continuous nanomanufacturing, a key step in moving nanodevices from the lab to the real world.

“Nanomanufacturing sounds great, but it really has to be scalable,” said **Venkat Selvamanickam**, MD Anderson Chair Professor of mechanical engineering. “You have to be able to control the quality.”

Selvamanickam is working with Nanomanufacturing Systems for mobile Computing and Energy Technologies (NASCENT), a multi-institution partnership led by the University of Texas at Austin, to develop the new tool, which will adapt Raman spectroscopy and



X-ray diffraction for use with roll-to-roll continuous manufacturing processes.

The work will be done under the auspices of the UH Advanced Manufacturing Institute; UH will receive about \$340,000 from the National Science Foundation for the project.

One of the world’s leading experts on manufacturing superconductors, Selvamanickam oversees manufacturing activity at the University’s Energy Research Park, including the advanced manufacturing of high-performance superconductor wires for next-generation electric machines. He is also director of the Applied Research Hub at the Texas Center for Superconductivity at UH and manages the Advanced Manufacturing Institute, an umbrella organization designed to help researchers make the leap between discovery and commercialization.

NASCENT, an NSF-funded Engineering Research Center, addresses issues limiting high-volume nanomanufacturing. Selvamanickam said one critical problem is ensuring quality control during the manufacturing process, rather than waiting until the device or product has been produced to check for imperfections or other problems.

The goal is an innovative tool that can provide continuous monitoring as production rolls past. “The challenge is, can you detect imperfections at fast speed and good resolution?” Selvamanickam asked. “You can’t be spending minutes examining the material, because the material is flying by at high speed.”

To work, the tool will have to detect imperfections within seconds or less.

Selvamanickam’s lab currently produces solar cells, flexible electronics and superconducting wires using roll-to-roll manufacturing, the same process NASCENT is pursuing.

While the tool initially will be tested on the manufacture of common semiconductors, including silicon and gallium-arsenide, Selvamanickam said it will then be adapted for additional materials. ⚙️

EVERYDAY



SUPERHEROES:

THE LEAGUE OF EXTRAORDINARY ENGINEERS

BY RASHDA KHAN

There are superheroes living amongst us.

They are more Clark Kent than Man of Steel and Diana Prince than Wonder Woman.

They don't wear capes or spandex suits, nor do they carry shields or fly through the air – but they do have superpowers: protecting humankind from disease and death, saving a megalopolis from storms and destruction, and providing guidance to new heroes in the making.

Our superheroes would probably never consider themselves hero-material. They are ordinary people who choose to do extraordinary things on a daily basis. They have the courage to aim high, work hard and make the impossible possible – all the while working to solve the most pressing problems facing our society.

Meet the league of extraordinary engineers at the UH Cullen College of Engineering, who use the power of science to save lives, impart hope, forge a better future – and inspire others to do the same.

STANDING STRONG:

A COOG HERO
WORTHY OF
THOR'S HAMMER

“
SO YOU TAKE THE
WORLD I LOVE AS
RECOMPENSE FOR
YOUR IMAGINED
SLIGHTS? NO, THE
EARTH IS UNDER
MY PROTECTION!
”



- THOR,
“THE AVENGERS” (2012)

*Marvel Studios, Walt Disney Studios
Motion Pictures*

A tough hammer-wielding god known as Thor stands tall in historical narratives of Norse mythology. He is credited with harnessing the power of thunder and lightning to protect humankind from destruction.

More recently, comic books and movies have made this god of thunder a popular and familiar superhero. His quests in distant places with a bevy of friends and monstrous challenges are pop culture legends.

The University of Houston Cullen College of Engineering is fortunate to have someone close to a real-life Thor – undergraduate student **Jacob Dylan True Furrh**. He believes in standing up to storms and other natural disasters. And while he’s at it, he wants to help others – entire communities – to not only survive, but to bounce back, stronger than ever before. To meet his goals, he’s willing to use a hammer, travel to faraway lands and harness the power of science.

“I think it’s because I have been through hurricanes before. I have seen what happens to a community whenever a hurricane hits,” says Furrh, a 20-year-old double majoring in civil engineering and environmental sciences.

He encountered his first major storm, Hurricane Ike, at the age of nine. “I remember evacuating, but what I remember very strongly is coming back,” says Furrh. The family returned to find a 40-foot oak tree lodged in their home in Lake Jackson, a coastal city south of Houston. The house sustained significant structural damage, but his parents rebuilt.

“We had the resources to rebuild and we were fine, so we went back in. We were displaced for about 19 months. It was a pretty lengthy process,” he recalls. “But not everyone has access to those resources.”



BRINGING DOWN THE HAMMER

When disaster strikes the world around him, Furrh – in a very Thor-like manner – not only charges in to help, but generally brings his friends along.

Last year, when Hurricane Harvey – a Category 4 hurricane with winds reaching 130 miles per hour – hit Houston with 50 inches of rain, Furrh happened to be in the city. He started the “UH Harvey Relief Carpooling & Volunteer Opportunities” Facebook group to act as a volunteer hub. The group grew from 50 people on his friends list to about 1,500 members within days.



During that time, Furrh also volunteered with other UH Coogs at the George R. Brown Convention Center, where more than 9,000 Harvey evacuees sought shelter.

Later, Furrh worked with a UH institutional effort involving students, deans, faculty, staff and alumni to form UH CARES (Cougar Assisted Relief Efforts).

“This gave us the flexibility to turn our UH volunteers group into a long-term association,” he says.

Since the launch of UH CARES about a year ago, Furrh and other volunteers have spent most weekends gutting and mucking out flood impacted housing across the greater Houston area. They have used hammers, shovels and brooms – whatever is needed to get the job done. This spring they helped rebuild a house, tearing down damaged dry wall and caulking cracks and crevices.

“One thing we’ve found we can do effectively is serve as a conduit for organizations and other groups to come out and work on projects,” he says. “We have a house that needs to be rebuilt, we have supplies and we have training for volunteers. The purpose of UH CARES and the Facebook group was to decrease the time to move back for other people who don’t have access to [needed] resources.”

He also volunteers when he can with UH’s Metropolitan Volunteer Program – a UH student organization that provides year-round service opportunities for students by collaborating with campus and community partners on various social issues. For Furrh, it’s a way to de-stress.

“It’s really nice to go to a service event that you didn’t organize yourself,” Furrh says. “You don’t have to worry about the administrative details, you don’t have to worry about logistics, you don’t have to worry about getting people there. You just show up and volunteer.”



 True Furrh and hundreds of fellow UH Coogs assisted in relief efforts across the city of Houston after Hurricane Harvey
Photo credit (top right): SC National Guard

“ I WANT A FUTURE WHERE LESS PEOPLE WILL NEED THEIR HOUSES TO BE GUTTED. I WANT TO ALLEVIATE PROBLEMS BEFORE THEY HAPPEN. ”

- TRUE FURRH



THE HERO’S HEROES

In the Marvel Comics universe, Odin is the king of Norse gods, the ruler of Asgard and father to Thor. He is depicted as peace-loving and wise, someone Thor looked up to throughout his life.

This narrative rings true to Furrh, who says his parents – both of whom work as lawyers and advocates representing low-income and underserved populations at Lone Star Legal Aid – are his personal heroes.

“In my eyes that’s just a way to do more service,” Furrh says. “They’re helping the most vulnerable communities not only in Houston, but in the whole Gulf Coast region. That really impacted me... just being able to see them serve for the entirety of my life.”

There’s a need for public service in the world, he says. “They can be your neighbors or strangers, there’s no shortage of people who need help.”

Furrh, who is scheduled to graduate in 2020, brings the same ferocious focus on storms and disasters to his academic life.

“Living on the coast growing up is just a different experience than living in Houston,” says Furrh, whose childhood included volunteering for beach clean-ups and dune building efforts. “You can really see the effects of what a storm does to an actual coastline.”

He remembers Hurricane Ike took out more than one city block worth of beach from the small community of Surfside. “The storm just physically pulled the sand out,” Furrh says. “There are still houses in the water that haven’t been torn down yet. And that’s another part of community resilience.”

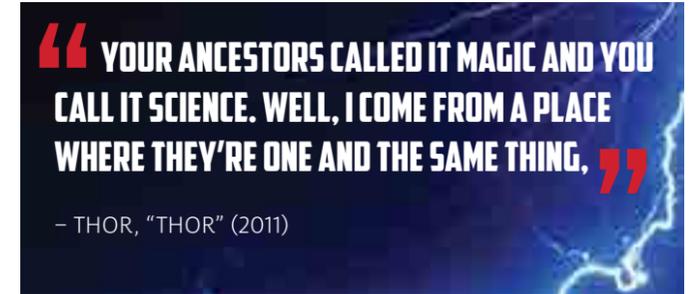
Every disaster has its own lessons for survivors. Furrh holds up Galveston as an example. Its very existence is considered a triumph over nature by many. In response to the devastation of the 1900 hurricane, they took several steps to prevent future destruction including building the massive seawall.

According to Furrh, every place has its unique vulnerabilities and inherent risks are everywhere.

“That’s why you need proper plans for evacuation, and you plan ahead with resources to rebuild or to move... do whatever is needed,” he says. “I want to study how communities respond to such stress and through research improve a community’s ability to respond.”

USING SCIENCE TO MAKE MAGIC

Like Thor, Furrh believes in the power of science to make magic happen, so he sought opportunities in engineering, research and life that helped him bolster his goals.



He applied for and was awarded a Summer Undergraduate Research Fellowship (SURF) last year to work in the environmental engineering lab of Hanadi Rifai, associate dean of research and facilities as well as director of the environmental engineering graduate program at the Cullen College. At the lab, he researched the qualities of water extracted with fossil fuels.

Furrh also participated in a UH study abroad to Iceland, where he visited geothermal and hydroelectric power plants.

“It was fascinating to see a country so rich in renewable energy sources fully utilize them. Homes and businesses were mostly heated geothermally and I got to see the pipes being installed,” he says. “It shows how communities can take advantage of their resources, like wind in West and North Texas.”

This summer he worked a summer research internship at the National Institute of Standards and Technology in Maryland where he looked at the social impact of Hurricane Maria and emergency communication. While all disasters are unique, there are certain commonalities – in impact, response and behavior modeling – that are shared. “It’s another aspect of natural disasters and it fits in with what I want to do,” Furrh says.

In the spring, Furrh was one of two UH students to win a prestigious Ernest F. Hollings Scholarship – a first win for the University. The award helps with tuition, but also comes with a 10-week paid internship with the National Oceanic and Atmospheric Administration (NOAA). He will be able to choose his own research topic and the applicable NOAA site to work at for summer 2019.

While Furrh is not afraid to wield a hammer when needed, he wants to prevent and contain future disasters.

“In the long term, research is the only way we have to mitigate hazards before they occur, which is what I want to do,” Furrh says. “I want a future where less people will need their houses to be gutted. I want to alleviate problems before they happen.”

Spoken like a true protector of humankind. ⚡

POWER.GRACE. WISDOM.WONDER... AND WATER.



THE LEGEND AND LEGACY OF UH'S VERY OWN WONDER WOMAN

“

WHAT SORT OF
WORLD DO YOU
WANT TO LIVE IN?

”

- WONDER WOMAN, VOL. 2
#170 (“SHE’S A WONDER”)



Warner Bros. Pictures

Comic book writers like Stan Lee, former editor-in-chief of Marvel Comics, and William Moulton Marston, the creator of “Wonder Woman,” wrote the heroes they wished existed in the world.

Wonder Woman, the iconic female superhero who debuted in 1941 in the same month as the Pearl Harbor bombing, is all about empowering people – especially women – to make the world a better, safer place for all of humanity.

“If the prospect of living in a world where trying to respect the basic rights of those around you and valuing each other simply because we exist are such daunting, impossible tasks, that only a superhero born of royalty can address them, then what sort of world are we left with? What sort of world do you want to live in?” Wonder Woman asks in one of Marston’s “Wonder Woman” comics.

Debora Rodrigues, an associate professor in civil and environmental engineering at the UH Cullen College, became the “Wonder Woman” she wished to see in the world.

Her superhero mission is to provide global access to clean water through affordable purifying technologies. But that’s not her only superpower.

The mother, teacher, researcher, mentor and supporter of female and minority scientists is an archetype of balance, strength and heroism – tempered with demure.

“I just want to leave the world a better place for future generations, at least a bit,” she says.

A HERO IS BORN

Rodrigues’ superhero trajectory began in Brazil and led to the bustling city of Houston and its Carnegie-designated Tier One public research University.

“Good quality water is becoming scarcer. To be honest, I think water is going to be the reason for many wars in the future,” she says.

As an undergraduate at the University of São Paulo in Brazil, she participated in environmentally-related field-work and researched water and sanitation issues, both of which involved her visiting communities and slum areas – called favelas – plagued with disease and high child mortality rates.

Lack of safe drinking water and proper sanitation increase the chance for outbreaks of waterborne diseases like diarrhea, typhoid, hepatitis and cholera.



Her team warned community members about the danger; a few chose to listen, but many didn't.

"Why would people treat water if it looks clean? Why would they pay more to treat it? They couldn't see the problem," she says, adding that the team didn't have affordable and accessible technological solutions to offer the people at the time. "Many people believed that if the problem wasn't visible, then there wasn't any problem. Sometimes we don't make the connection."

Even today she tears up recalling those memories.

"It was sad, but it made me realize I wanted to make a difference," Rodrigues says. "So I ended up going into environmental science and engineering."

She earned a master's degree in environmental microbiology from the University of São Paulo, a doctorate in microbiology and molecular genetics from Michigan State University and a postdoctoral degree in chemical and environmental engineering from Yale University.

Rodrigues has been teaching at the Cullen College for eight years while leading several research projects focused on improving water quality and sustainability. Her goal is to understand the aquatic system and its microbial ecology, investigate the effects of nanomaterials on the environment and develop new nanotechnologies and biotechnologies to remove harmful contaminants and keep aquatic systems safe.

She wants to create energy-efficient technologies – alternatives to more expensive and high-energy treatment methods like reverse osmosis – that will filter out metals, microbes, radioactive materials and other contaminants from water. In her quest for affordable technology, she created a filter using hydrogel beads and then partnered with a group of UH Bauer College of Business alumni to introduce the filtration system to the commercial market.

Together they founded a company called WAVVE, which won many competitions and some related funding. However, the partnership dissolved after about three years. Rodrigues says both she and the students learned a lot from the experience. She is now working with another company to make her technologies available to the public.

"It's a work in progress," Rodrigues says. "Nobody has solved the water problem in so many years, and I don't think I'll be able to solve the water problem completely either during my career, but maybe I'll help mitigate it as much as possible."



Photo credit (top center and right): Children collecting water in a São Paulo favela
Bottom: Rodrigues with her WAVVE colleagues, all UH students

According to 2018 information from worldwaterday.org, about 1.9 billion people around the world live in potentially severe water-scarce areas. This number is expected to grow to 3 billion by 2050. Of these, an estimated 1.8 billion people use an unimproved source of drinking water with no protection against contamination from human feces.

In one community, after Rodrigues and her team collected and tested the water, they discovered it was contaminated with *Cryptosporidium* – a microscopic parasitic protozoa that causes the diarrheal disease cryptosporidiosis.

The community had built septic systems close to their wells, leading to contaminated groundwater.

"I saw these people collecting the water from the wells. The water was very clear and fresh, but full of invisible microbes," Rodrigues says. "They'd drink directly from the wells because they thought it was clean. A lot of people in that region suffered with diarrhea and children, especially the younger ones, were dying because of these water transmittable diseases."



“ I BELIEVE WOMEN CAN DO AS WELL AS MEN. WE JUST NEED A LITTLE BIT OF HELP, SOME GUIDANCE AND SOME EMPOWERMENT. ” - DEBORA RODRIGUES

Earlier this year, Rodrigues was appointed as associate editor of *npj Clean Water*, a new open access online journal dedicated to publishing papers about cutting-edge research aimed at ensuring clean water supplies around the globe.

CHOICES, CHOICES

In the superhero story arc, there are certain guarantees: a towering evil villain; a series of pitfalls and challenges that test the strength and principles of our heroes; and, of course, choices.

Superheroes are constantly faced with choices – difficult, heart-wrenching choices – that ultimately define the scope of their super-powers and the content of their character.

Rodrigues is no exception.

She had a full scholarship from the Brazilian government to pursue her Ph.D. at Michigan State University. However, political instability caused the currency value to drop and the government put the scholarships on hold. "My scholarship disappeared overnight," Rodrigues says. "I was very sad and I cried a lot because I thought my dream to study in the U.S.A. was over."

It was a hurdle, for sure, but not one that would defer Rodrigues' dream. She wrote to the school and the professor she was supposed to work with, who helped her with funding. Soon after, she found herself fully committed to completing her doctoral degree in Michigan while her husband worked in Connecticut.

Balancing work and personal life is fraught with difficult choices

and sacrifices. Rodrigues points out that no matter how you choose to balance your time, guilt and stress are often inherent in those decisions.

"Latin American society is different. When women get married they are expected to take care of family and children. I have so many friends who did their Ph.D. and are now housewives. I have had people tell me I should do the same – stay home and take care of my family. There's nothing wrong with being a housewife, but that's not what I wanted to do," Rodrigues says. "But my husband knows my passions, he knows how much I love to teach and do research. He's always been supportive and the first one to encourage me to go for new opportunities."

Motherhood brought its own joys and challenges. She is mom to an 8-year-old boy – who she describes as "the love of my life" – with cerebral palsy.

"Having a family, especially a child with special needs, and needing to travel for conferences and work is very painful," Rodrigues says. "Every time I had to leave, I'd be heartbroken. But my husband kept me going. He's pretty amazing and we're partners – a team."

She knows other women face similar struggles when it comes to making career choices. As a member of the Association of Environmental Engineering and Science Professors (AEESP), Rodrigues tries to recruit more women for the AEESP Distinguished Lecture Series. Selected lecturers commit to traveling twice a month to present lectures at different universities.

Before 2014, the series had only one female distinguished lecturer in 45 years.

"It's a great professional honor and networking opportunity," Rodrigues says. "The committee says we need more women, so I started asking female colleagues if I could nominate them."

Most of the time the response she gets is: "It's not a good time for me." Other times she's met with surprise and deprecation of the "I don't think I deserve it" variety. Rodrigues has also seen many women take a backseat in other professional settings such as conferences and networking opportunities.

So the real Wonder Woman that she is, Rodrigues seeks to encourage other women to harness their own superpowers to advance science and, ultimately, save the world.

"This is one of my passions because I believe we [women] can do as well as men. We just need a little bit of help, some guidance and some empowerment," she says.

"Can you do it alone? It's possible, but it's harder, much harder," she adds, noting some of the monumental mentors she's had along the way. Cullen College professor Fritz Claydon – also the director of the division of undergraduate programs and student success – played a central role to Rodrigues' success as a teacher and researcher.

"To be honest, most of the professional success I have had in my early career is owed to him," she says. "He helped me with my first grant application to the National Science Foundation (NSF), my NSF CAREER Award application, as well as my early outreach programs. He's an awesome mentor."

“ I JUST WANT TO LEAVE THE WORLD A BETTER PLACE FOR FUTURE GENERATIONS, AT LEAST A BIT. ”

- DEBORA RODRIGUES



Her experiences taught her the value of mentorship and the importance of a support system.

Rodrigues now gives back whenever she can – from mentoring and supporting junior faculty members and students to outreach and providing career-building workshops.

This summer she conducted a NSF-funded two-week workshop for women and minority students interested in finding jobs and succeeding in academia.

"The aim of the workshop was to give students all the tools they need to be successful, but it goes beyond the two weeks, because now the participants are our mentees," Rodrigues says. "It's a long-term supportive relationship."



RELATABLE AND EXCEPTIONAL

In the 2017 film "Wonder Woman," Diana Prince – the alter ego of Wonder Woman – is warned by her love interest and partner, Steve Trevor, not to cross "No Man's Land."

Set in the trenches of a French battlefield during World War I, Diana witnessed innumerable casualties of both soldiers and civilians leading to this scene.

"This not something you can cross. This is not possible," Trevor warns.

Diana then pulls off her cloak, revealing her Amazonian armor and her true identity as Wonder Woman. She emerges from the bunker and strides across "No Man's Land," deflecting gunfire all along the way, to rescue a village.

The iconic scene reveals our superheroine is a warrior, sure, but a warrior driven by compassion for people and a love for this planet. In the comic book universe, just as in our universe, these traits render Wonder Woman both relatable and exceptional.

When it comes to Wonder Woman or Debora Rodrigues, nothing stands in the way of their courage, empathy and determination to make a difference. And the world, both fictional and real, is a better place because of it. ⚡

WHAT WOULD YOUR SUPERPOWER BE?

“ I'D FLY SO I COULD GET PLACES QUICKER AND DO MORE STUFF. ”

- STUART LONG,
professor of electrical and computer engineering, associate dean of the UH Honors College and Undergraduate Research

“ I WILL TAKE SUPER COMMUNICATION –

the capacity to read, write, speak and comprehend any forms of languages. From Farsi, Spanish and English to Prakrit and Phoenician, Khat-e-Mikhi and so on. I could travel anywhere and speak to anyone. Simply, appreciate everything this world offers.

” - MOHAMMAD SARRAF JOSHAGHANI,
Ph.D. student studying computational mechanics

“ I'D LIKE TO HAVE A MAGICAL TOUCH TO STOP AND ELIMINATE ANY TYPE OF CANCER!

Cancer has proven to be a huge challenge for science, affecting so many lives...I believe elimination of cancer would have a tremendous effect on quality of life for people across the world.

” - SHEEREEN MAJD,
assistant professor of biomedical engineering



“ I THINK IT WOULD BE THE ABILITY TO MAKE EVERYONE SEE OUR PLANET FROM OUTER SPACE,

perhaps from the Moon, so we can understand that we – all together – are just a part of a much bigger world.

” - OLGA BANNOVA,
director of the space architecture graduate program at the Sasakawa International Center for Space Architecture (SICSA)

“ IF I COULD HAVE ANY SUPERPOWER I WOULD CHOOSE TIME MANIPULATION.

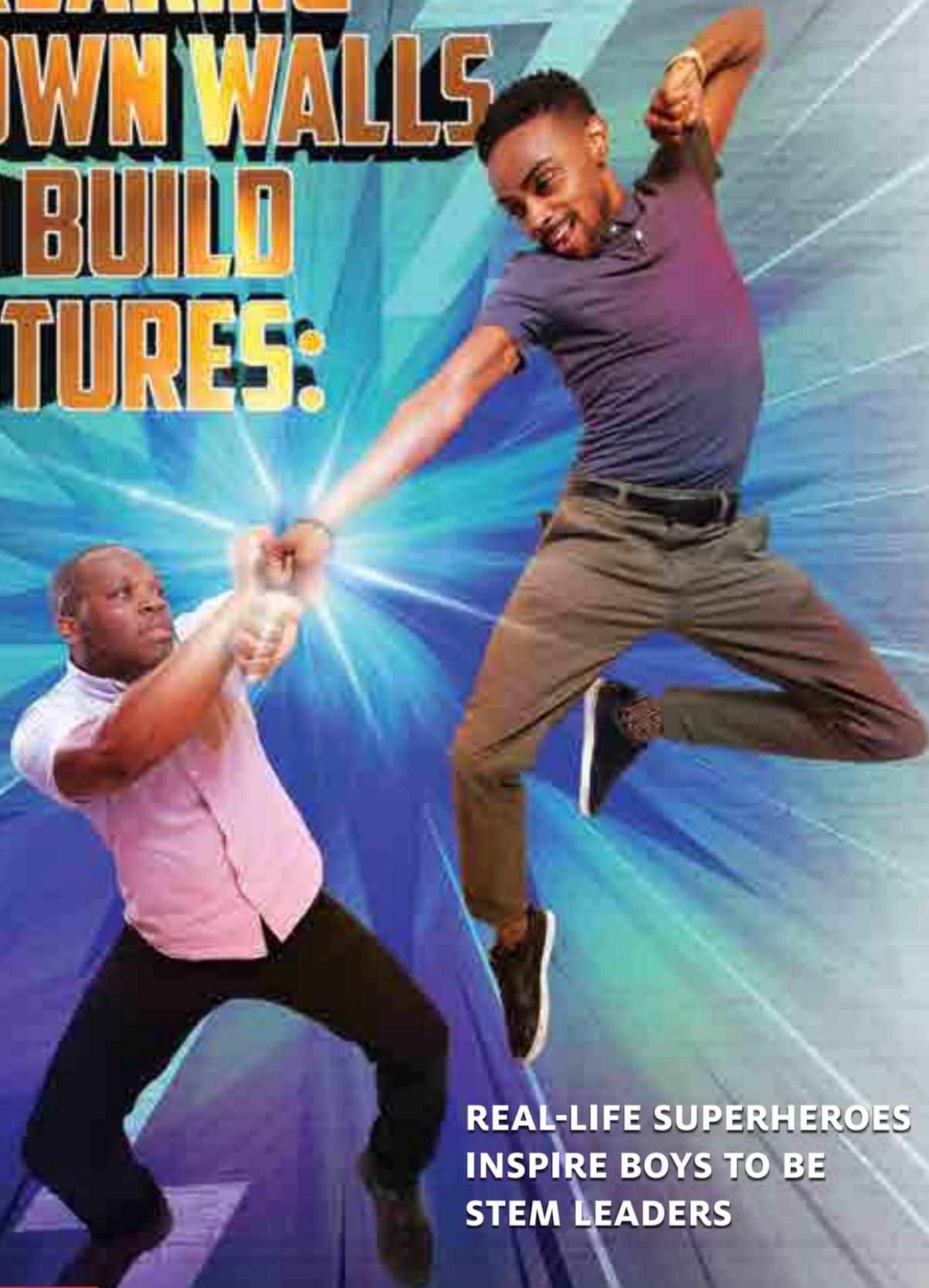
In addition to being able to save the day, I'd never run short on time for studying for an exam.

” - JACOB TRUE FURRH, undergraduate student double majoring in civil engineering and environmental sciences

“ I'D LIKE TO HAVE THE POWER OF KNOWING WHAT'S GOING TO HAPPEN IN THE FUTURE. ”

- DEBORA RODRIGUES, associate professor of civil and environmental engineering

BREAKING DOWN WALLS TO BUILD FUTURES:



**REAL-LIFE SUPERHEROES
INSPIRE BOYS TO BE
STEM LEADERS**

“**MENTORS ARE
ABSOLUTELY LIKE
SUPERHEROES.**

”

- JERROD
HENDERSON

If Houstonian Juan Becerra, a father of three boys, could have any superpower, it'd be to look into the future. He'd use it to do everything right and lift his boys up as high as possible. He believes that all parents dream of giving their children a better life than their own.



His father had a sixth grade education and his mother reached only second grade. "Growing up I always knew my father wanted us to be better off and the same thing applies to me," Becerra says. "I was lucky to graduate high school. I did better than my father and my mother, but now I want [my kids] to do better than I did. I want them to grow."

He hopes they will go to college, apply themselves and gain the skills and knowledge needed to ride the wave of technological advances to future opportunities.

To make that future happen, Becerra and his 10-year-old son, Joshua, are participating in an innovative after-school program at the University of Houston Charter School called the St. Elmo Brady STEM Academy – made up of the highly-prized disciplines of science, technology, engineering and mathematics.

The Academy, which aims to engage underrepresented minority boys in STEM activities and issues, is named after St. Elmo Brady, the first African-American man to earn a Ph.D. in chemistry from the University of Illinois in 1916. He went on to teach and mentor several students during his lifetime.



⚡ ABOUT ST. ELMO BRADY ⚡

The St. Elmo Brady STEM Academy is named after the first African-American in the U.S. to receive a Ph.D. in chemistry. Born in Kentucky, St. Elmo Brady earned his doctoral degree from the University of Illinois in 1916. As a student, he was a member of Phi Lambda Upsilon, the chemical honor society, and was among the first to be included in Sigma X, the Scientific Research Society. Brady went on to teach and conduct research at Tuskegee University, Howard University and other colleges. He strived to build strong undergraduate curricula and boost fundraising at historically Black colleges. Brady was also known for advancing the field of spectroscopy.

 This page: Juan Becerra and his 10-year-old son, Joshua
Opposite page: Jerrod Henderson (left) and Rick Greer

The original St. Elmo Brady serves as a superhero inspiring hope and possibility for the two founders of the program: **Jerrod Henderson**, instructional assistant professor at the UH Cullen College of Engineering, and **Rick Greer**, a graduate student in the UH College of Education.

ORDINARY PEOPLE DOING EXTRAORDINARY THINGS

The UH St. Elmo Brady STEM Academy encompasses a partnership across disciplines and programs, allowing different skills, expertise and resources to work together for a common goal. It brings together the University of Houston's Cullen College of Engineering, College of Education, College of Natural Science and Mathematics, Charter School and teachHouston, a program that prepares students to teach math and science.

University of Houston undergraduate and graduate students help create the curriculum, teach the boys twice a week in after-school

lessons and work with them on Saturdays for hands-on sessions. In return, UH students are gaining teaching experience and getting the opportunity to make a difference in the local community.

“It’s a great partnership, which not only lets the fourth and fifth graders grow, but also our UH students,” Henderson says. “It expands everyone’s world.”

Role models are at the root of the Academy’s success and another unique component. The program stresses the involvement of role models, preferably the boys’ fathers, grandfathers or other close male relatives. In addition, the college students who are involved in the program also act as role models and mentors.

“Mentors are absolutely like superheroes,” says Henderson, who knows the value of a good role model from personal experience.

From sixth grade through graduating high school, Henderson participated in a program called Mentoring and Educational Network for Technical and Organizational Readiness (MENTOR) in North Carolina. Thanks to MENTOR, Henderson attended his first Black Engineer of the Year Awards, decided he wanted to be an engineer and met his personal mentor, Nathaniel Vause.

When Henderson graduated with his doctorate in chemical and biomolecular engineering from the University of Illinois, Vause – who is the founder of MENTOR – drove up from North Carolina with three students he was mentoring at the time to celebrate the event.

For Greer, who says he grew up without a male role model, the mentor/mentee relationship between Henderson and Vause is a major inspiration behind the St. Elmo Brady Academy model.

“They [Henderson and Vause] still talk to this day. If we can cultivate that bonding and mentoring in our program, that would be perfect,” says Greer.

BREAKING THROUGH BARRIERS

STEM fields are driving U.S. economic growth and show no signs of slowing down.

Employment in STEM occupations has grown 79 percent – from 9.7 million jobs in 1990 to 17.3 million in 2016, vastly outpacing employment in non-STEM sectors, according to the Pew Research Center.

There’s more good news: data from the U.S. Bureau of Labor Statistics project employment in computer occupations could grow by half a million by 2024, and roughly 65,000 new engineering jobs will be available in the same timeframe.

But there’s also a downside: growth in engineering and other STEM occupations is outpacing the supply of skilled workers.

“The future of the engineering profession depends on our ability to attract more underrepresented students into STEM fields,” says



Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College of Engineering.

African-Americans and Hispanics are underrepresented in the STEM workforce. According to the 2017 Women, Minorities and Persons with Disabilities in Science and Engineering report by the National Science Foundation, White males constitute about 49 percent of the workers in science and engineering jobs, while African-American and Hispanic males make up only 3 percent and 4 percent of the workforce, respectively.

Just under 8 percent of science and engineering doctorates were earned by underrepresented minorities in 2014.

Very much like superheroes themselves, Henderson and Greer are facing this challenge head-on, focusing on solutions and making a difference through the Academy.

THE ORIGIN STORY

Henderson and Greer started the program five years ago when they were both working at the University of Illinois at Urbana-Champaign and piloted it at the Don Moyer’s Boys and Girls Club. Initially, they paid program expenses out of their own pockets, but as word spread private donations and public funds began flowing in.

“There is research indicating that by the time students – particularly African-American and Latino males – get to the eighth grade, they’ve already identified that they don’t like math and science,” says Greer, who specializes in K-12 education.



Students and mentors in St. Elmo Brady STEM Academy conduct hands-on experiments and solve complex problems

Henderson points out that there are many reasons for this – from poverty and lack of encouragement to disparities in the U.S. educational system.

MAKING A DIFFERENCE

Henderson and Greer hope to bridge these gaps.

“The main reason for this program is to help change that narrative and get these kids on the path to become STEM leaders,” says Greer. “One way we do that is by exposing our students to these opportunities, meeting professionals and other students in the STEM fields, and really trying to get them excited about math and science.”

The National Science Foundation awarded the team a three-year, \$1 million grant earlier this year to expand the project and continue the research. Henderson says St. Elmo Brady STEM Academy should be in four Houston elementary schools by the end of those three years.

The Academy is the latest offering in the Cullen College’s repertoire of outreach programs aimed at inspiring underrepresented groups to enter STEM fields. Two such programs – G.R.A.D.E. (Girls Reaching and Demonstrating Excellence) Camp and Girls Engineering the Future (sponsored by Chevron) – focus on encouraging young girls to pursue careers in engineering. Researchers at the Cullen College track the impact of these programs annually, reporting that a much higher percentage of the participants go on to study STEM fields in college when compared to their peers.

Henderson and Greer have seen St. Elmo Brady STEM Academy have a similar impact on young, underrepresented male students. They will be tracking its impact in the Houston community over the years.

The team – which now includes Mariam Manuel, a science master teacher with teachHouston, and Virginia Snodgrass Rangel, assistant professor in the UH College of Education – also has a very specific research focus tied to the program: how STEM identity develops among young boys of color who have access to this after-school program.

SUPERHEROES IN ACTION

The first Saturday Becerra accompanied Joshua to St. Elmo Brady STEM Academy, he walked into a room full of books. “I had some preconceptions about the program,” he admits, adding that he expected a lot of lectures and textbook-learning because “that’s what I have always thought about science.”

“IT’S A GREAT PARTNERSHIP, WHICH NOT ONLY LETS THE FOURTH AND FIFTH GRADERS GROW, BUT ALSO OUR UH STUDENTS. IT EXPANDS EVERYONE’S WORLD.” - JERROD HENDERSON

Instead, he saw young boys – his son Joshua included – solving complex math problems and explaining how they did it, making catapults, designing spacecraft, solving problems, having fun and, most importantly, thinking analytically.

“My favorite parts are the experiments and Saturdays – that’s when they do the coolest things,” Joshua says. “Sometimes, if I’m lucky, I get to keep the experiments.”

One project involved the boys creating a rocket of sorts that had to land with a toy astronaut figure inside a cup. The goal was to make sure the astronaut did not fall out or “get ejected” during landing. Joshua and his team came up with a design that had padding underneath the bottom to cushion the landing.

It worked.

Another team challenged Joshua’s team. While the challenger’s craft fell apart, the astronaut stayed inside the cup. So was it a tie?

Joshua explained that just because the goal had been achieved didn’t mean success, because the craft wasn’t “designed to break apart,” so it missed the larger goal.

“It was a proud moment for me,” Becerra says. “He had an opinion, based on fact and logic. The group setting they’re in, they learn to have opinions and to put their thoughts out and contribute to the group. I think that’s an important piece of the program.”

In the latter part of 2018 Joshua will participate as a fifth grader. Both father and son are looking forward to the second year of the program.

“Back when I was in elementary school, they didn’t have all the technology and programs they have now. It just wasn’t part of the curriculum,” Becerra says. “It’s our responsibility as parents to give them the opportunity to grow when it’s there. Yes, it’s a time commitment. It’s not easy, it involves Saturdays... but at the end of the day, it’s worth it.”

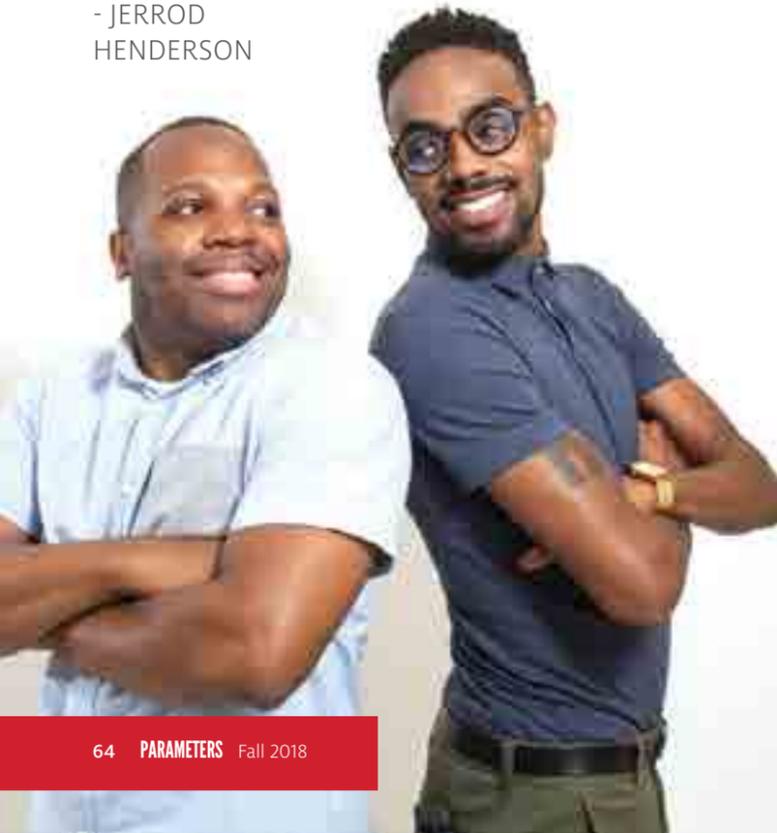
Seeing participants excited about the program makes it worth it for the Academy’s two founders. Greer’s favorite memory of this journey stems from the pilot program. It involved building mousetrap racecars.

“Fathers were literally on their hands and knees on the ground, working on their cars with the students,” Greer shares. “It was a powerful moment for me.”

Henderson agrees. “That was the seed for us,” he says. “That’s when we knew we had something to expand upon.”

“THE POSSIBILITIES ARE ENDLESS.”

- JERROD HENDERSON



JOINING FORCES TO BEAT THE ODDS

Henderson, who is also director of PROMES – the Program for Mastery in Engineering Studies – has long-term ambitions for St. Elmo Brady STEM Academy. He is thinking in terms of pipeline, supply and demand, and impacting the national STEM sectors.

According to the New American Economy Research Fund analysis, the United States “has a persistent and dramatic shortage of STEM workers.” In 2010, an estimated 5.4 STEM jobs were posted online for every one unemployed STEM worker. By 2015, such postings outnumbered unemployed STEM workers by almost 17 to 1.

In 2016, STEM employers still faced the issue: 13 jobs posted online for each unemployed worker – roughly 3 million more jobs than the number of available professionals who could fill them.

The UH team of researchers hope St. Elmo Brady STEM Academy is a model that can be duplicated in other areas around the country. Currently it’s being used in Champaign, Illinois and Houston, but there’s some interest in taking it to Connecticut and North Carolina as well.

“We have an enormous opportunity to impact that pipeline in a key place – the city of Houston – by working with fourth and fifth graders,” Henderson says. “We impact them here, and that will translate eventually to making a decision to come to a college of engineering, to become graduates in STEM, who will then impact the U.S. economy and the global economy.”

It seems that Henderson’s superpower involves looking into the future as well.

“The possibilities are endless,” he says with his trademark grin. ⚡



Professor of Petroleum Engineering

Birol Dindoruk, a National Academy of Engineering (NAE) member and, until recently, an adjunct professor at UH, now joins the Cullen College part-time as a professor of petroleum engineering.

Dindoruk’s theoretical and practical work on enhanced oil recovery and CO2 sequestration – which earned him the NAE membership – began during his time at Stanford, where he received a Ph.D. in petroleum engineering. He also holds an MBA from the UH C.T. Bauer College of Business.

A chief scientist of reservoir physics and reservoir engineering at Shell International

E&P Inc., Dindoruk has extensive experience in the oil and gas industry and knowledge of its current state to share with UH engineering students.

He has taught at UH since 1999 and served as a consulting professor at Stanford since 2013.



Assistant Professor of Biomedical Engineering

Renita Horton will join the Cullen College as an assistant professor in the biomedical engineering department in January 2019.

Horton comes to UH from Mississippi State University (MSU), where she worked as assistant professor of agricultural and biological

engineering. While at MSU, she established the Cardiovascular Tissue Engineering Laboratory.

Previous to her MSU appointment, Horton completed a postdoctoral fellowship at Harvard University’s Wyss Institute for Biologically Inspired Engineering.

Horton received her bachelor’s degree in chemical engineering from MSU in 2005. She went on to earn a master’s and doctoral degree from Harvard in engineering sciences with a concentration in biomedical engineering. She first became affiliated with Harvard when she participated in a Research Experience for Undergraduates summer program – funded by the National Science Foundation – at the university’s Materials Research Science and Engineering Center.

Her research interest lies in better understanding the factors leading to heart disease and sickle cell anemia. She hopes to use that knowledge to improve patient care and outcomes.



JINSOOK ROH

Assistant Professor of Biomedical Engineering

Jinsook Roh joins the Cullen College as an assistant professor in the biomedical engineering department. Previously she served as an assistant professor of kinesiology at Temple University in Pennsylvania. She also serves as an adjunct professor for Northwestern University.

Her research focuses on the neural mechanisms of motor coordination in unimpaired and neurologically impaired individuals. She completed her Ph.D. at the Massachusetts Institute of Technology (MIT) on systems and computational neuroscience. She worked as a postdoctoral research fellow at Northwestern University's Rehabilitation Institute of Chicago, where she helped identify abnormalities in muscle coordination in stroke survivors with varying levels of motor impairment and addressed basic motor control topics.

She received the American Heart Association postdoctoral fellowship (2010-2012) and several awards for excellence in research and fellowships from various institutes.



HONG-YI LI

Assistant Professor of Civil and Environmental Engineering

Hong-Yi Li joins the civil and environmental engineering department at the Cullen College as an assistant professor. Previously, he

served as associate professor of land resources and environmental sciences at Montana State University.

Li has a Ph.D. in hydrology and water resources from the University of Illinois at Urbana-Champaign. He earned a master's degree in hydrology and water resources and a bachelor's in hydraulic and construction engineering from Tsinghua University in China.

Li specializes in hydrological and biogeochemical modeling and analysis. His research interests include developing innovative modeling and data analysis tools to understand lateral transport of water, energy and biogeochemistry fluxes across land surfaces and through river systems under climate and human-induced changes. His work also pursues the understanding and representation of two-way interactions and feedbacks between human and earth systems within the climate-water-energy-environment nexus.



XINGPENG LI

Assistant Professor of Electrical and Computer Engineering

Xingpeng Li is an assistant professor in electrical and computer engineering at the Cullen College. Before joining UH, Li worked as a senior application engineer at ABB Inc., a pioneering U.S. company specializing in digital technologies for various industries.

Li has a Ph.D. in electrical engineering with a focus on power systems and a master's in industrial engineering with a focus on operations research from Arizona State University. He also earned a master's in electrical engineering with a focus on power systems from Zhejiang University in China.

His research interests include cyberattacks, energy management, transmission networks, and power grids and flow.



FENG-CHANG CHANG

Instructional Associate Professor of Industrial Engineering

Feng-Chang Chang joined as an instructional associate professor in the industrial engineering department of the Cullen College. Before coming to UH, he served as an associate professor and the coordinator of the industrial management and applied engineering program in the technology department of Southern Illinois University (SIU). He won several Outstanding Teacher of the Year awards at SIU.

His research interests include lean manufacturing, artificial intelligence, Six Sigma, theory of constraints, computer simulation and supply chain management.



DESIREE PHILLIPS

Instructional Assistant Professor of Electrical and Computer Engineering

Desiree Phillips is an instructional assistant professor in electrical and computer engineering at the Cullen College.

She earned a Ph.D. and a master's degree in electrical engineering from the University of Illinois at Urbana-Champaign. Her doctoral thesis focused on a power system's role in the water-energy nexus, which included examining the introduction of water costs in electricity markets and its effect on optimal market bids. ⚙️



UH Engineering Professor Wins Prestigious MOORES PROFESSORSHIP

BY RASHDA KHAN

Zhu Han, professor of electrical and computer engineering at the Cullen College, is having a good year.

He's been awarded a 2018 Moores Professorship, a University-level honor awarded annually to UH faculty members who have made outstanding contributions in research, teaching and service. Each Moores Professor receives a \$10,000 annual stipend, and the professorship is renewable every five years.

Han, who started in 2008 as an assistant professor in the electrical and computer engineering department, considers the award an honor and a significant reward. He compared his career in academia to climbing a mountain.

"In the beginning it feels difficult and daunting," he said. "But when you reach the top, it's beautiful and an achievement."

This isn't the only reward Han found at the top of the academia mountain. He was named a Fellow of the Institute for Electrical and Electronics Engineers (IEEE) in 2014 for his contributions to resource allocation and security in wireless communication and received the IEEE Distinguished Lecturer Award in 2015. He also earned a National Science Foundation CAREER Award in 2009.

One wall of his office showcases all of his awards and achievements, framed and neatly displayed.

When asked what he's proudest of achieving in his career, Han points to another part of his office. This side showcases frame after frame of smiling former students he has mentored through the years.

"Those photos were taken just before they were leaving UH as graduates and moving on to the next chapter," Han said. "You can see how happy they are. I'm proudest of my students."

He hopes that he's helped his students be intellectually curious and independent thinkers – that they will not only be useful in society, but become leaders.



Other Cullen College faculty honored by various University awards are:



Christiana Chang, instructional assistant professor of mechanical engineering, won a Teaching Excellence Award in the instructor/clinical category. This award honors outstanding teaching effort.

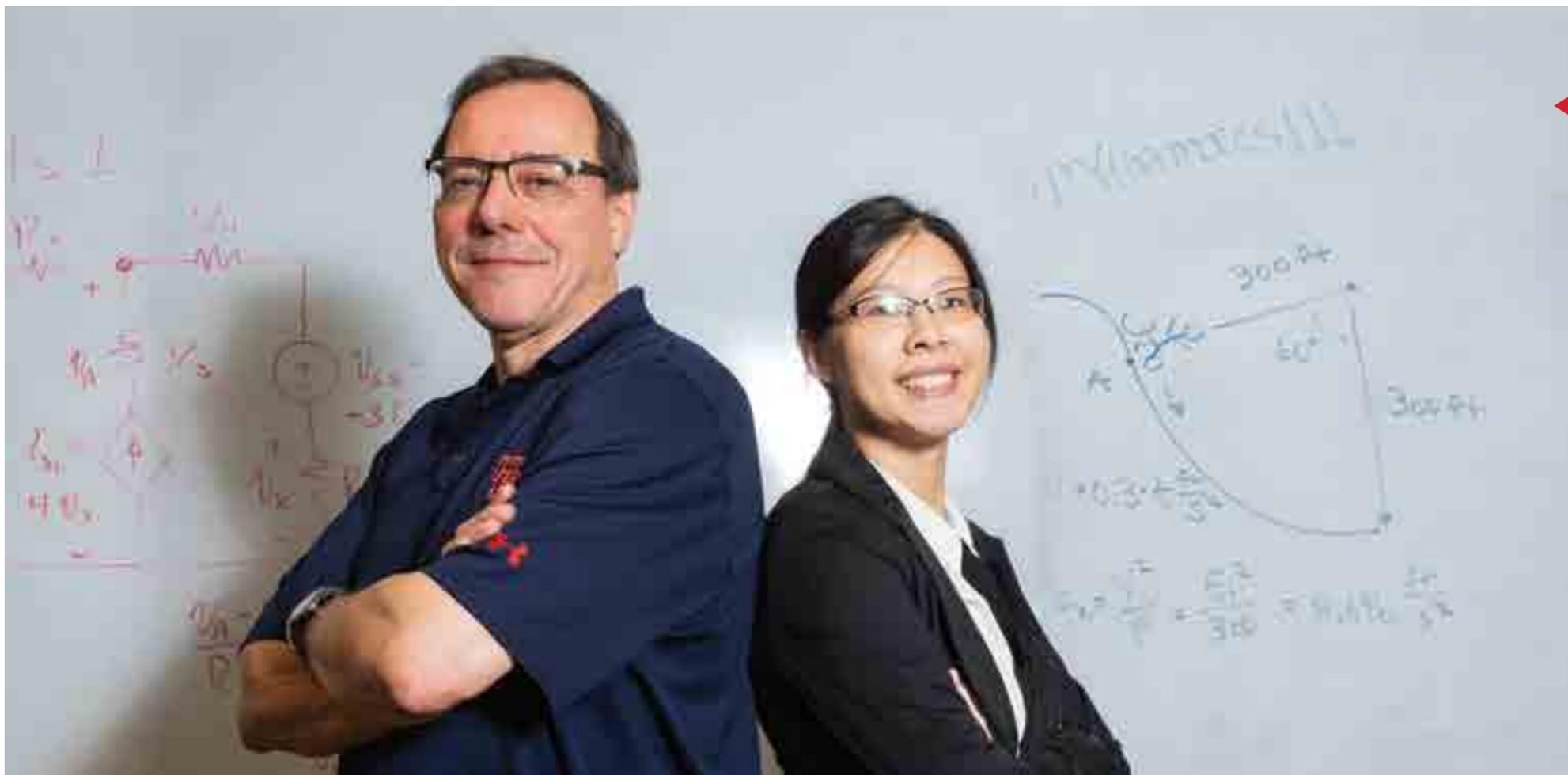


Jose Luis Contreras-Vidal, professor of electrical and computer engineering, won an Undergraduate Research Mentoring Award. This award recognizes faculty – with at least five years mentorship involvement – making a significant impact in their field by supporting and mentoring undergraduate students in research and scholarship. Contreras-Vidal is known for working to improve prosthetics with brain-computer interfaces.



Jacinta Conrad, associate professor of chemical and biomolecular engineering, and **Yan Yao**, associate professor of electrical and computer engineering, received Awards of Excellence in Research, Scholarship and Creative Activity for the 2017-2018 academic year. ⚙️





Cullen College Announces TWO WINNERS of Inaugural Brookshire Teaching Excellence Awards

BY RASHDA KHAN

The late William A. Brookshire – a UH chemical engineering alumnus – understood firsthand the impact that dedicated teachers can have on students’ lives. Raised without means, Brookshire often credited his profes-

sors at the Cullen College of Engineering for pushing and inspiring him to complete his degree.

Years later, Brookshire found a way to give back. He donated funds to the Cullen College to create the William A. Brookshire Teaching Excellence Award Endowment to honor engineering faculty “who demonstrate an unwavering commitment to exemplifying the highest levels of teaching excellence inside the classroom.”

This May the Cullen College presented the first Brookshire Teaching Excellence Awards to two engineering faculty who excel in their roles as educators – Christiana Chang, instructional assistant professor of mechanical engineering, and Len Trombetta, associate professor of electrical and computer engineering.

“Dr. Brookshire intended for this award

to recognize engineering professors who go above and beyond standard classroom lessons to shape and inspire the next generation of global engineers,” said Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College of Engineering. “Christiana and Len are two of the most dedicated and innovative educators I have ever had the pleasure of knowing, and I am so pleased to see them recognized as the inaugural winners of Dr. Brookshire’s award.”

Christiana Chang

One of the students who sent in a letter recommending Chang for the award credited her for his career. He had just failed his first mechanical engineering exam when he approached Chang for advice on whether he should continue with the course or drop it.

She responded with tutorials, study tips and

advice about using available resources better.

“With her help, motivation and influence, I passed the class and made an A on the final, which led me to believe that I can be a mechanical engineer,” he wrote.

Chang designs “kitchen sink” quizzes from scratch, combining as many exam concepts as she can into each problem to challenge her students and help them build a strong knowledge base. She also creates hands-on design workshops to help students learn coding and instrumentation. Her open-door policy and office hours are resources available to any student needing help – whether it’s clarification of a confusing concept, career advice or tips for more effective study habits.

Her passion for teaching has netted Chang several other awards. She’s won the Cullen College of Engineering Outstanding Lecturer

“

Christiana and Len are two of the most dedicated and innovative educators I have ever had the pleasure of knowing, and I am so pleased to see them recognized as the inaugural winners of Dr. Brookshire’s award.

”

- DEAN JOSEPH W. TEDESCO

Award for 2014-2015, the Student’s Choice Professor of the Year Award in 2015 from UH’s American Society of Mechanical Engineers (ASME) student chapter, and a UH Teaching Excellence Award in the instructor/clinical category for 2017-2018.

While Chang is grateful for her awards, she is even more grateful that she’s able to help students discover their own potential.

“UH students can achieve much more than they realize – my job, both as an instructor and as a faculty advisor, is to help them realize how much they can achieve,” said Chang, who is herself a UH engineering alumna. “I want students to know they can take on any challenge with their UH engineering degree.”

Len Trombetta

Len Trombetta, who started teaching at the Cullen College in 1986, has the reputation of being a rigorous and challenging professor who genuinely cares about his students.

“I try to treat people in my class as colleagues as much as students. In developing lectures, I try to reduce complex ideas to their roots,” Trombetta said. “Once in the classroom, I try to put myself in the place of students who

have never seen the material, and to get them to think about those roots.”

He is open to trying new methods for more effective teaching. A big proponent of hands-on, project-based learning, Trombetta has helped introduce those elements to several courses and made engineering “real” to students.

Trombetta also overhauled the way the electrical and computer engineering “Circuits Lab” class was taught. Instead of bringing electronic workbench tools into a traditional classroom and lecture format, he decided to take the students into the laboratory. There, they work on the equipment while simultaneously viewing lectures and demonstrations by the instructor.

He has directed numerous M.S. theses and Ph.D. dissertations, as well as undergraduate research and senior thesis projects.

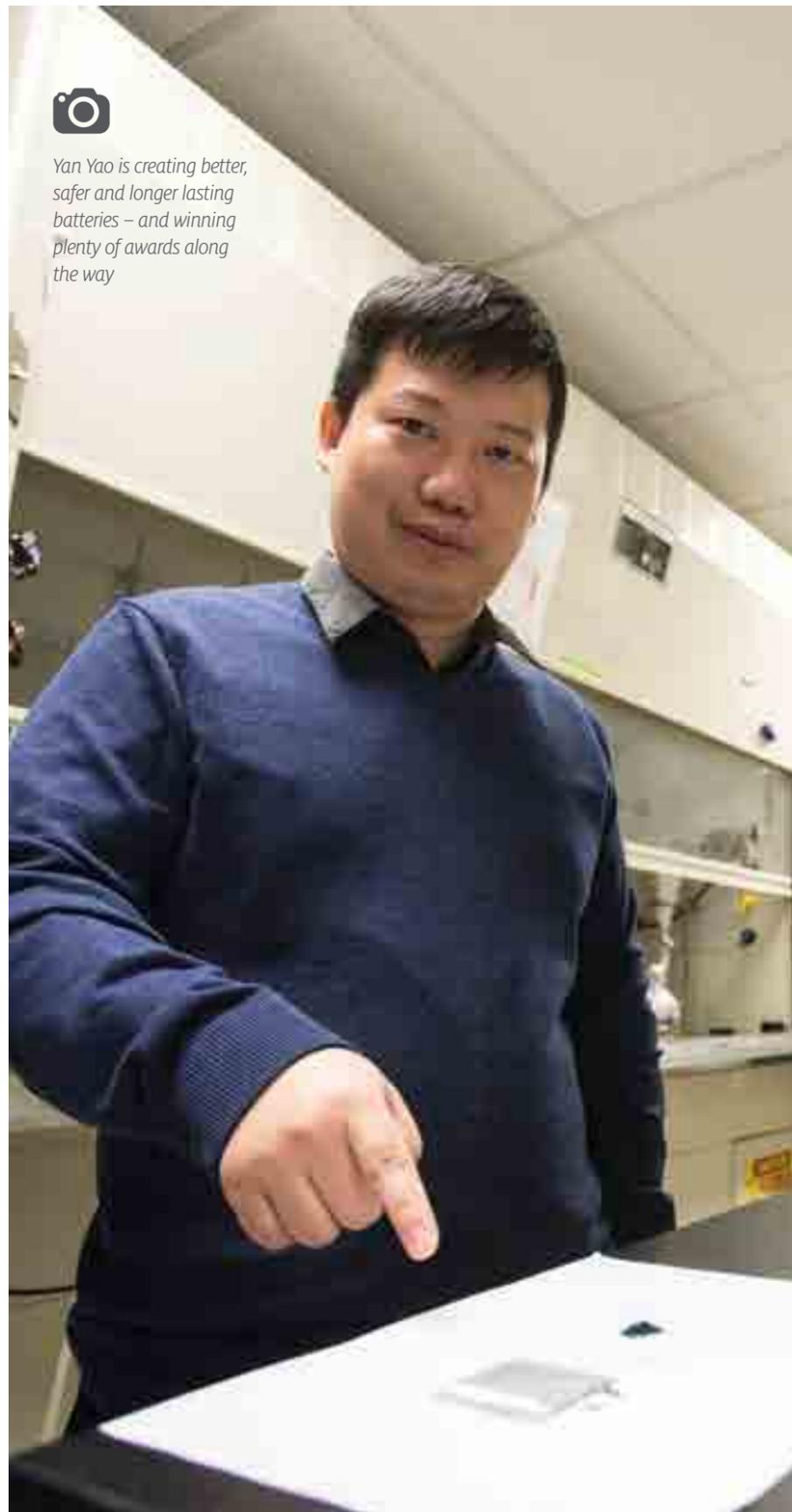
Over the years, Trombetta’s dedication has earned him several other teaching awards. He won the University of Houston’s W.T. Kittinger Teaching Excellence Award in 2017, the Cullen College of Engineering Career Teaching Award in 2010, and the College of Engineering Outstanding Teacher Award in 1991, 1994, 2001 and 2008.

He’s also received some student recognition: The IEEE (Institute of Electrical and Electronics Engineers) student chapter awarded him its Outstanding Teacher Award in 2009 and Eta Kappa Nu – the international electrical and computer engineering honor society of the IEEE – awarded him the Outstanding Teacher Award in 1992.

“Students actively seek out his sections because the word has passed on from one generation of students to the next – that if you take his class, you will learn the material and be well prepared for the next courses in the sequence,” said Fritz Claydon, director of the division of undergraduate programs and student success. ⚙️



Yan Yao is creating better, safer and longer lasting batteries – and winning plenty of awards along the way



BATTERY EXPERT POWERS UP

With Scialog Award

BY RASHDA KHAN

When it comes to batteries, UH engineer **Yan Yao** never runs out of award-winning ideas.

Yao, an associate professor of electrical and computer engineering at the UH Cullen College, and his research partners are known for their work creating better, safer and longer lasting batteries in the energy storage field.

He teamed up with Jahan Dawlaty of the University of Southern California and Puja Goyal of SUNY Binghamton to further explore the fundamental mechanisms at play in aqueous batteries. Their work on an alternative, non-flammable and rechargeable aqueous battery, titled “Proton-coupled electron transfer in batteries based on quinone crystals,” recently received a Scialog Award from the Research Corporation for Science Advancement.

In March, research by Yao and his post-doctoral researchers made the cover of *Angewandte Chemie International Edition*, a renowned chemistry journal.

In 2017, Yao’s group announced a technical breakthrough in aqueous batteries using inexpensive, organic quinone materials. A paper on this was published in *Nature Materials*. He was also named a Scialog Fellow and received funding from the Department of Energy’s Battery500 consortium the same year.

Other accolades earned by Yao include: The Robert A. Welch Professorship by UH’s Texas Center for Superconductivity (TcSUH), the Ralph E. Powe Junior Faculty Enhancement Award from the Oak Ridge Associated Universities and the 2013 Office of Naval Research Young Investigator Award. ⚡

SOCIETY OF PETROLEUM ENGINEERS

Recognizes Professor for Innovative Contributions to Oil and Gas Industry

BY RASHDA KHAN

The Gulf Coast Region of the Society of Petroleum Engineers (SPE) recognized **Konstantinos Kostarelos**, associate professor of petroleum engineering, with the 2018 Regional Distinguished Achievement Award for Petroleum Engineering Faculty.



“Just being nominated for this award is rewarding when you know that students appreciate your efforts to pass on knowledge to them, so being selected is really special,” Kostarelos said. “I am humbled when I see the names of others who received this award in the past.”

Previous UH recipients of the award include subsea engineering program director Phaneendra Kondapi in 2017 and Tom Holley – founding director of the petroleum engineering department – in 2014. With Kostarelos, that’s three UH recipients in the last five years.

Kostarelos is known for innovative research in the oil and gas field. In 2017, he and his students built a prototype device to address the issue of blockage inside crude oil pipes – a common and costly problem in the oil industry. The process involves putting two electrical plates, highly charged at 4,000 volts, into the pipe. Blockage-causing asphaltene molecules are then pulled to the plates and removed from the oil.

The year before Kostarelos designed a way to use applied enhanced oil recovery methods to clean up the site of an underground fuel leak in Denmark, recovering 35,000 kilograms of jet fuel. He also developed an optical fiber chemical sensor that can be used in the subsurface environment.

He is part of a team of UH researchers working with the oil industry to develop new ways to predict when an offshore drilling rig is at risk for a potentially catastrophic accident. The work is funded by a \$1.2 million grant from the National Academies of Sciences, Engineering and Medicine. It was inspired by the Deepwater Horizon explosion in 2010, which left 11 crew members dead and spilled more than 3 million barrels of oil into the Gulf of Mexico, sparking efforts to better understand the movement of hydrocarbons in offshore drilling.

Other projects Kostarelos and his students are tackling involve improving oil recovery for unconventional reservoirs and working with alternatives to carbon dioxide that could reduce greenhouse gas emissions.

The SPE award recognizes Kostarelos’ outstanding contributions at the regional level. He received it at the 2018 SPE Awards and Scholarships Banquet on May 25 at the Hess Club in Houston.

SPE is the primary professional organization for petroleum engineers around the world, with the Gulf Coast Section (GCS) of SPE alone boasting more than 17,000 members. The mission of the SPE-GCS is to enhance technical knowledge among its members, promote professional development and networking in industry, support local education initiatives and perform community service in the greater Houston area. ⚡

Professor Earns LEGION OF HONOR AWARD From Society of Petroleum Engineers

BY RASHDA KHAN

Ali Daneshy, adjunct professor of petroleum engineering at the University of Houston and president of Daneshy Consultants International, was honored with a 2018 Society of Petroleum Engineers (SPE) Legion of Honor Award.



“Keep plugging and the light at the end of the tunnel will be bright and beautiful.”

- ALI DANESHY

“I am humbled and honored to receive this award,” Daneshy said. “I am grateful for the work and technical contributions of my colleagues and fellow SPE members who have generously shared their knowledge with the rest of our oil and gas community and made it possible for others to add their piece to the foundation built by them.”

The award, which recognizes individuals with 50 years of continuous SPE membership, was presented last May at the SPE Gulf Coast Section Annual Awards and Scholarship Banquet at the HESS Club in Houston.

Daneshy earned a M.S. in mining engineering from the University of Tehran and a M.S. in mineral engineering (rock mechanics) from the University of Minnesota, as well as a Ph.D. in mineral engineering from the University of Missouri-Rolla.

He has 49 years of experience in the oil and gas industry and wrote more than 50 technical papers related to hydraulic fracturing. Previous accolades include SPE honorary membership, distinguished service and distinguished member awards.

Daneshy is also the co-editor-in-chief of *Hydraulic Fracturing Journal*, a quarterly publication dedicated to technology and operations of hydraulic fracturing.

His advice to students and young engineers is simple – talent and hard work will always be rewarded. “Keep toiling, do not get discouraged by the stumbling blocks that you will encounter along your academic path,” Daneshy said. “Keep plugging and the light at the end of the tunnel will be bright and beautiful.” ⚡

UH Subsea Engineering Professor Receives **DISTINGUISHED ACHIEVEMENT AWARD** at 50th Offshore Technology Conference



BY RASHDA KHAN

Brian Skeels, adjunct professor with the subsea engineering program, received the 2018 Distinguished Achievement Award for Individuals at the Offshore Technology Conference (OTC) – one of the biggest energy expositions in the world – on May 1.

“To be recognized with the giants of the offshore industry is truly humbling,” Skeels said. “My career has been filled with wonderful mentors and leaders, some of whom have been recipients of this award.”

The award recognizes Skeels for his pioneering subsea completions in record water depths and the development of new tieback connections that have redefined industry standards. His innovative designs in subsea completions – systems of pipes, connections and valves on the ocean floor that gather hydrocarbons produced from completed wells – held world record water depths from 1986 through 2010 and established the first 10,000 pounds per square inch (psi) and 15,000 psi subsea completions in the Gulf of Mexico.

Other firsts under his belt include the first guideline-less subsea tree, first driverless lay-away flowline system in Brazil and the Gulf of Mexico, and the first subsea well tieback to a

spar (a type of floating oil platform).

“Being able to be part of the first of anything is every engineer’s dream, and it’s gratifying to see that subsequent generations of design haven’t wandered too far from what you originally dreamt up,” Skeels said.

Skeels has about 39 years of experience in subsea completion and offshore pipeline design and installation. He authored nearly 40 technical papers and articles and holds 14 U.S. patents for oil and gas industry-related technology. He has served on the American Petroleum Institute’s Subcommittee 17 for Subsea Production Systems – on their leadership team and chairing several task groups for equipment standards – since 1984.

In addition to teaching at UH, Skeels serves as senior technical advisor, technology fellow and emerging technologies director at TechnipFMC. His work involves strategic planning for frontier technologies – such as HPHT (high pressure, high temperature) equipment, deepwater and remote light well intervention – and new business opportunities, including remotely operated underwater vehicles (ROVs), remote robotics technologies and hydrate remediation programs.

“
I’m a designer at heart.
Present me with a
problem and a clean
sheet of paper, and I’m
a happy camper.”

- BRIAN SKEELS

”

Skeels became an American Society of Mechanical Engineers (ASME) Fellow in 2010 and received the Titanium Crawfish Award that year from ASME’s UH student chapter.

He has been involved in an advisory capacity with the OTC, Deep Offshore Technology (DOT) Conference, World Oil HPHT Conferences, ASME International Petroleum Technology Institute Deepwater Conference, SPE Forum Series Conferences on Subsea Production and other organizations.

“It’s a proud moment for our subsea program and UH to have our adjunct professor receive the highest individual award at OTC for his pioneering and extraordinary work,” said Phaneendra Kondapi, director of the UH subsea program and a former colleague of Skeels at FMC Technologies. “Brian loves to share his wisdom and experience with our students through his ‘Subsea Systems’ class and we are very fortunate to have him in the program. He is one of our best instructors and it’s very rare to see such passion and dedication towards students.”

Skeels’ advice for recent graduates entering the subsea engineering field:

- 1 Read Colin Powell’s autobiography “My American Journey” and “The Unwritten Laws of Engineering” by J.G. Skakoon and W.J. King. They contain common sense advice that’s pretty sage and that we all too often forget.
- 2 Family always comes first.
- 3 Ask questions and learn from them. Keep asking questions forever.
- 4 Presentation skills get you noticed.
- 5 Delegate with equal amounts of responsibility and authority.
- 6 Working hard gives you the right and opportunity to play hard.
- 7 Keep it simple – make it symmetric.
- 8 Management can be a technology contradiction.
- 9 Be skeptical, but stop short of becoming a curmudgeon. ⚙️

SUBSEA ENGINEERING

EXPLORING THE DEPTHS OF UNDERWATER ENERGY

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“
Science has no
boundaries and it’s
exciting to see that in
action.”

- ELEBEOBA E. MAY



UH Biomedical Engineering Professor APPOINTED BY NATIONAL SCIENCE FOUNDATION AS PROGRAM DIRECTOR

BY RASHDA KHAN

Elebeoba E. May, associate professor of biomedical engineering at the UH Cullen College, received a \$215,032 Intergovernmental Personnel Act (IPA) award from the National Science Foundation (NSF).

The award supports her year-long appointment at the NSF as a program director of the Systems and Synthetic Biology Cluster within the Molecular and Cellular Biosciences Division.

As a program director, May will make funding recommendations; influence new directions in the fields of science, engineering and education; and support cutting-edge interdisciplinary research.

“It’s a really unique opportunity,” May said. “I get to engage the seemingly disparate research communities and generate a multi-disciplinary conversation.”

She said the interaction of biosciences and engineering is a growing area with many opportunities.

May, whose teaching and research at UH focus on computational and experimental methods to study host-pathogen and microbial community interactions, said a lot of questions need to be answered in order to achieve a sustainable bio-based economy. For example: How do you make the biosciences more predictive? How can scientists

control bio-systems in order to integrate them with industrial processes? How can we industrialize the production of biological components to realize mass production of bio-based products?

“The more we can integrate engineering and mathematical methods with biological sciences, the more likely we are to achieve reliable bio-manufacturing of novel products and therapeutics,” May said, adding that she hopes to encourage conversations between engineers, mathematicians, scientists and researchers in the biosciences during her time at the NSF.

One of the aspects she’s enjoying most in her new position is the scientific exchanges with others – not just within her cluster and division, but with individuals across the NSF as well as at other organizations on the national and international level.

“There are lots of moving parts and opportunities,” May said. “Science has no boundaries and it’s exciting to see that in action.”

The prestigious appointment will not only impact May’s career, but also her students and UH. She plans to bring back the knowledge she gains from her experience, including an understanding of where the bioengineering field is headed. She wants to help ensure UH is aware of emerging opportunities at the intersection of biology and engineering.

The NSF is an independent federal agency that supports fundamental research and education across all fields of science and engineering. According to the NSF website, the agency receives more than 48,000 competitive proposals for funding annually and makes about 12,000 new funding awards.

“U.S. taxpayer dollars support federal-funded research that fuel discoveries to not only benefit our society, but global communities, now and in the future,” said May, who has previously received NSF funding for research and served on NSF review panels. “It’s great to see what the NSF does and be able to contribute to it.” ⚙️

UH Students Exhibit Robots CREATED IN MAKERSPACE

BY RASHDA KHAN

New and interesting things are being made at the UH Makerspace, which opened this spring in the M.D. Anderson Library.

Two University of Houston electrical and computer engineering students – **Kaushik Mandiga** and **Denny Luong** – exhibited the robots they made in the Makerspace at the 2018 Electrical and Computer Engineering Department Heads Association Conference in California. ECEDHA is a nonprofit that serves a membership of about 300 colleges and universities.

“The best part of the conference was networking and socializing with all the people in the industry who were present,” said Mandiga. “They were genuinely interested in our projects and gave us plenty of terrific advice.”

One of the projects displayed was the “Non-Living Assembling Machine Ensemble,” or N.A.M.E., featuring seven robots able to assemble into different preset positions based on user input.

The Makerspace, a collaboration between the UH Library and the Cullen College’s electrical and computer engineering department, has five work bays open to individuals or groups to use for maker activities. A sixth bay offers access to high-end measurement and testing equipment. Walk-up use and class reservations are

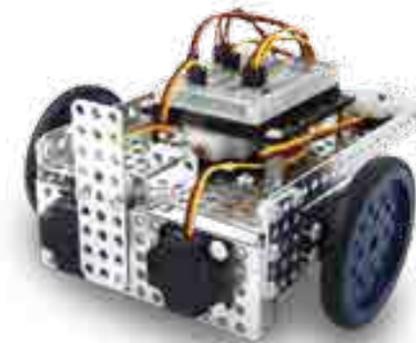
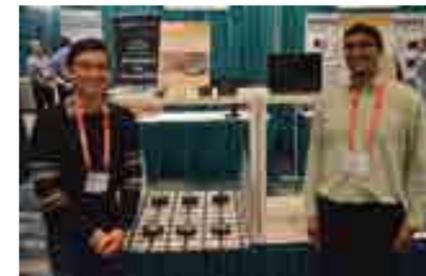


Image credit: Modern Robotics



Denny Luong (left) and Kaushik Mandiga display robotic projects at the 2018 ECEDHA Conference

available. Students can bring their own materials or use what’s available in the Makerspace – outfitted with a variety of kits, supplies and tools for programming and electronics projects.

“The UH Makerspace is an exciting place for students to build projects in their free time and a great outlet to experiment with ideas,” Luong said. “I participated in the Makerspace for fun as it is a passion of mine to create projects and work on teams with other people.”

Luong said his next project will be to build a sentient-like robot to tie in with artificial intelligence.

Mandiga also has plans for the Makerspace.

“In the short term, I plan to use the Makerspace to help finish my Capstone Design project and for any simple side projects I can think of and find time to create,” he said. ⚙️



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The Conference Circuit



1 CAMBRIDGE, MASSACHUSETTS

Mohammad Sarraf Joshaghani, who is pursuing a Ph.D. in computational mechanics, won first place in the Computational Mechanics Best Poster Competition at the 2018 Engineering Mechanics Institute Conference. He was among 14 participants chosen from around the world to compete. The poster reflected work by Joshaghani's research team on a mathematical framework for computers to model complex network systems in nature and numerically solve flow-transport issues in different settings.



2 STATE COLLEGE, PENNSYLVANIA

Narendra Dewangan, a Ph.D. student in chemical engineering, presented a poster titled "Effect of dispersants on adhesion of bacteria on oil/water interfaces" at the 92nd American Chemical Society (ACS) Colloid and Surface Science Symposium at Penn State University. His poster was one of three to win an award from among 70 entries. Dewangan's poster focused on how dispersants – a class of chemicals designed to remove oil from the water surface in oil spill cleanups – affect the bacteria adhesion on oil/water interface since the presence of dispersants alters the interfacial properties.



3 CHARLOTTE, NORTH CAROLINA

Sara Pouladi, a Ph.D. student in materials science and engineering, received an Albert Thumann Scholarship from the Foundation of the Association of Energy Engineers (FAEE). She was the top ranked out of three recipients of the 2018 Albert Thumann, which is the top honored scholarship in the FAEE program. Pouladi will receive \$4,000 to help with her tuition, a one-year membership to AEE and conference registration fees for the 2018 World Energy Congress – hosted by Duke Energy – this October in Charlotte, North Carolina.



4 MINNEAPOLIS, MINNESOTA

Biomedical engineering Ph.D. student **Musa Ozturk** presented a poster at the Neuro-modulation Symposium at the University of Minnesota and won second place out of 120 presentations. Neuro-modulation encompasses a broad range of implantable and noninvasive technology-based approaches for the treatment of neurological and psychiatric disorders. Ozturk's poster focused on assessing the measurement methods for symptom severity in patients with Parkinson's disease.



5 BERKELEY, CALIFORNIA

Danny Guevara, a mechanical engineering undergraduate, was recently selected for the prestigious Science Undergraduate Laboratory Internships (SULI) program. He will spend the fall semester conducting research at the Lawrence Berkeley National Laboratory in California. Guevara, who is interested in the dynamics of human motion, is a member of the UH research lab of Christopher J. Arellano, assistant professor in the department of health and human performance. There, he assists with research projects and helps build and design custom structures for future biomechanics experiments.



6 SAN DIEGO, CALIFORNIA

Justin Brantley, a Ph.D. student in electrical and computer engineering, accepted an invitation to speak at the eighth annual Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences (ENDURE) meeting at the Society for Neuroscience in San Diego in November. ENDURE is the Blueprint initiative of the National Institutes of Health. He will provide a 15-minute talk highlighting his personal career path and lessons learned along the way to illustrate what a successful neuroscience research career involves, share best practices for graduate school and convey research advances and opportunities in the field. ⚙️



DISCOVER
your passions

UH Senior Wins Prestigious FORD FOUNDATION FELLOWSHIP

BY RASHDA KHAN

Serrae Reed, a mechanical engineering senior at the Cullen College of Engineering, is at a bittersweet point in life.

On one hand, she'll be graduating this year and leaving behind her family and her University of Houston community – both of which supported her through thick and thin. On the other hand, she's won one of the 60 prestigious 2018 Ford Foundation Predoctoral Fellowships and is on her way to Yale University to earn her Ph.D. in mechanical engineering and materials science.

"I'm very grateful for everything UH has done for me. Being here has always made me feel that I had a lot of people on my team," Reed said. "It was a really good place to grow and succeed for the last four years."

At times her journey seemed a bit atypical, but Reed likes to learn, explore and forge her own path. Along the way she's earned several accolades and achievements. In particular, she was chosen as the Outstanding Mechanical Engineering Student at the UH Cullen College of Engineering for three consecutive years. She also participates in the Honors Engineering Program and Program for Mastery in Engineering Studies (PROMES).

Reed launched two writing-related community service programs while at UH. Each uses UH student volunteers to tutor Houston-area youngsters. She created Writing to Inspire Successful Education as part of the UH Bonner Leaders Program, and then – in fall 2016 – developed the Houston Scholars Writing Workshops to help 11th graders prepare their college essays.

Gaining a wide variety of experience is important, Reed said. "Trying out new things kind of gave birth to new passions that I didn't know I had, such as research," she said.



3 Tips for College from Serrae Reed

1

Building relationships is really important. It's important to go to class, but also to visit your professors during office hours, even if you don't have extremely important questions. These relationships can lead to partnerships for community service projects, potential research projects and references down the line.

2

Make it a priority to get at least one research experience, one community service experience and one industry experience. That way, when you're in your senior year, you'll have plenty of material and experience to draw upon when it comes to interviews and applications, regardless of whether you want to go into academia or industry.

3

Apply for fellowships starting your sophomore year because you can win funding to study abroad, conduct research or start a project after your first year.

She worked as an Arizona State University research fellow during the summer of 2016 on a project that reported on the energy requirements of delamination of solar panels, the second step in the disposal and recycling process of photovoltaic waste. This experience spring-boarded her interest in academia.

That same year, Reed won the Houston Scholars Program's competitive independent research grant and used it to research making solar cell photovoltaics more affordable and efficient with a process known as thin film deposition using gallium arsenide instead of the traditional silicon.

In 2017, she attended a week-long Shell Drilling and Production Training Camp to better understand subsea wells, drilling, casing, production operations and well equipment. Reed also worked for LyondellBasell as a machinery reliability intern at their Channelview plant.

The Ford Fellowship, administered by the National Academies of Sciences, Engineering and Medicine, is her most recent achievement. It will provide three years of support for Reed.

"When people often talk about UH, they know that it's a good school but I don't think they necessarily understand that the resources we have here – undergraduate research, access to internships and mentoring – are really top notch and that we're competitive on a national level," Reed said. "This [award] just proves that. I'm happy with how it all turned out."

At Yale, Reed will be working in the laboratories of two mechanical engineering and materials science professors – with Judy Cha on a research project involving 2-D layered nanoaluminum and with Rebecca Kramer-Bottiglio on a soft robotics project.

She also plans to continue giving back and addressing community needs. "I'm trying to get a good feel for what service commitments are already active there, and where are the voids that I could possibly fill with my passion for community service," she said.

Other than that, she's keeping her options open and exploring new paths. ⚙️



From GHANA to HOUSTON

Grad Student Wins Prestigious
Fellowship, Continues to
Follow Her Dreams

BY RASHDA KHAN



Priscella Asman fell in love online – more than 6,000 miles across the North Atlantic Ocean while sitting at a computer in Ghana – with the biomedical engineering program at the University of Houston.

She read about Cullen College of Engineering researchers looking for biomarkers for different diseases and about students working in labs who saw medical problems in the field thanks to the University's proximity to the largest medical center in the world. She read about UH biomedical engineer Nuri Ince building a device to improve treatments for patients afflicted with Parkinson's disease.

"It was all so inspiring," said Asman, who has a bachelor's in biomedical engineering from Kwame Nkrumah University of Science and Technology and previously worked as a quality control officer for MediWise International Company Ltd. She applied to the master's program, but didn't think she'd get accepted.

Asman was not only accepted, but also got to work with Ince in his lab. With a talent for bioinstrumentation, she first rebuilt a device connected to the Parkinson's disease

research and then built a digital glove – a low-cost device to monitor sensory responses while patients undergo surgery.

"I'm all for coming up with new ways to do something – anything that involves helping people, anything that involves hands-on work where I'm building something," Asman said.

As her master's studies and her research project drew closer to completion, Asman started dreaming of earning a Ph.D. in biomedical engineering at UH. Her big concern was how to pay for it.

Ince, who is also Asman's graduate advisor, told her about the international fellowship from the American Association of University Women (AAUW). The organization awards fellowships for full-time study or research to women who are not U.S. citizens or permanent residents. Both graduate and post-graduate studies are supported. More than 3,600 women from more than 145 countries have received AAUW fellowships.

She applied for a fellowship and became one of 245 AAUW award winners for the 2018-2019 award year.

"The fellowship is a great help, even to the point where I can actually pay back my parents," said Asman, choking up as she recalled her mother spending her savings to make her daughter's dream come true by sending her halfway across the world to attend school at UH and her father's encouragement and support. "When things are hard, I remember my parents and all that they have done to get me to this point. That's what keeps me going."

She's excited about continuing her studies and research, working with Ince and building her expertise in the biomedical field.

"I have done biomedical so long that I have fallen in love with it," said Asman, who is now inspiring others. "People, my younger sister, look up to me back at home. I tell them, 'I'm just like you. I really struggled, but I have come this far and I really like it.' I encourage them." 🌟

“

I'm all for coming up with new ways to do something – anything that involves helping people, anything that involves hands-on work where I'm building something.

- PRISCELLA ASMAN

”



The Reality of PROJECT-BASED LEARNING

BY AUDREY GRAYSON

Industrial engineering professor **Randal Sitton** begins his “Engineering Systems Design” class with the same introduction each year:

“This is the hardest class you’re ever going to take.”

It’s no small claim. Most of the undergraduate students in Sitton’s class are seniors, some mere months away from graduation. All have made it through the rigorous coursework, labs and exams leading up to this class – if you can call it that.

“In the senior design course, the project is the class,” Sitton said.

At the UH Cullen College of Engineering, all undergraduates take a senior design course, also called a Capstone Design course, in their final year of school, applying all of the engineering knowledge and skills they’ve learned so far to solve a real-world problem.

In architecture a capstone is affixed to the top of an edifice, representing a crowning achievement. Like its namesake, Sitton’s class represents the final academic triumph for these students.

“The senior design course is a bridge between academia and the real world,” Sitton explained.

Down to business

During the first week of class, Sitton randomly creates student teams and presents each group with their real-world challenge.

“All of the projects are sponsored by companies who come to us with a specific problem they’re facing in the industry and ask if we can find a solution to it,” said Sitton.

Last spring leading pipe manufacturer Tenaris sponsored a student team to increase safety while reducing the time it takes to conduct collapse testing at TenarisBayCity in Bay City, Texas. Trafficware, a company specializing in the manufacture and design of traffic management hardware and software, sponsored a project to increase efficiency and improve storage space by redesigning the company’s stockroom.

Once the projects are assigned, Sitton steps back from his traditional role as a professor. There is no weekly lecture or chalkboard problem-solving. Instead, students file weekly status reports with Sitton, whose role is more project facilitator than teacher.



Students were tasked with reducing MD Anderson's OR turnover time from 56 to 30 minutes in just two and a half months

There is no hand-holding, no long-winded discussions about what to do next, how to do it or who to ask for help along the way. In Sitton's words, there's only one thing for the students to do next: "They have to get creative."

"There's no silver bullet in the real world. Sometimes there are clear answers, and sometimes there's not. Sometimes not even the problem itself is clear or well-defined," Sitton said.

No hypotheticals

For industrial engineering student **Amanda Herrera**, the most difficult course she ever took at the Cullen College of Engineering was also the most rewarding.

"Dr. Sitton was right. This was by far the hardest class I took as an undergrad," Herrera said.

Herrera was assigned to a team with fellow industrial engineering undergrads **Brandon Kwan**, **Cindy Sanchez** and **Craig Wild**. The group was asked to scrutinize a rather large and ill-defined optimization problem: MD Anderson Cancer Center's operating room (OR) turnover time – the time between one patient leaving the OR and the next patient entering the OR – is approximately 56 minutes.

“The students get a glimpse into what it's really like to work in a certain industry, and companies get a chance to test out potential employees.”

- RANDAL SITTON

Their task was to reduce the OR turnover time to the national average of 30 minutes.

In addition to solving a complex real-world problem in one academic semester, there were also the challenges of juggling schedules, delegating workloads, communicating effectively and managing emotions among a team of very different personalities.

"The project-based learning course taught me so much more than a traditional class. We were given a really tough real-world problem – not a hypothetical problem – that a company was facing and needed to fix," Herrera said. "We had to learn by doing and we had to come together as a team to get it done."

First things first

Before they could work on tackling the problem, the UH team had to start with the basics. Sitton requires each group to complete a project overview statement outlining their problem, objectives, goals, obstacles and success criteria. The project sponsors approve each team's statement before the real work begins.

Herrera's team worked with MD Anderson project facilitators and senior healthcare systems engineers Dalia Farhat and Ashley Robinson, who acted as liaisons between the UH engineering students and MD Anderson's operations executives.

"Everyone we worked with at MD Anderson treated us like legitimate contractors rather than a student team, and at first that really intimidated us," Herrera said.

Visits to MD Anderson and meetings with project facilitators were scheduled between classes, tests, study groups, part-time jobs, families and social lives. The student team met each Tuesday and Thursday to discuss project deliverables and milestones, reporting their progress to Farhat and Robinson by weekly emails.

"They had a thorough project plan and timeline, which they delivered to us without us

asking them for it. They gave regular progress reports and sent their questions for each meeting ahead of time so that we had time to prepare. I was beyond impressed," Farhat said.

The students' efficiency, organization and hard work paid off by the end of the course – to the tune of \$3.5 million.

Solving a multi-million dollar problem

Operating rooms are one of the most expensive components of hospital operations. Increasing efficiency and productivity in the cleanup and setup that takes place between each surgery can mean incredible cost savings. But the solution is multifaceted and complex, involving human factors, room layouts, scheduling, staffing, hospital culture and equipment organization.

"So many factors have to be taken into consideration to solve this problem," Herrera said. "MD Anderson knew there was a problem, but they didn't know where it was coming from. We had to look at their whole system to get the answers."

The team started by interviewing the entire OR staff, including doctors, nurses, anesthesiologists, maintenance and cleaning personnel, to understand their roles. Then the UH students verified the anecdotal information with video footage of the OR operations, taking notes on the processes, shift changes, staffing levels and seemingly minute details that can impact OR turnover time.

"We began to notice all of the little problems that created the big problem," Herrera said.

By standardizing cleanup and setup processes, instituting new safety and time-saving procedures, reorganizing equipment, and changing staffing levels and schedules, the student team successfully reduced the turnover time to 30 minutes and identified more than \$3.5 million in potential cost-savings in the process.

"The [UH Engineering] team completed the project in two and a half months. That's a lot of work," Farhat said.

“We had to learn by doing and we had to come together as a team to get it done.”

- AMANDA HERRERA

Try before you buy

Each senior design class culminates with the student teams presenting their solutions to the companies or individuals who sponsored their project. Herrera and her teammates presented their findings to an audience of more than 25 senior engineers at MD Anderson.

"They came up with extremely valuable solutions and the engineering team was very impressed with their presentation," Farhat said.

The UH team's recommendations are being reviewed and may be implemented at MD Anderson as early as this fall, Farhat said. "There's a 'try before you buy' aspect to the course," Sitton said. "The students get a

glimpse into what it's really like to work in a certain industry, and companies get a chance to test out potential employees."

As a result, senior design courses can lead to job and internship offers for many Cullen College students.

That may very well be the case for Herrera, who envisions a future for herself in the healthcare field.

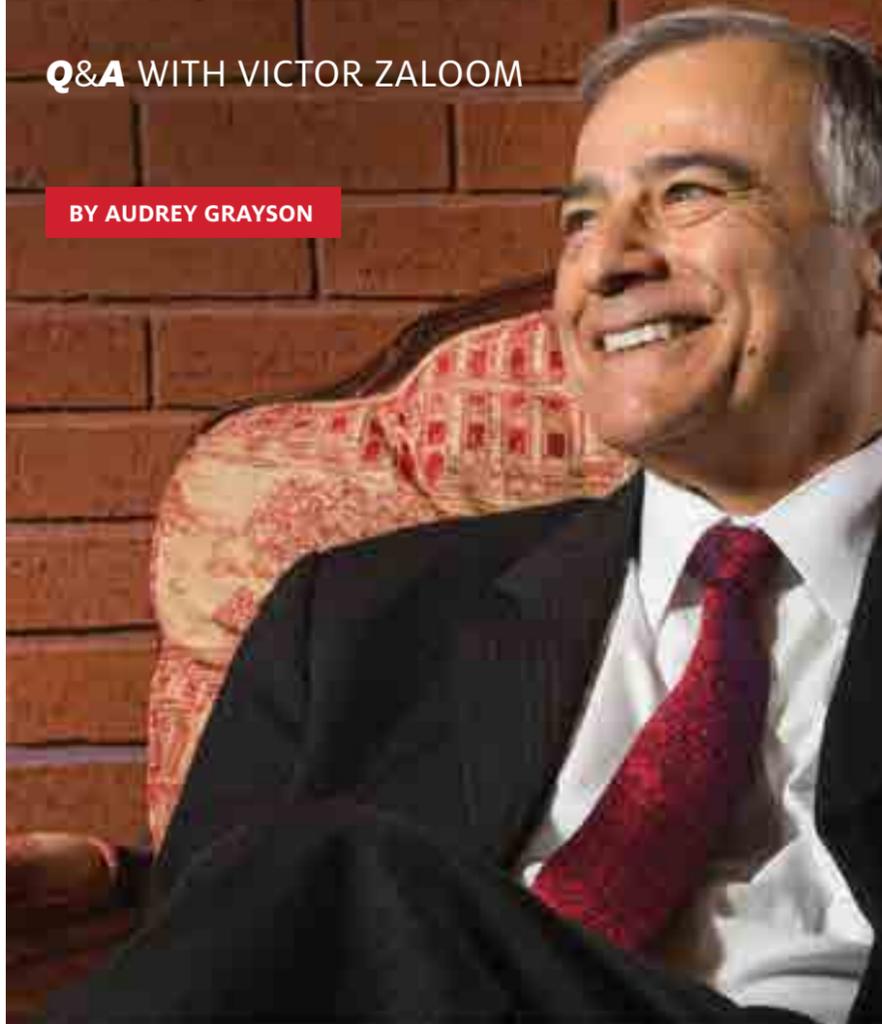
"I dreamed of working in healthcare before this project, and now I can't imagine working anywhere else," she said. "Working at MD Anderson would be a dream come true."

A PASSION

for Paying it Forward:

Q&A WITH VICTOR ZALOOM

BY AUDREY GRAYSON



VICTOR ZALOOM (Ph.D. IE '70) is a man with interests as broad and deep as the industrial engineering (IE) field in which he works. A professor of industrial engineering at Lamar University, Zaloom has really done it all, working in research, industry, teaching and academic administration. But it is his passion for teaching, influencing and shaping the next generation of industrial engineers that continues to drive him.

Q&A

Did you always know that you wanted to be an engineer?

VZ: I never had a plan to be an engineer early on. When I was a junior in high school I think I was only interested in playing baseball and other sports.

Why did you pursue industrial engineering in college?

VZ: I grew up inside of my parents' grocery store in Miami, so I was always interested in business. Engineering, science and math came pretty naturally to me, and I enjoyed those subjects in school, so that led me to pursue an engineering degree at the University of Florida.

One of my "Intro to Engineering" courses went over all of the different engineering disciplines and careers. That's the first time I was introduced to industrial engineering – they sold it as a broad field, a combination of science and business. It was a perfect blend of the two things I was most interested in.

Why did you decide to continue on to graduate school after earning your bachelor's in IE?

VZ: When I became a senior at the University of Florida I interviewed for several jobs and got job offers but none of them seemed interesting to me, so I decided rather than take a job I wasn't passionate about I'd stay in school. After I finished my master's degree I got fewer job offers, but they were more interesting. I chose to take a position at Lockheed Martin in the Dallas area.

What prompted you to make the transition from private industry to academia?

VZ: While working at Lockheed I was asked to teach a night course at Texas Christian University (TCU) in Fort Worth pretty much out of the blue. I had never taught anything before in my life, but I decided just to do it. In the early part of teaching that course I realized that this is what I want to do for the rest of my career rather than working in industry.

How did you end up at the University of Houston to pursue your doctoral degree in IE?

VZ: Once I found my passion for teaching I knew I needed to get my doctoral degree to compete for professor positions. Then I seriously started looking at Ph.D. programs. I was drawn to the city of Houston and the industrial engineering department at UH, but I had a family and needed financial support to get my Ph.D. The UH Cullen College offered me a fellowship right away and I made the decision to leave my job at Lockheed to pursue my degree at UH.

Did you find that doors opened for you after earning your doctoral degree in industrial engineering from UH?

VZ: Without it I couldn't have had the career that I've had. I owe UH a lot for believing in me from the start. They looked at my background – I had good degrees, I was mature and had experience working in industry – and they offered me financial support to pursue my degree and didn't ask me to prove myself first. That meant a lot to me. UH was a very welcoming place for me.

Where did your career take you from there?

VZ: After earning my Ph.D. in 1970 I joined the IE faculty at Auburn University and taught there until '78. That really got me a great start in my academic career.

I had decided early on in my career that I'd like to be a department chair. The role combines teaching as well as administration and management, which really appeals to me. I had an opportunity to do that at North Carolina A&T State University in Greensboro, North Carolina, a historically Black school that had just started an industrial engineering department at the time. I was the department chair there from '78 to '81, and during that time I got the department accredited by the Accreditation Board for Engineering and Technology (ABET).

Then I was offered a bit of a promotion at Lamar University – a department chair position as well as heading up their graduate program in engineering. I jumped at the opportunity and I've been at Lamar University

since then. I have also served as the chairman of the industrial engineering department, associate dean of engineering, interim dean of the college of engineering, dean of the graduate school and, of course, professor of industrial engineering.



and helping me with financial support and with office space while I earned my doctoral degree. The faculty at the Cullen College were very friendly and treated me as an adult – not just as a student, but as a fellow scholar. That shaped me a great deal and helped solidify my goal of becoming a faculty member myself. It's so important to me to help ensure future IE students have the same opportunities that I did.

Where do you see the IE field going in the future?

VZ: I think IE is going to be an important major for the information economy. Industrial engineers are very flexible and I think that's a very important quality to have today. Fifty years ago you could have one career your whole life, but nowadays you need to change career paths maybe several times to be successful. With industrial engineering, the flexibility and broadness of the degree is very amenable to that. I think the kinds of people who are attracted to IE are the kinds of people that our country needs to lead us into the future.

Do you have any career advice for current IE students?

VZ: Find your passion, no matter what it is. You need to find out what type of work you want to do. Whether it's teaching and research, administration, working as an IE in a company or working for yourself as a consultant – find your passion and pursue it.

I often repeat Confucius' words to my students: "Choose a job you love and you'll never have to work a day in your life." It's so important to find your passion. I found mine very inadvertently. I was working for a company and got a call one day and was asked to teach a course. I had no idea if I wanted to be a teacher but I was open-minded and willing to make sacrifices, and that allowed me to find my passion. I would wish anybody to do that. As a professor I try to encourage and help my students to do the same.

Socrates said the "unexamined life is not worth living." In that case, look at where you are and if you're not doing something you want to do, then look at your options and pursue them. ⚙️

“

It's so important to me to help ensure future IE students have the same opportunities that I did.

”

- VICTOR ZALOOM

You are a longtime supporter of UH Engineering and have established the Dr. Victor A. Zaloom Scholarship Endowment for industrial engineering students. Why do you feel it is important to give back to your alma mater?

VZ: My career is totally dependent on the University of Houston believing in me

Cullen College Honors
Distinguished Alumni and Faculty
at Annual

Alumni Awards GALA



BY AUDREY GRAYSON

2018 Engineering Alumni Association Gala celebrates five outstanding UH engineers

The 2018 UH Cullen College of Engineering Alumni Awards Gala was held at the Bayou City Event Center on Thursday, June 7. The annual event, hosted by the Engineering Alumni Association (EAA), celebrates the professional achievements and contributions of Cullen College alumni and faculty.



Lifetime
ACHIEVEMENT
AWARD

Benton F. Baugh (BSME '67), Ph.D., P.E., a member of the National Academy of Engineering and a charter fellow of the National Academy of Inventors, serves as the president of Baugh Consulting Engineers, Inc., which provides oilfield-related consulting, patent licensing and expert witness work. With more than 55 years of experience in oilfield and subsea systems, Baugh has developed numerous tools and novel solutions to equipment design, leading to more than 100 U.S. patents covering areas including gas compressor systems, drilling chokes, subsea wellhead systems, tubing hangers, subsea flowline systems, gate valves, hydraulic control systems, riser buoyancy systems, consumer products and much more. In 1979 Baugh founded the company Radoil Inc., which specializes in the design and manufacturing of oilfield and subsea products, and served as president of the company until 2012. Currently Baugh is a distin-

guished adjunct professor of mechanical engineering at both the University of Houston Cullen College and Oklahoma Christian University. He has written numerous technical papers on subsea applications that have been presented at conferences all over the world and has received numerous industry honors, including being named a Fellow of the American Society of Mechanical Engineers and a Fellow of the Marine Technology Society (MTS).

Baugh received his bachelor's degree in mechanical engineering from the UH Cullen College in 1967, followed by master's and doctoral degrees in mechanical engineering from Kennedy-Western University in 1989. He currently serves as chair of the MTS Deepwater Field Development Technology and is a member of the Academy of Medicine, Engineering and Science of Texas. ■

Thank you

to Cullen College alumna and ExxonMobil retiree Cynthia Oliver Coleman (BSChE '71), P.E., for her generous support of the college's programs! Cynthia has donated to the Women in Engineering program, Engineers Week events and many other activities at the Cullen College throughout her 33-year career at ExxonMobil and retirement.

Utilizing ExxonMobil's Match Program, Cynthia's donations to the college were matched by

ExxonMobil

A big **#CoogEngineer THANK YOU** to Cynthia and all of the ExxonMobil employees and retirees who have supported the Cullen College!

GO COOGS!



Distinguished
ENGINEERING
ALUMNI AWARD

Cynthia Oliver Coleman (BSChE '71), P.E., is a retired ExxonMobil chemical engineer and a passionate engineering volunteer leader. Since graduating magna cum laude in 1971 and becoming one of the first women (and the first Black woman) to receive a chemical engineering degree from the UH Cullen College of Engineering, she has been on a lifelong mission to help others, especially women and minorities, to pursue engineering. She currently serves on the UH Petroleum Engineering Industrial Advisory Board, the Cullen College's Campaign Committee for the UH \$1 Billion Campaign and the UH Alumni Association Founda-

tion Board. She is a dedicated advocate and donor for UH Women in Engineering, a program that cultivates a community of support among female engineering students, faculty and alumnae. She also serves as counselor for the UH Society of Women Engineers, providing annual scholarships to its members and donations for special initiatives. She is a past president of the UH Engineering Alumni Association (UH EAA) as well as founder and chair emeritus of UH EAA Engineers Week, which generated a 10-year total of \$330,000 in scholarships for UH engineering students and student organizations under her leadership.

Coleman's life is filled with "firsts" – in 1967, when she enrolled as a freshman at the Cullen College, Coleman was both the only woman and the only Black woman in the chemical and biomolecular engineering department at that time. Even though she had doubts about engineering, she persevered to obtain her degree, becoming the first in her family to graduate college. Coleman began her career as the first woman engineer in the large East Texas Division of Exxon (then Humble Oil). During her 33-year ExxonMobil

career she was featured in various publications and held positions in gas engineering, reservoir engineering, engineering applications, engineering recruiting and engineering information systems before her retirement in 2004.

Coleman has received the UH EAA Roger Eichhorn Leadership Service Award and the UHAA Outstanding Volunteer Award. Coleman's involvement in the UH Women in Engineering program inspired an award named after her. She served as the distinguished speaker for the fall 2017 UH Cullen College convocation ceremony, was featured in various UH magazines and is one of 238 women engineers in the country featured in "True Stories of Women Engineers," a book used in educational outreach. She is a senior life member of the Society of Women Engineers (SWE) and recently received the Woman of Excellence Award from SWE's Houston chapter. She is also a life member of the National Society of Black Engineers and the Alpha Kappa Alpha Sorority, Inc. Coleman is married to UH alumnus Leonard, and they are proud parents of UH alumna Kelly. ■



Top Right: 2018 EAA Gala Honorees (L-R) Carlos A. Chiquillo, Cynthia Oliver Coleman, Benton F. Baugh, Dean C. Rietz, Matteo Marongiu-Porcu



 Dean Rietz and Cynthia Oliver Coleman at the 2018 EAA Gala



Dean C. Rietz (MSPETE '92, MHM '94), P.E., president and member of the board of directors at Ryder Scott Company, has over 30 years of diverse experience in evaluating oil and gas properties, including more than 25 years applying numerical modeling approaches to these evaluations.

At Ryder Scott, Rietz was instrumental in creating a stand-alone reservoir modeling group, enabling the company to expand and offer services beyond reserves evaluations in a more deliberate way. As part of the reservoir studies conducted while at Ryder Scott, complex models were constructed and history matched, including highly volatile

and near critical fluids, thermal models and unconventional shale wells. He managed and grew this innovative group from the ground up for 15 years, after which he was promoted to executive vice president and then, in 2015, president.

Prior to joining Ryder Scott, Rietz worked at Chevron and Golden/Gruy constructing simulation models to evaluate and forecast primary, secondary and enhanced oil recovery projects.

Rietz has not only excelled in his career, but he has also given back by teaching in various facets in the industry. In 1999, as manager of the simulation group at Ryder Scott, Rietz spearheaded development of a two-day school on the practical aspects of reservoir simulation. This school is now being conducted by Rietz and a colleague on behalf of the Society of Petroleum Engineers continuing education/professional development. Around the same time, the University of Houston expressed an interest to have Rietz spread his reservoir simulation knowledge in the form of a graduate-level course. He developed and

has been teaching "Applied Reservoir Simulation" to master's students in the petroleum engineering department at UH for more than 15 years.

In addition to his role as an adjunct professor at the Cullen College, Rietz was also one of the founding members of the UH Petroleum Engineering Industrial Advisory Board (IAB). As a member of the board, he was directly involved with establishing the petroleum engineering department (including undergraduate, master's and doctoral programs). Since then, the undergraduate program has received its ABET accreditation and grew to be one of the larger programs in the country. Rietz was recently nominated to serve as the chair of the Petroleum Engineering IAB.

Rietz received his bachelor's degree in petroleum engineering from the University of Oklahoma in 1984, followed by his master's degree in petroleum engineering from the University of Houston in 1992 and a master's in hospitality management from the UH Hilton College in 1994. ■



Carlos A. Chiquillo (BSME '04, MBA '10) was born in 1982 in Bogotá, Colombia. He moved to the U.S. in 1999 and graduated from James E. Taylor High School in Katy, Texas. After high school he attended the University of Houston, where he pursued mechanical engineering and a minor in mathematics. After graduation he was hired as an engineer at Baker Hughes, followed by positions at Wood Group and Universal Pegasus. In 2009 he completed his MBA, focusing on energy economics, and was named director of international business development in Universal Pegasus shortly thereafter.

In 2010 Chiquillo co-founded Innovatech Strategic Solutions LLC in Houston, which provides portable, ecological infrastructure to industry. Today Innovatech Strategic Solutions has a manufacturing plant in Bogotá, Colombia and offices in Ecuador, Colombia and the U.S. With over 50 direct employees and 50 more subcontractors, Innovatech has

successfully carried out projects in the U.S., Colombia, Venezuela, Paraguay, Ecuador, Peru, Bolivia and Mexico.

Chiquillo has been married for 12 years to his wife, Carolina, and has a 4-year-old son named Santiago. Chiquillo and his family are very active within the community and are members of St. Peter's United Methodist Church. ■



Matteo Marongiu-Porcu (MSPETE '07), Ph.D., is an internationally acknowledged technology leader and innovator, with a track record of success developing and implementing cutting-edge technologies to optimize production from conventional and unconventional oilfield assets. He started his career in oil and gas in 2002, when he joined the Italian national oil company, Eni E&P, after obtaining a five-year degree in chemical engineering from the Polytechnic University of Milan ("Politecnico di Milano") in Italy.

In 2006 he made the decision to pursue higher levels of education, consequently moving to the U.S. where he obtained his master's in petroleum engineering from the UH Cullen College, followed by his Ph.D. in petroleum engineering from Texas A&M University.

In 2011 Marongiu-Porcu became an associate partner of Economides Consultants, owned and managed by his professor, mentor and friend, the late Michael J. Economides. In 2014 he joined Schlumberger in Houston, where today he is a senior completions consultant and leads execution and deployment of consulting services, which focus on the integration of multiple technical domains such as geophysics, petrophysics, geology, geomechanics, completion engineering, production engineering and reservoir engineering.

For the past four years Marongiu-Porcu has served as adjunct professor in the UH Cullen College's petroleum engineering department, where he constantly applies logical and unbiased reasoning, fosters critical thinking, develops a variety of problem-solving strategies and teaches students how to translate back and forth between formal mathematical models and the very pragmatic modern oilfield applications. ■

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

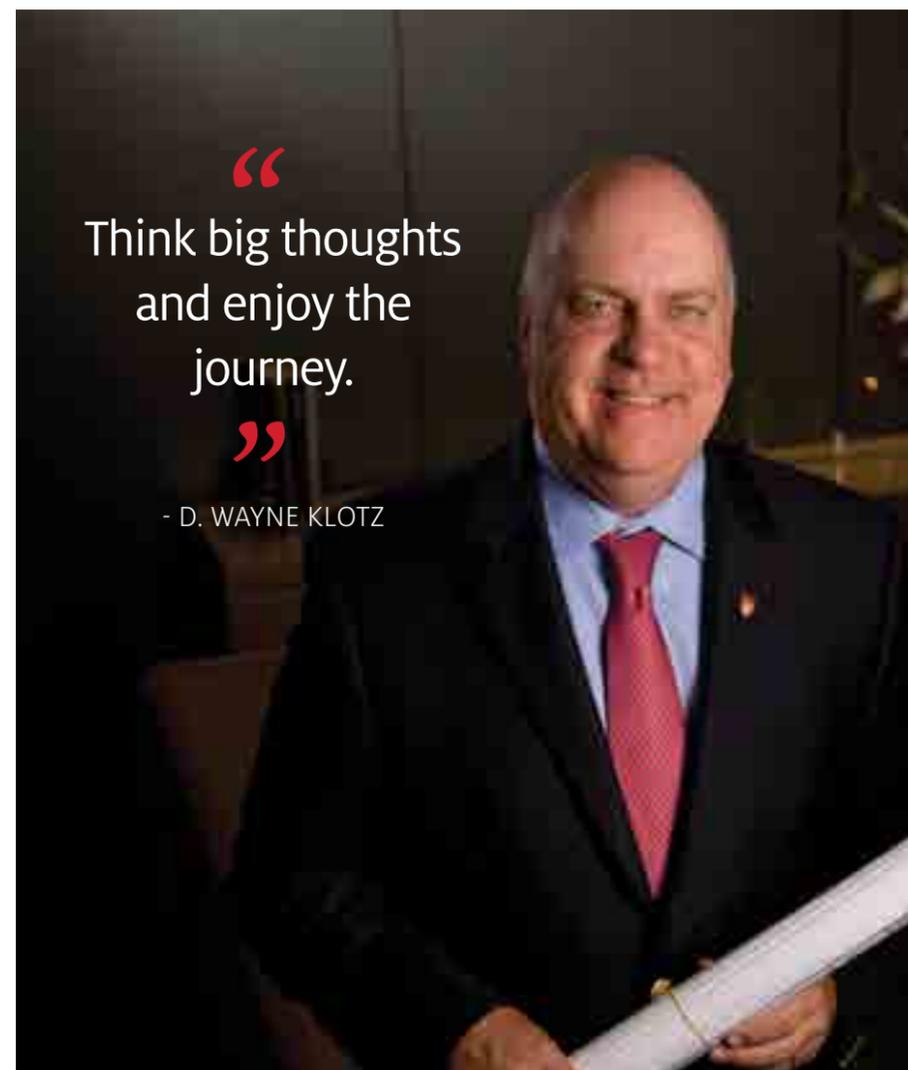


 View more EAA Gala photos online at www.flickr.com/photos/cullencollege/albums

UH Engineering Alumnus Wins Prestigious NATIONAL ENGINEERING AWARD

BY RASHDA KHAN

Klotz views engineering as ‘license to change the world’



“Think big thoughts and enjoy the journey.”

- D. WAYNE KLOTZ

Houston civil engineer **D. Wayne Klotz** (MSCE '76) has added another feather in his cap. The University of Houston alumnus recently became the fourth recipient of an Outstanding Practitioner in Water Resources Engineering Award from the American Academy of Water Resources Engineers (AAWRE), a subsidiary of the American Society of Civil

Engineers (ASCE).

The award, established in 2014, recognizes engineers who hold a Diplomate, Water Resources Engineer (D.WRE) certification – an honor Klotz achieved in 2007 – for a significant contribution to the engineering practice based on either a single outstanding

achievement or a body of work related to the practice of environmental or water resources engineering.

“The engineering profession is a license to change the world. We build an improved quality of life using scientific knowledge and natural resources to construct civilization,” Klotz wrote in his LinkedIn profile. “Where else can you so significantly impact the lives of tens of thousands of people you will never meet?”

Klotz – who is now president of Klotz Strategies, a consulting service that helps other engineering firms, businesses and public entities achieve their goals – has made more than a lifetime’s worth of achievements and contributions in his 45-year career.

After earning a bachelor’s degree in civil engineering from Texas A&M University in 1974 and a master’s degree in civil engineering from the UH Cullen College of Engineering in 1976, he founded the Klotz Associates civil engineering firm in 1985. It became RPS in 2017.

“The most satisfying part of my career has been the knowledge that the projects we designed and built improved the quality of life for our community,” Klotz shared.

His career success led him to establish the Klotz Associates Endowed Scholarship in Civil Engineering at both Texas A&M and UH.

Klotz’s other contributions to UH include being named a UH Distinguished Engineering Alumni and serving as a member of the UH Civil and Environmental Engineering Academy and the Engineering Leadership Board.

In 2011, Houston’s then-mayor Annise D. Parker appointed Klotz to the Coastal Water Authority’s board of directors, where he continues to serve as board president today. He was co-chair for public works on Parker’s transition team and went on to chair Mayor Sylvester Turner’s transition committee as well.

He also co-founded the Transportation Advocacy Group Houston Region (TAG), the largest transportation, education and policy

group in the Houston area.

On the national level, Klotz was a member of the U.S. Department of Homeland Security’s Community Resilience Task Force.

Klotz served as both an officer and as national president of ASCE. He has also served on the Harris County Flood Control Task Force, the C Club, and the UH and A&M Civil Engineering Industrial Advisory Boards.

In 2010, Klotz led ASCE to co-found the Institute for Sustainable Infrastructure (ISI) and served as chair of the institute in 2013. Since then he’s been a board member and helped shepherd the institute’s education of civil engineers in sustainable design, certification of thousands nationwide and recognition of the first Gold Award for sustainable infrastructure.

About 350 projects are estimated to be using ISI’s Envision guidelines for sustainable infrastructure, and nearly 5,000 engineering professionals have earned their Envision Sustainability Professional (ENV SP) designation.

Other accolades earned by Klotz include: ASCE’s 2005 Edmund Friedman Professional Recognition Award, the 2011 Texas Engineer of the Year Award and the 2011 Houston Engineer of the Year Award. A&M named him a distinguished graduate in 2004, and ASCE’s Texas Section and its Houston branch have recognized his contributions with several awards. The Ricardo Palma University in Lima, Peru awarded him an honorary professorship in 2008. The American Water Works Association honored him with lifetime membership for his dedication to the association and the water profession.

Klotz offered some advice to students aiming for an engineering career. “First, be a person of integrity. Second, do not sacrifice your family for your career. Think big thoughts and enjoy the journey,” he said.

He married Karen Wilson in 1974 and they have four children and grandchildren. Klotz and his wife are active in ministries at Tallowood Baptist Church. 🌟



BROOKSHIRE’S LEGACY OF GENEROSITY Lives on at Luncheon for Scholarship Recipients

BY INEZ HUTCHINSON

The legacy of kindness, hard work and generosity left behind by UH engineering alumnus William A. Brookshire† (BSChE '57) continues to live on at the Cullen College, where hundreds of undergraduate students receive significant support for their education through scholarships endowed by Brookshire.

The 2017-2018 recipients of the Brookshire scholarships gathered for a luncheon in Brookshire’s honor at the UH Hilton in March, where the students took turns sharing how the scholarship has helped them personally and professionally.

Undergraduate students at the Cullen College have rigorous course schedules and many work full-time jobs to pay for their education. The Brookshire scholarships allow these students to focus on their education, internships, research, professional development and extracurricular activities by reducing their financial burdens.

Brookshire, a chemical engineering alumnus, had a very similar college experience. He was the first in his family to earn a high school diploma.

“I had to work a full-time job during the day while attending night classes to finish my bachelor’s degree in chemical engineering at the University of Houston,” Brookshire said.

Acknowledging the unique challenges faced by students who work while earning their engineering degrees, Brookshire founded two scholarships to help pay the way for students who work full-time and part-time jobs to pay for school.

The William A. Brookshire Scholarship is for students taking a full course load (12 hours) and working at least 20 hours a week. The William A. Brookshire IMPACT Scholarship is for students who are working, taking a full course load and paying for college on their own with no outside financial support.

† Brookshire, co-founder and chairman of the board of S&B Engineers and Constructors, died on April 21, 2017. 🌟

LIENHARD'S LENS



BY JOHN LIENHARD



ALBATROS D.V



FOKKER Dr.1 TRIPLANE

Handsome *Is*, as Handsome *Does*...

That's what my grandmother used to tell me. Nowhere is that as apt as it is in engineering design. So much good technology is outshone by inferior flashy design.

Take the Red Baron's famed red triplane – so dramatic to the eye.

World War I German pilot Manfred von Richthofen (also known as the "Red Baron") shot down 80 Allied airplanes. He made 50 of those kills in another airplane – a drab, nearly-forgotten biplane fighter, the Albatros. He flew both models D.III and D.V.

Then, late in the war, his unit was given the new Fokker Dr.1 Triplane. He used it for five weeks, made just 17 kills with it, then he himself was shot down and died in that celebrated airplane.

Go to a movie about the Red Baron, and what do you see? Never an Albatros – only that striking (but awkward) red machine with its three wings.

Here are two photos, both taken at the Old Rhinebeck Aerodrome in upstate New York, a combination museum and airfield where an amazing collection of early 20th century aeroplanes is on display. The collection includes an original Albatros. That's possible, since the Germans built nearly 1,700 Albatros fighters during the war. The

Old Rhinebeck Aerodrome also has a Fokker Triplane, but it's only a replica. Just 300 were made, and not one original has survived.

It turns out that Fokker's Triplane had structural problems: it was slow, couldn't reach high altitudes, had poor visibility and was very tricky to fly. That latter problem was a virtue for an extremely gifted pilot because it was highly maneuverable in a dog fight. However, the Triplane soon had to be discontinued and replaced with the far superior Fokker D.VII biplane.

We engineers might draw one of two conclusions from this. The more cynical one is that we should think about appearance before quality. But, while Fokker's Triplane survives in legend and song, it did not

survive in practice. Perhaps we should think instead of Henry Ford building 15 million durable Model Ts – then turning around and telling the public that they could order it in any color they wished... as long as it was black.

In the end, Handsome really is, as Handsome does.



VIEW MORE PHOTOS AT enginespics.smugmug.com

PROMES CELEBRATES ITS 40TH ANNUAL BANQUET

The Program for Mastery in Engineering Studies (PROMES) held its 40th annual banquet on Thursday, April 12, celebrating the students, faculty, staff, alumni and donors of the Cullen College's most enduring academic success program.

Sponsors for this year's PROMES Banquet include the Chevron Corp., Shell Global, Fluor Corp., Praxair, UH Division of Research, Occidental Petroleum, Phillips 66, Marathon Oil Corp., Conoco Phillips, Chevron Phillips Chemical Co. LLP, ExxonMobil, Bechtel and BP.



TOP COMPANIES RECRUIT UH ENGINEERS AT FALL CAREER FAIR

Over 100 companies came to the University of Houston campus to recruit hundreds of engineering students for internship, fellowship and full-time positions at the Engineering Career Fair in September. More than 1,800 UH engineering students attended the fair, many of whom conducted or scheduled interviews with company recruiters. This year's fair attracted sponsorships and recruiters from LyondellBasell, Shell, Schlumberger, ExxonMobil, P&G, Daikin, Ineos, Sulzer, Oxy, Phillips 66, HEB, Enterprise Products and many more top companies.

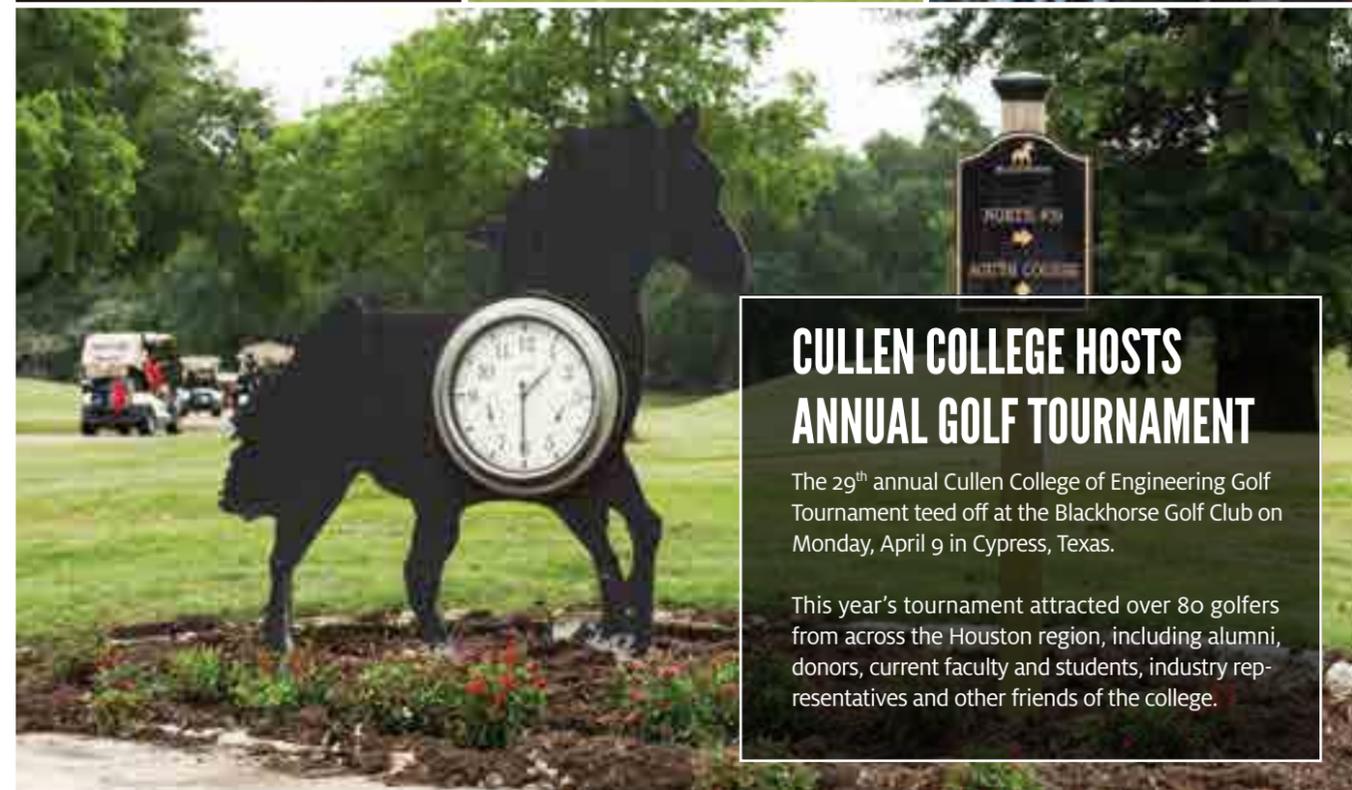
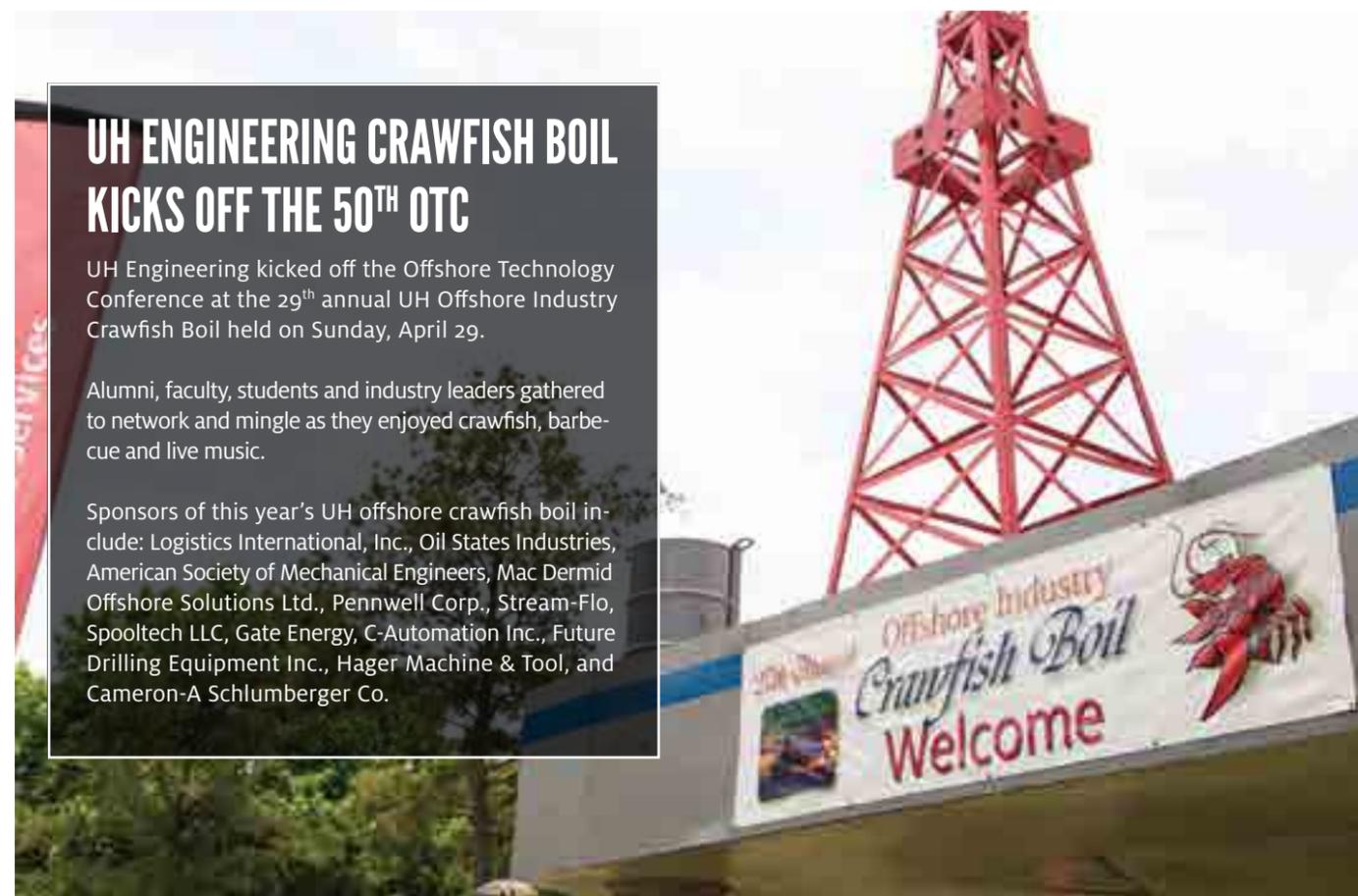


UH ENGINEERING CRAWFISH BOIL KICKS OFF THE 50TH OTC

UH Engineering kicked off the Offshore Technology Conference at the 29th annual UH Offshore Industry Crawfish Boil held on Sunday, April 29.

Alumni, faculty, students and industry leaders gathered to network and mingle as they enjoyed crawfish, barbecue and live music.

Sponsors of this year's UH offshore crawfish boil include: Logistics International, Inc., Oil States Industries, American Society of Mechanical Engineers, Mac Dermid Offshore Solutions Ltd., Pennwell Corp., Stream-Flo, Spooltech LLC, Gate Energy, C-Automation Inc., Future Drilling Equipment Inc., Hager Machine & Tool, and Cameron-A Schlumberger Co.



CULLEN COLLEGE HOSTS ANNUAL GOLF TOURNAMENT

The 29th annual Cullen College of Engineering Golf Tournament teed off at the Blackhorse Golf Club on Monday, April 9 in Cypress, Texas.

This year's tournament attracted over 80 golfers from across the Houston region, including alumni, donors, current faculty and students, industry representatives and other friends of the college.



UH CULLEN COLLEGE CELEBRATES CITY OF HOUSTON “PROMES DAY”

On April 25, Program for Mastery in Engineering Studies (PROMES) students and alumni gathered at the UH Cullen College of Engineering to celebrate “PROMES Day,” which was recognized by the city of Houston in 1985.

PROMES director Jerrod Henderson shared some brief comments on the program’s history, longevity and successes. The framed proclamation from the city of Houston was on display for the event attendees while they enjoyed refreshments and networking.



To learn more about events at the Cullen College,

visit www.egr.uh.edu/events or follow us on social media!

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View more photos online at www.flickr.com/photos/cullencollege/albums

ENGINES OF OUR INGENUITY - Episode No. 2273

Football season is here again. This time, I grow more curious about rifling. We’ve all watched that long-lens shot on TV: A football comes toward both us and the downfield receiver. It spins like a top, even in slow motion. Steady as a rock, it moves toward us at about 50 mph. So, exactly what do quarterbacks gain by rifling their passes like that?

For one thing, they temporarily minimize drag on the football by making it go end-first – by presenting the least cross-section to the air. Long narrow projectiles will naturally tumble as they fly through air. Tumbling increases drag and ruins accuracy.

That’s no problem for a knife-thrower. His dense knife travels a short distance. He intentionally makes it tumble end-over-end an exact number of times. He’s learned to make the knife rotate, say, twice before it reaches the target point first.

When we study the physics of rotation, we find something surprising about footballs and knives. If a rotating body is disturbed while it’s in motion, it’ll find a way to rotate about the axis that gives the greatest moment of inertia. The knife starts out that way. The football does not, but it’ll eventually get there too. Its most natural rotation would also be tumbling.

If a football could fly far enough, it would flip over and tumble, and it sometimes does. When a quarterback gives the ball a strong spin, its motion is held gyroscopically for a while. With luck and skill, it stays so until it reaches a receiver.

If you’ve ever used a bow and arrow, you may’ve noticed the arrow wobbling slightly after its rotating feathers brush your fingers. But its strong rotation soon stabilizes the wobble so the arrow can fly true. Same story for a bullet: It sometimes wobbles as its stern clears the barrel, then it straightens out.

The person throwing a football lays fingers on the strings and pulls on them during the throw. If the ball gets a quarter turn in a 4-foot swing, it then keeps rotating at around 300 rpm.

Compare that with a target-rifle bullet: One turn per foot is typical for gun barrel rifling. So, a bullet leaving at 3,000 feet per second rotates a lot faster than a football – maybe 180,000 rpm. (Bullets have been known to tear apart under huge centrifugal forces before they hit anything. That’s rare, but it happens.)

Bullets travel a lot further than footballs, and they have a longer, narrower, more unstable shape. Now and then, after traveling, say, 600 yards, bullets also occasionally flip and rotate end-over-end. And they go far wide of the mark.

So, if I find myself watching football on TV this season, I’ll look a lot more closely at the passing game – at that lovely arcing ball. I’ll look for so many forgotten details of its remarkable complex journey – all the way from scrimmage into the distant end zone.

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 2,800 episodes have been broadcast. For more information about the program, visit www.uh.edu/engines.

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