UNIVERSITY of HOUSTON | ENGINEERING

PARAMETERS

Cullen College of Engineering Magazine • Fall 2017

The HOUSTON *Dream*

2017 GRADE CAMP

In an effort to address the critical shortage of women in STEM (science, technology, engineering and math) fields, the UH Cullen College of Engineering hosts G.R.A.D.E. (Girls Reaching and Demonstrating Excellence) Camps each summer to introduce female middle school students to the field of engineering.

LEARN MORE AT
www.egr.uh.edu/grade/about

Being the Best: NSBE at UH is #1 in U.S.A. **PG. 86**

Disney Dreams Come True **PG. 78**

The HOUSTON Dream

PG. 50

A Perfect Marriage **PG. 32**

Eyes in the Sky **PG. 44**

For Stanko Brankovic, Life is Speeding Up **PG. 26**

Alumni Spotlight on Eric Ayanegui **PG. 104**

IN EVERY ISSUE

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UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

DEAN'S LETTER

Smithsonian Magazine ran an article in 2013 that posited, "What makes Houston the next great American city?"

Some may answer by pointing to our energy industry, or our medical center – the largest in the world – or our high quality of life, affordable housing and food options, or even the many theater and arts districts the Bayou City has to offer.

The answer, however, is much simpler. Houston is the greatest American city because of its people.

The *Los Angeles Times* estimates that, by 2050, America will look a lot like Houston does today. In Harris County, home to more than 4 million people, 51 percent of all those under the age of 20 are Latinos and 19 percent are African American.

Houston is the city of the future because our diversity gives us power. It's a place where all are welcome, where we can all dream big and succeed.

Like the city we serve, the Cullen College of Engineering is a true melting pot. Nearly 5,000 students with very different backgrounds, cultures and personalities come to Cullen College to pursue one common goal: to be among the next generation of global engineers.

As Houston's University, our community of students is a reflection of the population we serve. We have an obligation to ensure that, through deliberate and active student success initiatives, we are just as inclusive, welcoming and supportive as the wonderful city we call home.

Every student at the Cullen College has a unique path that led them here. In this issue of *Parameters,* you'll read about three first-generation college students from vastly different worlds who all share the same dream. Their needs might have been different when they entered school, but the resources were plentiful and each found the means to achieve their own Houston dream.

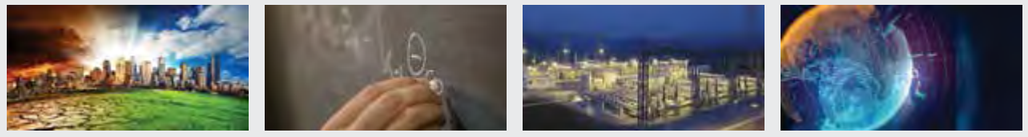
Warm regards,

Joseph W. Tedesco

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

UNIVERSITY of HOUSTON | ENGINEERING

NOW OFFERING GRADUATE-LEVEL CERTIFICATES IN:



GLOBAL CLIMATE, ENERGY AND ENVIRONMENT

POWER SYSTEMS AND SMART GRID

POWER ELECTRONICS AND RENEWABLE ENERGY

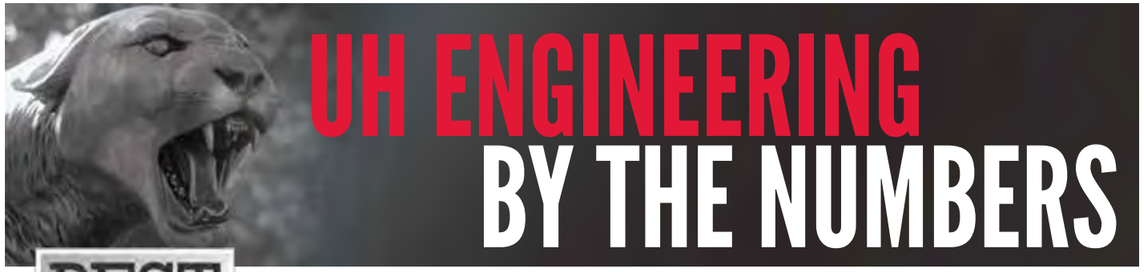
SUBSEA ENGINEERING

ADVANCED SUBSEA ENGINEERING

HIGH-PERFORMANCE COMPUTING

DATA ANALYTICS AND CONDITION AND PERFORMANCE MONITORING OF ENGINEERED SYSTEMS

UNCONVENTIONAL ENERGY RESOURCES



UH ENGINEERING BY THE NUMBERS

BEST GRAD SCHOOLS U.S.News & WORLD REPORT ENGINEERING 2017

#73 Best Engineering Program in the Nation

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

Top-ranking graduate programs in:

Aerospace (#56)
Biomedical (#73)
Chemical (#38)
Civil (#60)
Electrical (#65)
Environmental (#59)
Industrial (#50)
Materials (#71)
Mechanical (#69)
Petroleum (#12)

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

138 total faculty

1,287 graduate students

+

3,267 undergraduate students

4,554 total students

13 National Academy of Engineering faculty members

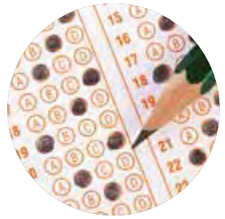
1) Andrew Veletsos; 2) Dan Luss; 3) Jerome Schultz; 4) James M. Symons; 5) Benton F. Baugh; 6) Charles D. Cutler; 7) John H. Lienhard; 8) Christine A. Ehlig-Economides; 9) Kaspar Willam; 10) Jamal J. Azar; 11) Andrea Prosperetti; 12) Kaushik Rajashekara; 13) Ganesh Thakur

Degrees Awarded in 2017

601 - B.S.

405 - M.S.

72 - Ph.D.



1300 average SAT score of entering freshman

$26M+ annual research expenditures

$104,640 average annual salary for engineers in Houston, Texas *(Source: U.S. Bureau of Labor Statistics, May 2016)*

25% of engineers in the Houston metro area earn **25% higher annual salaries** than the national average *(Source: U.S. Bureau of Labor Statistics, May 2016)*

87,500 jobs in engineering and architecture in the Houston metro area in 2016 *(Source: U.S. Bureau of Labor Statistics, May 2016)*

Your Prospects

Mean Entry-Level Salaries Nationwide $

Aerospace/aeronautical engineering
M.S. - $72,804
Ph.D. - $85,000**

Biomedical engineering
B.S. - $67,250
M.S. - $76,750
Ph.D. - $83,500**

Chemical engineering
B.S. - $68,445
M.S. - $74,529
Ph.D. - $93,833

Civil engineering
B.S. - $63,563
M.S. - $66,343
Ph.D. - $110,000**

Computer engineering
B.S. - $68,191
M.S. - $78,101
Ph.D. - $104,600

Electrical engineering
B.S. - $66,920
M.S. - $75,317
Ph.D. - $93,857

Environmental engineering
B.S. - $63,190
M.S. - $73,354
Ph.D. - $72,500**

Industrial/manufacturing engineering
B.S. - $64,280
M.S. - $75,029
Ph.D. - $85,250**

Materials engineering/science
M.S. - $74,948
Ph.D. - $92,000

Mechanical engineering
B.S. - $66,557
M.S. - $73,177
Ph.D. - $91,571

Petroleum engineering
B.S. - $77,000
M.S. - $83,500**
Ph.D. - $160,000**

*Source: National Association of Colleges and Employers 2017 Winter Salary Survey // ** Source: Payscale.com*

ENGINEERING SNAPSHOTS

2017 PROJECTED ANNUAL ENGINEERING SALARIES IN HOUSTON

BACHELOR'S DEGREES

BIOMEDICAL $78,360	CHEMICAL $125,040
CIVIL $113,580	COMPUTER $110,020
ELECTRICAL $105,930	ENVIRONMENTAL $92,700
INDUSTRIAL/MANUFACTURING $111,800	MECHANICAL $109,750
PETROLEUM $165,850	

DOCTORAL DEGREES

AEROSPACE/AERONAUTICAL $113,870	BIOMEDICAL $78,360
CHEMICAL $125,040	CIVIL $113,580
COMPUTER $110,020	ELECTRICAL $105,930
ENVIRONMENTAL $92,700	INDUSTRIAL/MANUFACTURING $111,800
MATERIALS $105,800	MECHANICAL $109,750
PETROLEUM $165,850	

MASTER'S DEGREES

AEROSPACE/AERONAUTICAL $113,870	BIOMEDICAL $78,360
CHEMICAL $125,040	CIVIL $113,580
COMPUTER $110,020	ELECTRICAL $105,930
ENVIRONMENTAL $92,700	INDUSTRIAL/MANUFACTURING $111,800
MATERIALS $105,800	MECHANICAL $109,750
PETROLEUM $165,850	

Source: U.S. Bureau of Labor Statistics National Occupational Employment and Wage Estimates, May 2016

IN THE MEDIA SPOTLIGHT

HOUSTON CHRONICLE

The Houston Chronicle asked wireless communications expert **Zhu Han** whether Super Bowl LI fans inside of NRG Stadium – formerly known as a wireless "deadzone" – would be able to Tweet, Facebook and Snapchat their experiences at the big game.

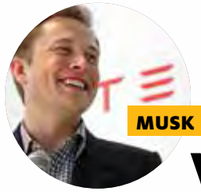
READ HAN'S PREDICTIONS AT
www.egr.uh.edu/news/201702/houston-chronicle-taps-uh-engineering-expertise-wireless-technology-upgrades-super-bowl

After Hurricane Harvey hit Texas many residents were left wondering what kinds of pollutants were in the flood waters that filled their homes. **Hanadi Rifai** spoke with the **Houston Chronicle** and CBS affiliate **KHOU** about the toxins contained in the water and why they are so dangerous to human health.

KHOU11

FIND OUT WHAT'S IN THE WATER AT
www.houstonchronicle.com/news/houston-texas/houston/article/Residents-washed-away-by-Harvey-wait-for-answers-12185912.php

U.S. NEWS & WORLD REPORT



MUSK VS TESLA

U.S. News & World Report asked **Rose Faghih** to weigh in on the similarities between engineering pioneers Elon Musk and Nikola Tesla, after whom Musk named his electric car. Tesla went broke pushing his obsession with wireless communication and power transmission on a world that wasn't yet ready in 1900, and many pose the question whether the same could happen to Musk as he relentlessly pursues technology.

READ FAGHIH'S THOUGHTS ON THE NATIONAL TESLA VS. MUSK DEBATE AT
money.usnews.com/investing/articles/2017-04-27/elon-musk-is-determined-to-change-the-world

npr

In the early days of personal computing, Cullen College alumnus **Rod Canion** (bachelor's in electrical engineering 1966, and master's in electrical engineering 1968) left the security of his job at Texas Instruments and co-founded Compaq, which created the first IBM-compatible personal computer. **NPR** explores exactly how he did it on its business podcast "How I Built This." On the program, Canion tells how his start-up computer company took off immediately, ultimately ushering in the new PC era.

LISTEN TO THE COMPLETE PROGRAM AT
www.npr.org/podcasts/510313/how-i-built-this

Click2Houston.com

Inspired by the UH chapter of eNABLE, a group that provides 3D-printed prosthetic hands to those in need, Alief ISD students spent their summer days designing and building prosthetic hands using blueprints posted online by the UH eNABLE students. Alief students donated their prosthetics to the UH eNABLE team. Houston's NBC affiliate, **KPRC**, filmed the heartfelt hand-off.

WATCH THE VIDEO AT
www.click2houston.com/news/click2daily/click2daily-students-lend-a-hand-to-print-3d-prosthetics-1

Academia, Industry Collaborate on

SOLUTIONS TO NEURAL DISEASE, INJURY

BY JEANNIE KEVER

Neurological disorders like Parkinson's, the aftermath of stroke, limb loss and paralysis significantly diminish the length and quality of life – affecting about one in six people worldwide. But a growing number of biomedical innovations, driven in large part by an aging population dealing with debilitating health issues, are improving both cognitive and motor function.

A new National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) will focus on developing and testing new neural technologies with the potential to dramatically enhance patient function across a wide range of conditions while both lowering costs and increasing accessibility.

The BRAIN Center (Building Reliable Advances and Innovation in Neurotechnology) will be led by researchers from the University of Houston and Arizona State University and, working with industry partners, will speed technologies to market.

BRAIN will focus on developing and testing neurotechnologies designed to address a wide range of sensory, motor and cognitive functions. Such neural technologies could save an estimated $400 billion in future costs, according to the U.S. Centers for Disease Control and Prevention.

"The BRAIN Center is a way to bring together top faculty at both institutions to address critical challenges in the biomedical field," said **Jose Luis Contreras-Vidal,** professor of electrical and computer engineering at the UH Cullen College. "The best way to do that is working with industry."

Contreras-Vidal and Marco Santello, director of ASU's School of Biological Health Sciences, will lead the project, which involves more than 50 researchers from both institutions, along with 14 members from industry, including several hospital systems. The researchers come from a wide range of disciplines, from engineering to law, data science and physiology. More information is available on the center's website.

"Medical advances have dramatically increased life expectancy in the 21st century," said Santello. "The BRAIN Center will enable us to develop safe, reliable neurotechnologies to address the rise in chronic, degenerative diseases associated with an aging population."

The BRAIN Center was launched with a $1.5 million grant from the National Science Foundation, shared equally by the universities; industry collaborators pay $50,000 a year to partner with faculty, using university laboratories to co-develop and validate new technologies.

With dedicated space on both campuses, the center will host two meetings a year. The inaugural meeting in Phoenix was held in June and a second meeting in Houston will be held this fall. Industry/faculty teams will present proposals for developing collaborative research projects. Research areas range from big data to neurorehabilitation and neuromodulation device development, to robotic-assisted therapy and regulatory science.

The NSF grant also includes a workforce training component, with a focus on recruiting and training students from underrepresented communities in undergraduate programs.

"We are training the next workforce," said Contreras-Vidal. "The technology is so new, we don't have enough people to design, repair, validate and prescribe these technologies."

LEARN MORE ABOUT THE BRAIN CENTER AT
brain.egr.uh.edu

Subsea Engineering Pioneer Joins Cullen College as Founding Director of

ENGINEERING PROGRAMS IN KATY

BY AUDREY GRAYSON

As one of the pioneering instructors in the subsea engineering program, **Phaneendra Kondapi** is a familiar name at the UH Cullen College of Engineering. Now Kondapi is forging new paths at the college once again, this time as the founding director of engineering programs in Katy, Texas.

Kondapi, who returns to UH after serving as the director of subsea engineering at Texas A&M University, will spearhead the expansion of UH Engineering program offerings in Katy.

The Cullen College began offering two energy-focused engineering courses at the Houston Community College (HCC) Northwest-Katy Campus last fall, in advance of the grand opening of a new UH branch campus in Katy scheduled for 2018. The graduate-level course offerings are focused on areas in high demand in Houston's Energy Corridor, including petroleum, subsea, electrical and environmental engineering.

With more than 20 years of experience managing engineering projects at energy industry giants FMC Technologies and KBR, Kondapi brings a unique and invaluable skillset to his new role at the college.

"Dr. Kondapi was vital to developing the first subsea engineering program in the U.S. here at the Cullen College. I am tremendously proud that he will now help to bring our top-ranked engineering programs to the Katy community," said Joseph. W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College of Engineering.

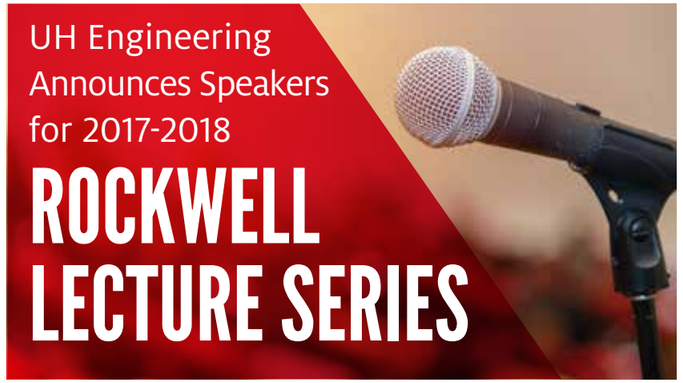
Three graduate-level classes are currently offered at the HCC building in Katy: Well Logging, Flow Assurance and Pipeline Design, all led by world-renowned energy and subsea engineering experts.

Plans are underway for several more course offerings in the spring.

"It's truly an honor to lead the new Katy Campus. I envision a day very soon when anyone in the Katy region with an interest in engineering will have access to the Cullen College's world-class engineering programs right in their own backyards," Kondapi said.

Phaneendra Kondapi brings UH Engineering to Katy

The HCC building in Katy is easily accessible for professionals in the Energy Corridor who are looking to pursue higher degrees or certificates to enhance their skills. "We are here in Katy to serve both the community and the industry," Kondapi said.



UH Engineering Announces Speakers for 2017-2018

ROCKWELL LECTURE SERIES

FEATURING

NED MOHAN

RONALD G. LARSON

JOHN C. CRITTENDEN

CATO T. LAURENCIN

CAROL K. HALL

The University of Houston Cullen College of Engineering has announced its distinguished speakers for the 2017-2018 Rockwell Lecture Series, which brings world-renowned engineers and scientists to the UH campus each year to deliver talks on high-impact topics.

This year's topics will include sustainable supply of electricity, multi-scale modeling of complex fluids, developing sustainable urban infrastructure, regenerative engineering for musculoskeletal tissues and atomistic modeling of the molecular dynamics associated with neurodegenerative diseases such as Alzheimer's and Parkinson's.

MARK YOUR CALENDAR

Rockwell Lecture Series 2017-2018

SEPTEMBER 25, 2017

NED MOHAN, *Oscar A. Schott Professor of Power Electronic Systems, University of Minnesota*

Research in Power Electronics and Curriculum Development for Sustainable Electricity Supply

NOVEMBER 17, 2017

RONALD G. LARSON, *A.H. White Distinguished University Professor of Chemical Engineering, University of Michigan*

Multi-Scale Modeling of Complex Fluids: Surfactants, Colloids, and Polymers, and Their Applications

JANUARY 26, 2018

JOHN C. CRITTENDEN, *Director of the Brook Byers Institute of Sustainable Systems and Hightower Chair of Civil and Environmental Engineering, Georgia Institute of Technology*

Gigatechnology: Developing Sustainable Urban Infrastructure to Solve Gigaton Problems

FEBRUARY 16, 2018

CATO T. LAURENCIN, *Albert and Wilda Van Dusen Distinguished Endowed Professor of Orthopaedic Surgery, University of Connecticut*

Regenerative Engineering: Convergence To Address Musculoskeletal Grand Challenges

MARCH 23, 2018

CAROL K. HALL, *Camille Dreyfus Distinguished University Professor of Chemical and Biomolecular Engineering, North Carolina State University*

Spontaneous Formation of Oligomers and Fibrils in Large Scale Molecular Dynamics Simulations of A-beta and Prion Peptides

FOR THE MOST UP-TO-DATE INFORMATION ON LECTURE DATES, TIMES AND LOCATIONS, PLEASE VISIT
www.egr.uh.edu/our-college/rockwell-lecture

UH Engineer Hosts Annual Conference on

HURRICANE AND DISASTER PREPARATION AND RECOVERY

BY AUDREY GRAYSON

Only a few short weeks before Hurricane Harvey devastated the Gulf Coast of Texas, **Cumaraswamy "Vipu" Vipulanandan,** director of the Texas Hurricane Center for Innovative Technology at the UH Cullen College of Engineering, was hosting a conference to prepare regional decisionmakers on how best to respond to such a disaster.

The 9th annual event, "Hurricanes, Major Disasters, Coastal Protection and Rapid Recovery in Texas and the Gulf Coast Region," was held in August at the University of Houston Hilton Hotel.

The Texas Hurricane Center for Innovative Technology studies ways to prepare for and mitigate disasters caused by hurricanes, serving as a testing and research facility for developing hurricane protection products and systems as well as repair technologies to mitigate losses both onshore and offshore. Vipulanandan is a professor of civil and environmental engineering in the UH Cullen College of Engineering.

Panels included speakers from government, academia and industry on topics ranging from emergency management during a hurricane to rapid response for repairs and advanced technologies for safety, maintenance and monitoring. Vipulanandan moderated a panel on coastal modeling, monitoring and debris management.

In addition to the Texas Hurricane Center for Innovative Technology, sponsors included the UH departments of civil and environmental engineering and industrial engineering.

LEARN MORE ABOUT THE TEXAS HURRICANE CENTER FOR INNOVATIVE TECHNOLOGY AT
hurricane.egr.uh.edu

Cullen College of Engineering

JOINS FORCES WITH MARITIME UNIVERSITY

BY LAURIE FICKMAN

Top: (from left) Keh-Han Wang, Roberto Ballarini and Yuqing Sun
Bottom: Roberto Ballarini (center) tours the training ship Yukun with Captain Xinzhuo Liu (left)

In April, representatives of the University of Houston's Department of Civil and Environmental Engineering (CEE) traveled to Dalian Maritime University (DMU) in Dalian, People's Republic of China, to write and sign a memorandum of understanding (MOU) that will bring what is expected to be a continuous stream of DMU students to CEE's M.S. and Ph.D. programs.

According to DMU's President Yuqing Sun, this inaugural agreement with CEE is the first of what they hope to be additional agreements with departments in the Cullen College of Engineering, which they selected as DMU's "go-to" school for master's and doctoral degrees.

Dalian Maritime University, one of China's premier maritime institutions, and the University of Houston, a global leader in subsea engineering education, continue to share many common goals. The two schools signed a similar MOU in February to leverage both universities' mutual interests in the fields of offshore energy and subsea engineering by sharing expertise, resources and facilities as well as jointly developing research and academic programs.

Representing UH were **Keh-Han Wang,** professor of CEE and director of the civil engineering graduate program, and **Roberto Ballarini,** Thomas and Laura Hsu Professor and department chair.

In a separate formal ceremony Ballarini was named honorary chair professor at DMU. As part of his appointment he will spend one month annually at DMU to nurture collaborative efforts.

"The appointment of Professor Roberto Ballarini has enriched the scientific research force and broadened the research direction for the development of marine engineering related fields," said Dalian vice president Zhengjiang Liu.

Ballarini added, "I would like to take this opportunity to build a platform for cooperation between Dalian Maritime University and the University of Houston to establish a normalization of the exchange of visits between teachers and students."

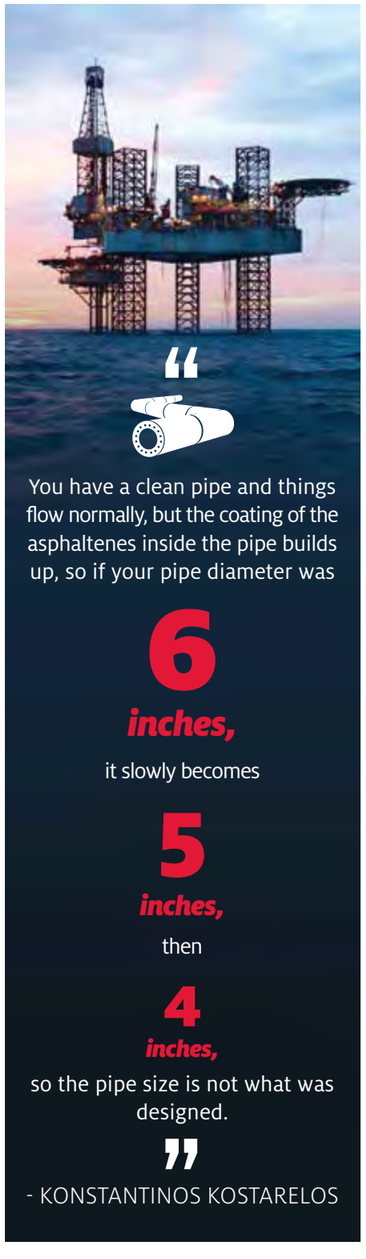
UH Engineer Builds NEW TECHNOLOGY to Keep the Oil Flowing

BY LAURIE FICKMAN

Konstantinos Kostarelos, associate professor of petroleum engineering, is building a new device to address the issue of blockage inside crude oil pipes.

Konstantinos Kostarelos with his prototype that electro-kinetically removes sludge and gunk from crude oil pipes

It's a big problem in the oil industry.



You have a clean pipe and things flow normally, but the coating of the asphaltenes inside the pipe builds up, so if your pipe diameter was

6 inches,

it slowly becomes

5 inches,

then

4 inches,

so the pipe size is not what was designed.

- KONSTANTINOS KOSTARELOS

Companies typically spend a lot of money on chemical dispersants and inhibitors to address the issue and then they may still have to physically clean out the pipes by scraping the solids that have accumulated with devices called "pigs."

Kostarelos has a new approach that might eliminate all of that.

His prototype uses an electric field to attract the components in crude oil that cause the blockage and remove them from the flow stream. His method has been published in the *Journal of Petroleum Technology*.

How the slowdown happens

It is not too refined a world in the business of crude oil. The black gold flows through pipes on its downstream journey to get it ready for consumers. But over time, imagine what the inside of that pipe might look like, filled with sludge buildup that prevents the pipe from filling to capacity and the Texas Tea from smoothly moving on.

Molecules called asphaltenes make up the heaviest fraction of crude oil, and they are known to precipitate with pressure and temperature change outside the reservoir. Over time that precipitation builds up and hardens on the inside of the pipe.

"You have a clean pipe and things flow normally, but the coating of the asphaltenes inside the pipe builds up, so if your pipe diameter was 6 inches, it slowly becomes 5 inches, then 4 inches, so the pipe size is not what was designed," said Kostarelos.

When that happens the flow rate of the oil is reduced and if pumps are used to increase the flow rate, there will be an enormous amount of pressure needed from the pump.

A better way

Kostarelos is accustomed to finding better solutions. Last year he 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.

This time he built a prototype device that would electro-kinetically remove asphaltenes from crude oil near the point of production. He was helped along by his undergraduate students Clint Martin, Kyo Tran, Jose Moreno and Aaron Hubik.

The process involves putting two electrical plates, highly charged at 4,000 volts, into the pipe. They attract the molecules to them and away from the pipe.

"The asphaltene molecules, which are polar, start coating the plates and we remove the plates," said Kostarelos. "It worked better than I expected," he adds with a smile.

The idea just came to Kostarelos. Like oil, it just flowed.

"I thought this would be an interesting method we might be able to use to address the flow assurance problem instead of using the chemicals or pigging the pipe, but no one had done it before."

So he did.

"It's still in the early stage and we have to explore how to optimize the device to make it as efficient as possible in removing particles," he said.

So he will.

Cullen College Team Knows How to

RESTORE POWER QUICKLY

...and Win Awards

BY LAURIE FICKMAN

Gino Lim, Saeedeh Abbasi and Masoud Barati

Whether you've suffered through a major Houston hurricane, flood event or momentary glitch in the power grid, no doubt you understand the severity of a power blackout. And lest you think Houston has cornered the market on such catastrophes, think back to 2003 when the biggest blackout in U.S. history left 50 million people in darkness in the northeast corner of America stretching into Canada.

In the case of these disasters, the first question **Saeedeh Abbasi** thinks about is: "What do we have to do to restore the power quickly?"

Luckily for us, Abbasi has answers. She is a doctoral candidate studying under Professor **Gino Lim,** chair of the Cullen College's department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow. The pair, along with **Masoud Barati,** an instructional assistant professor of electrical and computer engineering, published the answers in a paper "A multi-objective MPEC model for disaster management of power system restoration," given the Best Paper Award in the Energy Systems Division by the Institute of Industrial and Systems Engineers (IISE) during its annual conference in May 2017.

Powering back up

"We want to restore the power grid as soon as possible, so time is the most important factor in our study," said Abbasi. "We also want to reduce the number of people impacted by a power failure."

As an optimization expert, Abbasi breaks the population into segments, isolating those with the most critical needs like hospitals and data centers, giving them top priority in the restoration plan.

Once she segments the power network into smaller sections, or micro grids, Abbasi proposes to restore power of the islanded (or independently operable) sections at the same time. This way there is less load on the lines and the power is restored quickly.

It appears to be a low key approach, and there

are mathematical algorithms called mathematical program with equilibrium constraints (the MPEC from the paper title) to determine assignment of demands to emergency power generators known as black start generation units. Still, turning on one segment at a time seems such a simple solution.

"If you ask anyone about the greatest ideas, they are always the very easiest and simplest," said Lim.

Breakthroughs

Currently in the power industry, during a failure, the black start generation units are used to restore power. These generators don't depend on the failed electric grid to operate, but their capacity for generation is limited. Using the sectional approach, Abbasi has found a solution for their limited effectiveness.

Her solution minimizes the lost load and restoration time as well as power generation cost.

Another important innovation in the paper, said Barati, is the application of distributed energy resources in the restoration process of the power grid.

"Take, for example, the power grid on the UH campus," said Barati. "It can be categorized as a low voltage system. The black start generation units within these systems can help the bigger power systems for the restoration process, showing the capability of the micro-generation units and micro grid in restoration of the bulk power system."

In the end, the researchers see a better future for power restoration through the work.

"We are trying to maximize the resiliency of the restored power grid," said Barati. With the system for restoration institutionalized, precious time can be saved in restoring power after a failure occurs.

"Resiliency is all about evolution," said Lim. "Once you go through a process you understand the weaknesses and challenges and the process can be adapted so if the same thing happens again you will have much less damage and, in this case, quicker restoration of power."

If anything can benefit from evolution it would be the American power grid, built in the 1882 and launched by Thomas Edison at the Pearl Street Station in Manhattan. While it has expanded beyond anyone's conception at that time, it has had few adaptations since.

"It's a very vulnerable asset," said Abbasi.

Inexpensive Organic Material Gives

SAFE BATTERIES A LONGER LIFE

BY JEANNIE KEVER

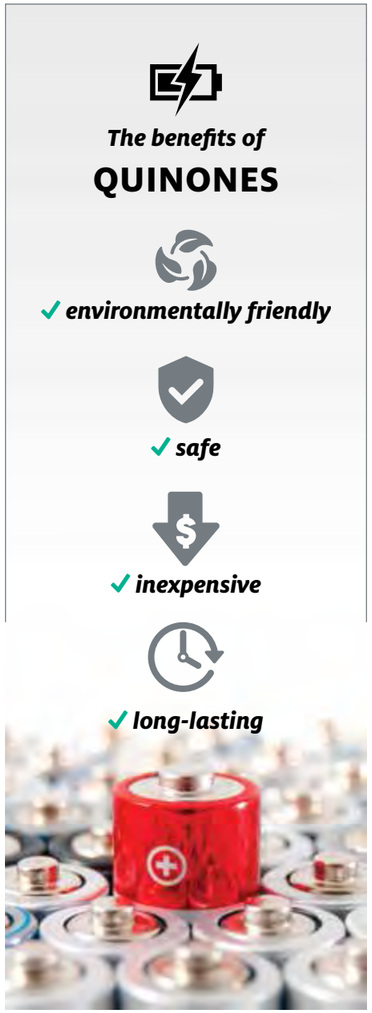
Modern batteries power everything from cars to cell phones, but they are far from perfect – they catch fire, they perform poorly in cold weather and they have relatively short lifecycles, among other issues. Now researchers from the University of Houston have described a new class of material that addresses many of those concerns in *Nature Materials*.

The researchers, led by **Yan Yao,** associate professor of electrical and computer engineering, report their use of quinones – an inexpensive, earth-abundant and easily recyclable material – to create stable anode composites for any aqueous rechargeable battery.

"This new material is cheap and chemically stable in such a corrosive environment," said Yao, who is also a principal investigator with the Texas Center for Superconductivity at UH, with an appointment to the chemical and biomolecular engineering faculty. The material also can be used to create a "drop-in replacement" for current battery anodes, allowing the new material to be used without changing existing battery manufacturing lines, he said.

"This can get to market much faster," he said.

Yao and his lab, including research associate Yanliang Liang, who served as first author on the paper, began the work in 2013, after he was awarded $1 million from the Department of Energy's Advanced Research Project Agency – Energy (ARPA-E) RANGE program to develop new battery technology. Other researchers involved in the project include



Yan Jing, Saman Gheytani and Kuan-Yi Lee, all of UH, Ping Liu of the University of California-San Diego, and Antonio Facchetti of Northwestern University.

Energy storage is the key to wider adoption of electric cars, wind and solar power, along with other clean energy technologies. But the development of battery storage systems, which would be able to store energy until it is needed and then be recharged with additional generation, has been hampered by the lack of batteries that meet a variety of requirements: environmentally friendly, safe, inexpensive and long-lasting.

"Aqueous rechargeable batteries featuring low-cost and nonflammable water-based electrolytes are intrinsically safe and … (provide) robustness and cost advantages over competing lithium-ion batteries that use volatile organic electrolytes and are responsible for recent catastrophic explosions," the researchers wrote. But state-of-the-art aqueous rechargeable batteries have a short lifespan, making them unsuitable for applications where it isn't practical to replace them frequently.

The stumbling block, Yao said, has been the anode, the portion of the battery through which energy flows. Existing anode materials are intrinsically structurally and chemically unstable, meaning the battery is only efficient for a relatively short time.

They worked with quinones, an earth-abundant organic material that Yan said costs just $2 per kilogram, demonstrating the material's benefits in three formulations.

The differing formulations offer evidence that the material is an effective anode for both acid batteries and alkaline batteries, such as those used in a car, as well as emerging aqueous metal-ion batteries, Liang said. That means the quinones-based anode will work regardless of which technology dominates in the future, he said.

The new material also allows the batteries to work across temperature ranges, Liang said, unlike some conventional aqueous batteries, which are notoriously balky in cold weather.

Yao said consumers would quickly notice one key difference in this change to existing battery technology. "One of these batteries, as a car battery, could last 10 years," he said. In addition to slowing the deterioration of batteries for vehicles and stationary electricity storage batteries, it also would make battery disposal easier because the material does not contain heavy metals.

The researchers have filed for three patents for the technology and hope to find partners to commercialize the technology.

SHALE TASK FORCE,

Directed by UH Engineer Christine Ehlig-Economides, Releases Findings

BY AUDREY GRAYSON

The Academy of Medicine, Engineering and Science of Texas (TAMEST) released findings in June from its Shale Task Force, chaired by UH petroleum engineering professor and National Academy of Engineering member **Christine Ehlig-Economides.** The report represents the most comprehensive overview to date of research on the impacts of shale oil and gas production in the state of Texas, focusing on key areas related to seismicity, land, air, water, transportation, economic and social impacts.

The state of Texas has long led the nation and the world in the development of technologies for oil and gas production. The combination of horizontal drilling and hydraulic fracturing was first developed in Texas in the late 1980s. By the late 1990s, this method was used across the state to produce natural gas from previously inaccessible reservoirs.

> *There's a lot of misinformation out there, so it is so important that we reach a scientific consensus on what we do and do not know about the impacts of shale oil and gas development.*
>
> - CHRISTINE EHLIG-ECONOMIDES

"We've been at it now for long enough in the state of Texas to take the opportunity to look back, see what we've learned and make recommendations based on what we find," said Ehlig-Economides.

Among the report's key findings are that shale development comes with environmental and societal risks, including earthquakes, contamination to water sources and increased traffic accidents.

The report also quantifies the knowns and unknowns surrounding these risks, highlighting some of the misinformation spread on the dangers of hydraulic fracturing. For example, an increase in earthquakes in Texas since 2008 has been linked to hydraulic fracturing activities; The TAMEST report finds that all of the seismic activity potentially caused by human activities to date was caused by wastewater disposal from oil and gas development rather than hydraulic fracturing activities.

The task force brought together multidisciplinary experts from academia, industry and government to conduct a thorough review of the existing peer-reviewed literature on hydraulic fracturing in Texas. "It was a great team," Ehlig-Economides said.

Ultimately, Ehlig-Economides hopes that the report will help to bring some clarity to the remaining questions surrounding the risks of hydraulic fracturing.

"There's a lot of misinformation out there, so it is so important that we reach a scientific consensus on what we do and do not know about the impacts of shale oil and gas development," she said.

READ THE TAMEST SHALE TASK FORCE REPORT AT
http://tamest.org/shale-task-force/

THE MAN WHO HELPED PLUG IN COMMERCIAL ELECTRIC CARS

is Plugging Away at the UH POWER PROGRAM

BY LAURIE FICKMAN

There are many ways to describe electrical and computer engineering Professor Kaushik Rajashekara, who heads the Cullen College power and energy systems program and is director of the Power Electronics, Microgrids and Subsea Electrical Systems (PEMSES) Center at UH: Member of the National Academy of Engineering, Fellow of the National Academy of Inventors, inductee of the Delphi Innovation Hall of Fame or, even, a member of the team that developed the General Motors EV1, the first mass-produced electric car from a major automaker.

But the title Rajashekara likes most is “futurist.”

“When people ask me what I work on, I always say, ‘The future,’” said Rajashekara, former chief scientist at General Motors/Delphi and chief technologist at Rolls-Royce.

It’s a spot-on answer for the scientist who has consistently worked on futuristic projects and brought them to life. After ushering in the era of electric and hybrids cars from 1989-2006 by advancing the technologies including the EV1, he left his position at GM/Delphi for his next revolutionary project.

At Rolls-Royce, he worked on advanced architectures for more electric and hybrid electric aircraft, bringing to life his notions of converting ancillary equipment used on aircraft (like air conditioning and cooking devices) to electricity, leading to next generation aircraft beyond the 787 Dreamliner-type.

Now, with those futuristic projects in the past, he says the next big thing will be flying cars – and he’s all in. If his track record is proof, it may be time to look skyward for a parking spot.

“Just recently I gave a lecture in India about flying cars. I give talks about them all over the world,” said Rajashekara. He is propelled in his pursuit by his desire to preserve the environment. “If you have a flying car, you don’t have to build as many bridges or cut as many trees,” he offers, with a logic that makes his science fiction-sounding future appear to be just plain practical.

Down to earth at UH

His pursuits at the Cullen College are a bit more terrestrial.

“I’m a power and energy guy,” said Rajashekara, who points out that most energy courses and majors at UH and other universities are related to petroleum or chemical engineering.

But to him, power means the energy of electricity, the magic that happens after converting the various petrochemicals and turning on the light switch.

“It is very important that electric energy gets importance at the University of Houston,” he said. And so, in the past year since he’s been at the Cullen College, Rajashekara has gone about creating the certificate program to prepare students to design electrical systems for the power and energy industry. The program offers two certificates – one in power electronics and renewable energy technologies and the other in power systems and the smart grid. The next step is to launch a curriculum offering a master’s of science in

> It is very important that electric energy gets importance at the University of Houston.
>
> - KAUSHIK RAJASHEKARA

electrical engineering in power and energy systems.

He hopes to grow his small lab and the program and welcome industry representatives to the lab to witness students tackling some of the greatest challenges in the power industry, like making the power grid smart and incorporating renewable energy into it.

"There is so much evolving in the infrastructure," said Rajashekara. But U.S. industry hasn't approached its biggest challenge, which, according to him, is burying the wires.

"The cables should be buried," he said, definitively, of the hundreds of thousands of miles of power lines that crisscross the cities. He notes safety from weather events, better security and a nicer landscape as benefits of burying cable.

He notices the sagging lines wherever he travels.

Amazing journey

And he has traveled a long way. As a little boy growing up in a village in India with his parents and two brothers, Rajashekara lived in a one room lean-to that he said was smaller than the office he now occupies at UH. He read by kerosene lamplight and though neither of his parents had any education, his mother was determined that her children do better and be the best at whatever they pursued. High school came to his village in time for him to attend.

His biggest challenge was money. In today's dollars, the salary his father made per month would equal about $175. But his circumstance held neither he nor his siblings back. One, like him, is an engineer and the other is a doctor. Scholarships played a big part in his life.

Coming from such humble beginnings, Rajashekara says he is proud to have worked for such large companies and of his role in convincing a skeptical society that electric cars could become reality.

But he says he's proudest of his ability to help students, colleagues and friends succeed. "To help them succeed in their lives and professions is what I want to see," he said.

That, and them flying to work in their cars over an expanded UH power program.

EGOR DONTSOV:

Tips for the Fracking Industry

BY LAURIE FICKMAN

In the world of hydraulic fracturing, where subterranean fractures are forced open to extract oil or gas, much is done before the drill meets the earth. Research to pinpoint the ideal extraction spot would be impossible if it had to be conducted 1-2 miles down in the Earth's core. So engineers like **Egor Dontsov,** assistant professor of civil and environmental engineering, create computer models to simulate the areas of rock to approach with special attention when determining where the tip of the fracture will be.

"The tip is where everything happens," said Dontsov. "It plays a fundamental role in how the fracture will grow and therefore needs to be thoroughly analyzed."

So agreed the American Chemical Society Petroleum Research Fund, which awarded Dontsov $110,000 to support his research in this step to advance simulation of the fracking process.

But rocks are rocky

Given that the rocks have a layered structure due to geological deposition, they obey anisotropic elastic behavior, which means they may stretch one way in one direction and another way if pulled in a different direction. Dontsov's work will incorporate such anisotropic behavior at the tip of the hydraulically-driven fracture.

"These are very expensive operations and so we want to make sure we can predict the fracture geometry as accurately as possible," said Dontsov. "If we know the material is anisotropic, we need to account for it in our model." He will add it into his research in the form of a math problem, formulating the governing equations for fractures in anisotropic rocks and then attempting to solve it numerically on a computer.

If successful, the project could lead to more efficient and effective extraction of hydrocarbons, no small feat for a process that has become significant to the energy industry and economy.

"Hydraulic fracturing changed the economic landscape," said Dontsov. "Before this process, the U.S. was only importing oil and now it's exporting oil. It's had a serious effect and will continue to."

And that, you could say, is a tip from Dontsov.

THE *Dream* TEAM:

Awash in Brilliance and Improving Water Filtration

BY LAURIE FICKMAN

When it comes to clean water, **Yandi Hu** and **Debora Rodrigues** have a thirst for it.

Hu, UH assistant professor of civil and environmental engineering, works with Flint, Michigan on their water crisis and conducts research on reducing lead release in water lines. Rodrigues, UH associate professor of civil and environmental engineering, helps improve global access to clean water with a nano-sized technology that can weed out metals and microorganisms from drinking sources. Now they've teamed up and received a grant for $184,000 from the Qatar National Research Fund to change the world of water purification by making it more efficient and less expensive.

"This work can be very transformative," said Hu of the joint project called "Mechanistic study of using polymer-modified graphene oxide nanocomposites for controlling $CaSO_4$ scaling and biofouling on reverse osmosis membrane."

The scope of the problem

To understand their work, you have to understand the scope of the problem. Saltwater comprises 97 percent of the earth's water supply. To convert that seawater into drinkable (or potable) water, it undergoes the desalination process, which includes reverse osmosis, in which minerals and salts are removed by passing through filter screens, called membranes.

"In the United States, 70 percent of reverse osmosis desalination plants are affected by mineral scaling and severe membrane biofouling from a buildup of bacteria," said Rodrigues.

"The minerals clog the pores and bacteria can grow on the membrane surfaces," added Hu. "When this clogging happens, high pressure is required to push the water through the membranes and that costs more energy."

More money, too. In California, at the Water Factory 21 desalination plant, at least $728,000 is spent on membrane cleaning. That's 30 percent of their operating costs. The clogging is not only expensive to clean, it seriously reduces membrane performance and lifetime.

Rodrigues and Hu have a better way to eliminate mineral scaling and biofouling.

They're going to modify the surface of the filter by using a polymer-modified graphene oxide nanocomposite to coat the membranes. They predict the new coating they are developing will prevent the buildup.

They have good reason to be positive.

Rodrigues had already determined that graphene oxide (GO) can kill bacteria and prevent biofouling. In Hu's lab they've been working on the concept that polymers could prevent mineral scaling. Now they're combining the GO with the polymers to see if they can combat both threats at once.

But the questions abound

The combination of properties has to be carefully measured. Bacteria may actually degrade polymers, and polymers might actually promote the growth of bacteria by becoming its food.

Problems to be faced by Rodrigues and Hu as they work together to blend their knowledge, talents and expertise to meet the worldwide challenge of keeping the water supply plentiful and healthy.

For Stanko Brankovic,

LIFE IS SPEEDING UP

BY LAURIE FICKMAN

That exciting feeling you get when you've made a breakthrough discovery and you know that something that seemed impossible yesterday is now completely clear –

that's the feeling that **Stanko Brankovic,** professor of electrical and computer engineering, has about his recent discovery of the speed in which catalysts are formed.

"I'm in the same position as Sir Isaac Newton was when the apple hit him in the head! It's that same excitement, a 'Wow!' moment," said Brankovic.

Newton's not-too shabby discovery resulted in nothing less than an understanding of gravity; Brankovic's may result in building better catalysts, the fundamental substance that speeds up reactions in all industries from petrochemical to manufacturing.

Brankovic is not alone in his excitement. The *Journal of the Electrochemical Society* selected Brankovic's paper as the "editor's choice" article, a distinction reserved for research highlighting transformative scientific discoveries. According to the journal, the designation is awarded for work showing extraordinary direction, concept, interpretation or way of doing something. The journal is the most acclaimed publication in its field.

Brankovic's article is titled "Reaction kinetics of metal deposition via surface limited redox replacement of underpotentially deposited monolayers studied by surface reflectivity and open circuit measurements."

Building a better catalyst

Brankovic and his group studied what affects the speed in which catalysts are formed by examining how quickly the thin-film monolayers are placed on top of each other to build them. Their results showed clearly that reaction kinetics of metal deposition is significantly impacted by the design of the reaction solution and ion concentrations.

"I'm in the same position as Sir Isaac Newton was when the apple hit him in the head! It's that same excitement, a 'Wow!' moment."

- STANKO BRANKOVIC

Nobody understood this before Brankovic.

"The speed in how quickly you put these monolayers down effects their morphology, and that effects the monolayer quality in terms of their catalysis performance," said Brankovic, noting that a catalyst will become something different depending on the speed with which the layers are stacked.

Knowing that catalysts become different dependent on the speed of their architecture gives scientists more control over what they are creating.

"We discovered some fundamentally important things that will eventually help people who use this method to design even better catalysts and control the design process better," said Brankovic.

Body of work

Although Brankovic has toiled away at thin film deposits for more than a decade, they still absorb much of his brilliant mind.

"Everywhere you look is a thin film," he said, pointing to his surroundings. "Paint is a thin film, windows are coated with thin films; in technology they exist everywhere. The world is made of thin films."

His enthusiasm over thin-film layered catalysts has translated to hard work and lots of success in his field. In 2001, he was highly cited for his work on creating a catalyst for fuel cells, the kind that ultimately brought us the electric car. Recently the National Science Foundation awarded him a grant to make "heavy water" less expensively, which could lead to safer nuclear energy (spoiler alert: his method involves catalysts).

Despite his stature in the field, Brankovic credits his students with the latest accomplishment. "Together we have opened this door for others to follow," he said.

His group includes his Ph.D. students Wu Dongjun, Ela Bulut, who has graduated and is now a professor in Turkey, Nikhil Dole, now graduated and employed by Lam Research, and the visiting scholar Dr. Hasan Kilic.

Brankovic is ultimately concerned about his students' success. "This is the type of recognition that increases the visibility not only of UH, but of my students in their pursuit of excellence in academics and research."

A catalyst for success you might say.

FUNDAMENTALS

DISCOVERING HOW NATURE WORKS

and Cells Adapt to Changes

BY LAURIE FICKMAN

In the high energy world of **Ashutosh Agrawal,** assistant professor of mechanical engineering, two things turn the head of the man who always seems to be spinning with excitement about science: Discovering how nature works and seeing what happens when students understand it.

> *THE TWO BEST PARTS OF THIS PROFESSION ARE WHEN YOU DISCOVER SOMETHING FUNDAMENTAL AND WHEN YOU SEE THAT SPARK OF UNDERSTANDING IN A STUDENT'S EYES WHEN YOU EXPLAIN IT.*
>
> - ASHUTOSH AGRAWAL

"The two best parts of this profession are when you discover something fundamental and when you see that spark of understanding in a student's eyes when you explain it," said Agrawal.

Both of those things happened for him while doing the research on cellular transport that was published in the Royal Society of Chemistry's journal *Soft Matter* under the name "Clathrin polymerization exhibits high mechano-geometric sensitivity." In the article Agrawal unravels the fundamental principles of transport to discover how cells adapt to changes in their mechanical environment.

Soft does matter

To understand Agrawal's work you first have to consider a cell itself, surrounded by a membrane made of a soft fluid wall, which defines its identity and serves as a barrier to foreign objects. But macromolecules like nutrients need to continuously penetrate the membrane and enter the cell to help it survive. In that case, when the wall doesn't want to break, but is being nudged to, proteins within the cell recognize they're being called to duty.

"When that happens, these clathrin molecules, or proteins, come and dock on the inside of the membrane and they start to bend the membrane wall to allow the foreign cargo to enter," said Agrawal. The proteins work to reshape the cell membrane, forming a vesicle to allow the substance in and then reforming around it without ever having to break – a process called endocytosis.

"Much is known about how tension modulates cellular transport, but the effect of tension on the clathrin assembly and vesicle growth remains less understood," said Agrawal.

Until now.

Through computer modeling and cellular experimentation, Agrawal, with his Ph.D. students Ehsan Irajizad and Nikhil Walani and collaborators at the University of Michigan-Ann Arbor, unlocked part of the mystery by quantifying the price clathrin pays to remodel the membrane.

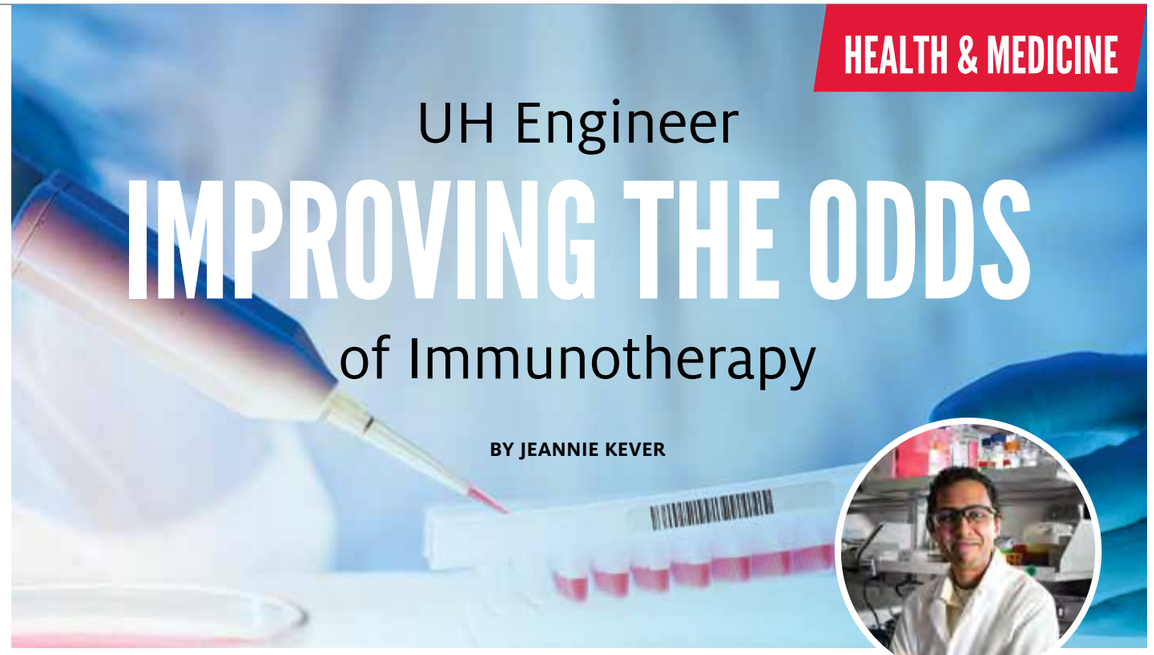
Studying at a cellular level

Agrawal first studied the energetics of vesicle formation in response to changes in tension of the membrane. "We find the polymerization of the protein is sensitive to tension and the geometry of the membrane," said Agrawal. It's like a circular path: The protein comes first to deform the membrane, but then the protein is affected by its very change. The study reveals that both the tautness and the geometry of the membrane determine the extent to which clathrin can polymerize. Contrary to intuition, the study shows that clathrin can form large domains both in low and high tension regimes. While the shape in the low tension regime is spherical, the shape in the high tension regime is planar. This finding reveals that clathrin can assemble into these distinct structures by a unified mechanism regulated by tension, which has been a subject of debate in the biology literature.

Knowing this moves Agrawal closer to understanding how cellular transport adapts to mechanical stresses, which makes him smile with glee.

Eventually the research may find its way to supporting drug delivery research, but for Agrawal the driving force is the one accomplished – recognizing the physics of why nature does what it does.

HEALTH & MEDICINE



UH Engineer IMPROVING THE ODDS of Immunotherapy

BY JEANNIE KEVER

Navin Varadarajan

Immunotherapy, in which cells from the human immune system are unleashed to fight disease, has been the big story in cancer treatment over the past few years. When it works, it can spur long-lasting remission in patients for whom other treatments have failed. But most patients don't benefit, and there is still no good way to predict who will respond.

A team of researchers led by a UH engineer is trying another tack – designing immune system cells that can survive within a tumor even when the nutrients needed to sustain them aren't available. That should allow the cells to work more efficiently in more people.

Navin Varadarajan, associate professor of chemical and biomolecular engineering, works with T cells, immune cells that can recognize and attack disease cells. But all cells need nutrients to survive, and tumors harbor areas of nutrient limited zones, meaning T cells often die before completing their task, Varadarajan said.

"We know once they get to the tumor, nutrients are limited," he said. "If they are not able to cope and compete effectively for these nutrients, they're going to die. The question is, can you engineer the T cells to survive and persist?"

To further the work, Varadarajan has received a $375,000, three-year grant from the Melanoma Research Alliance, part of $8.5 million in new funding awarded to researchers at 28 institutions in six countries.

"These awards will further our ability to improve melanoma outcomes, support the next generation of melanoma researchers and help draw us ever closer to a cure," said Debra Black, chair and co-founder of the Melanoma Research Alliance.

Varadarajan's work will use a novel research platform he developed to allow researchers to study T cells at a single-cell level, as well as single cell T cell-tumor cell interactions. The proprietary chip-based platform works by co-incubating T cells and tumor cells in dense arrays of nanoliter wells, or nanowells, and monitoring the functional interaction between the cells. The goal is to engineer T cells that retain their anti-cancer properties in the inhospitable environment of a tumor.

The platform will allow researchers to track thousands of interactions and hone in on the traits that predict success. The engineered T cells will then be tested in mice at the University of Texas MD Anderson Cancer Center. This work builds on existing research conducted by Melisa Martinez, a postdoctoral researcher in Varadarajan's lab, in collaboration with an MD Anderson team headed by Chantale Bernatchez.

Varadarajan began working on immunotherapy after arriving at UH about seven years ago. Since then, the therapy has taken off.

"It's amazing how well it's done," he said. "It's become a major player in clinical oncology. All of our work now is going toward getting it to work for more people."

He said the treatment is effective for about 20 percent of patients who receive it.

"For now, we don't have good biomarkers to tell who is a good candidate for immunotherapy," he said. Engineering T cells to work more broadly could be another way to increase the therapy's effectiveness. "It's a complementary approach."

FINDING NEW CURES FOR AN OLD DISEASE:

Groundbreaking Malaria Study Opens Doors to New, More Effective Treatments

BY AUDREY GRAYSON

In 2015 the Nobel Prize in Physiology or Medicine went to Chinese scientist Youyou Tu for her discovery of a novel malaria treatment rooted in traditional Chinese medicine. Tu isolated the drug artemisinin from an herb used to treat malaria in China for more than 2,000 years. Today the World Health Organization recommends artemisinin combination therapy as the first line of defense against malaria cases worldwide.

That same year, half way across the world, two UH engineering professors, **Peter Vekilov,** John and Rebecca Moores Professor of chemical and biomolecular engineering and chemistry, and **Jeffrey Rimer,** Ernest J. and Barbara M. Henley Associate Professor of chemical and biomolecular engineering, published a study in the *Proceedings of the National Academies of Sciences* (*PNAS*) shedding new light on how some of the most effective malaria drugs – those from the quinoline class – prevent the growth of hematin crystals, a key piece of the infection process, from taking place.

The timing of the UH discovery couldn't be better. Although the use of artemisinin-based treatments has reduced global malaria deaths from nearly 1 million in 2010 to less than 450,000 in 2015, malaria-causing parasites have been known to adapt quickly to current drug treatments, making the need for rapid drug development a priority among medical researchers.

"We have to find drugs faster than the parasite adapts," Vekilov said.

To do that, Vekilov and Rimer dug deep into the physiology of the malaria parasites and how antimalarial drugs work to stop hematin crystallization, pointing to new directions for malaria drug development. Now their findings are published, once again, in *PNAS*.

How the disease takes hold

Plasmodium falciparum, one of the parasites that cause malaria, usually infects its hosts through a mosquito bite. Once the parasite enters the host's red blood cells it begins to consume hemoglobin, producing the toxic byproduct heme.

The plasmodium has evolved to segregate the heme molecules into tiny crystals, about one micron in size. Instead of killing the parasite, the toxic heme molecules attach to sites along the surface of the crystals, allowing the plasmodium to replicate freely inside the host.

Scientists generally understand that antimalarials work by inhibiting the growth of hematin crystals, creating a toxic concentration of heme molecules and killing off the plasmodium.

MEET THE MEN BEHIND THE SCIENCE

PETER VEKILOV

JEFFREY RIMER

"But the mechanisms of this crystal inhibition were completely unknown," said Vekilov.

Disproving the theory

The prevailing theory was that antimalarial drugs prevented crystal growth by binding to the free heme molecules in the solution, but that theory was proved wrong by Rimer and Vekilov. The pair developed an innovative platform to study hematin crystal growth at the microscopic level in nearly in situ conditions. Then they showed a significantly higher and possibly toxic concentration of drugs are necessary to inhibit the growth of hematin crystals by binding to the free heme molecules.

Instead they found the drugs bind at six specific sites at the surface of the crystals, blocking the attachment of hematin. Eventually the accumulation of toxic heme in the parasite's digestive vacuole spells its death.

The duo's latest paper looks more closely at these binding sites with an eye on designing new, more effective drug treatments for the deadly disease.

"People had speculated that some sites might be better to block than others and we definitively showed that certain modes of inhibition were better than others," said Rimer. "That might be influential in how we view the design of new antimalarial drugs in the future."

Co-authors on the paper include former graduate student Katy Olafson, now a postdoc at MIT, and former undergraduate student Tam Nguyen, who is now pursuing his Ph.D. at the UH Cullen College. "They really led the experimental thrusts of the research. They first disproved a popular theory, then proved this new theory. It's very cool," said Vekilov.

Staying ahead of the parasite

Despite the success of artemisinin-based therapies in treating malaria, the need for new malaria drugs hasn't vanished. Before Tu's discovery of the drug, a drug called Chloroquine was used to treat the disease. Overuse of Chloroquine caused plasmodium parasites to evolve, growing pumps that extracted the drug from their bodies.

Artemisinin-resistant parasite strains have emerged in Southeast Asia in the last two years. With the use of artemisinin-based therapies on the rise, it's only a matter of time before the resistant strains spread globally, rendering the treatment ineffective.

"The platform we developed means we can stay ahead of the parasite because it will keep adapting," said Vekilov.

The researchers see their biomimetic platform for studying hematin crystallization as a new beginning in the accelerated development of antimalarial drugs.

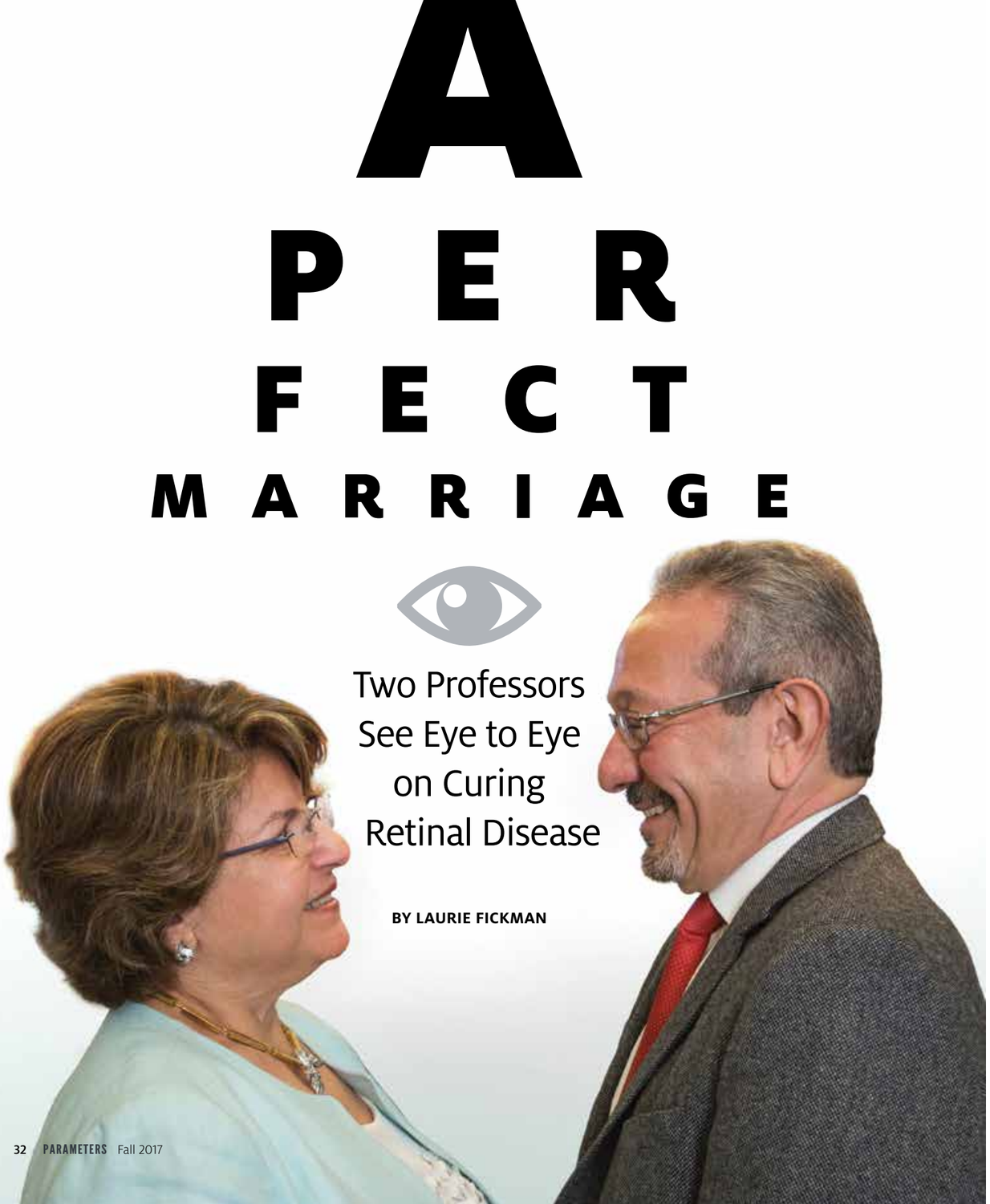
"It's really an enabling tool," Rimer said. "Our hope is that we can help guide pharmaceutical companies in selecting molecules that would have the highest probability of success in treating the disease by inhibiting crystal formation."

> ***"Our hope is that we can help guide pharmaceutical companies in selecting molecules that would have the highest probability of success in treating the disease."***
>
> - JEFFREY RIMER

A PERFECT MARRIAGE

Two Professors See Eye to Eye on Curing Retinal Disease

BY LAURIE FICKMAN



Two Cullen College biomedical engineering professors, **Muna Naash,** John S. Dunn Endowed Professor, and **Muayyad Al-Ubaidi,** see eye-to-eye on just about everything. Both are working to eradicate eye disease, both discovered Retbindin, a retina-specific protein, and together they have now received $1.1 million from the National Institutes of Health to explore the role of Retbindin in diseases.

But wait, there's more. The pair of professors, hired at UH in 2015, has been married for over 40 years. They discovered each other the same way they discovered Retbindin. They weren't looking, but there it was.

First, the story of science. Then the tale of chemistry.

Muayyad Al-Ubaidi, left, beams at his wife, Muna Naash, as they work in the lab

Discovering Retbindin

"It was what you might call serendipity," says Naash, who was leading a research group in 2014, investigating other retina-specific proteins when they identified this new Retbindin, or Rtbdn for short.

Although the gene was known, no one had ever studied the protein, which is retina specific.

The couple began working on identifying its exact locations in the body, making antibodies to help pinpoint its whereabouts, eventually finding it only occurs in the retina at the interface between photoreceptors and retinal pigment epithelium (RPE) microvilli, a region critical for retinal function and stability.

A closer look

The pair conducted further work and proved that Rtbdn may be vital for keeping eyes healthy.

"We know that the amount of Rtbdn is changed as the retina becomes sick," said Al-Ubaidi. "We also know that this protein is involved in the energy production in the retina and, of course, energy is the only way to keep tissue healthy and alive."

Rtbdn is capable of binding with retinal flavins, a critical metabolic factor in keeping the retina healthy. Flavins are derived from riboflavin, a member of the vitamin B family. Rtbdn is also a potential carrier of flavins between the retina and the RPE.

In the retina, the levels of flavins are several folds higher than in blood. In fact, riboflavin deficiency results in photosensitivity and degeneration. But unbound flavins are toxic, so, in practice, flavins are virtually always bound to flavin-binding proteins.

"The study on flavins in the eyes has been forgotten since the 1940s and '50s," said Naash.

Not anymore.

With the NIH funding, the pair will test the role Rtbdn plays in the development and progression of retinal degenerative diseases such as retinitis pigmentosa, which often leads to blindness. If, in fact, Rtbdn turns out to be beneficial, they could eventually provide it to a diseased retina as a cure.

In science, cures and breakthroughs like that often come in small steps. According to Al-Ubaidi, "We're at the top of the first floor of a 20-story building."

Love at first sight

Pace is often faster in the world of chemistry. For Naash, it was over the first time she saw Al-Ubaidi on the very first day of college at the University of Baghdad where they were both freshmen, majoring in biochemistry.

"I really noticed him the very first day because he was fluent in English, because he did all his high school studies in an American high school," she said. "I was so impressed." Naash said she shocked herself when she realized that she was immediately thinking, "That's my man!"

She says it took him a couple more days to notice her when she began to speak up in class. "She was not passive or afraid and that was my idea of how women should be – that they should be equal to men," he said.

Four decades, one son, two grandchildren, countless hours of work and major scientific discoveries later, their collaboration remains strong.

No wonder they study vision. They've had a very clear one since the day they met.

Mini-Robots Marching Through Your Veins Could Offer

TARGETED TREATMENT

BY JEANNIE KEVER

Invasive surgical techniques – cutting through the breastbone for open heart surgery or making a large incision to inspect an abdominal tumor – allow physicians to effectively treat disease but can lead to sometimes serious complications and dramatically slow healing for the patient.

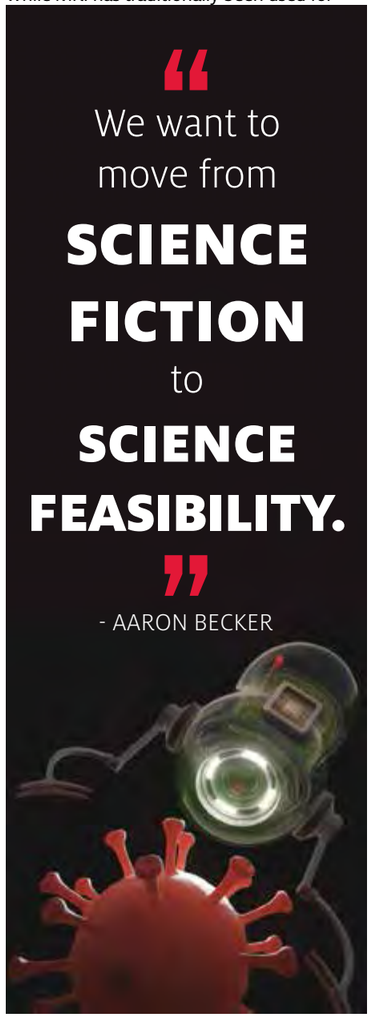
Scientists instead want to deploy dozens or even thousands of tiny robots to travel the body's venous system as they deliver drugs or a self-assembled interventional tool. Researchers from the University of Houston and Houston Methodist Hospital are developing control algorithms, imaging technology, ultrafast computational methods and human-machine immersion methods to harness the force from a magnetic resonance imaging (MRI) scanner to both image and steer millimeter-sized robots through the body.

"We want to move from science fiction to science feasibility," said **Aaron Becker,** assistant professor of electrical and computer engineering at the UH Cullen College and principal investigator for a $608,000 Synergy Award from the National Science Foundation (NSF) to develop prototypes for testing.

To tackle this unprecedented challenge, the award involves two additional investigators: Nikolaos Tsekos, associate professor of computer science and director of the Medical Robotics Laboratory at UH, who has expertise in MRI and computational methods, and Dipan J. Shah, a cardiologist and director of cardiovascular MRI at Houston Methodist Hospital, who brings expertise in clinical MRI and focusing the efforts to find solutions that are clinically necessary and valuable.

While MRI has traditionally been used for noninvasive diagnosis, the next frontier is its use as a tool to offer noninvasive or minimally invasive treatment.

> "We want to move from **SCIENCE FICTION** to **SCIENCE FEASIBILITY.**"
>
> - AARON BECKER



The milli-robot development and control work is an outgrowth of Becker's previous research, which was funded in part with an NSF CAREER award and demonstrated the theory behind the proposal. This grant, awarded through NSF's Cyber-Physical Systems (CPS) program, will fund work to build a prototype suitable for animal testing. The MRI control and computational methods follow a previous CPS award in image-guided robotic surgeries led by Tsekos and Shah.

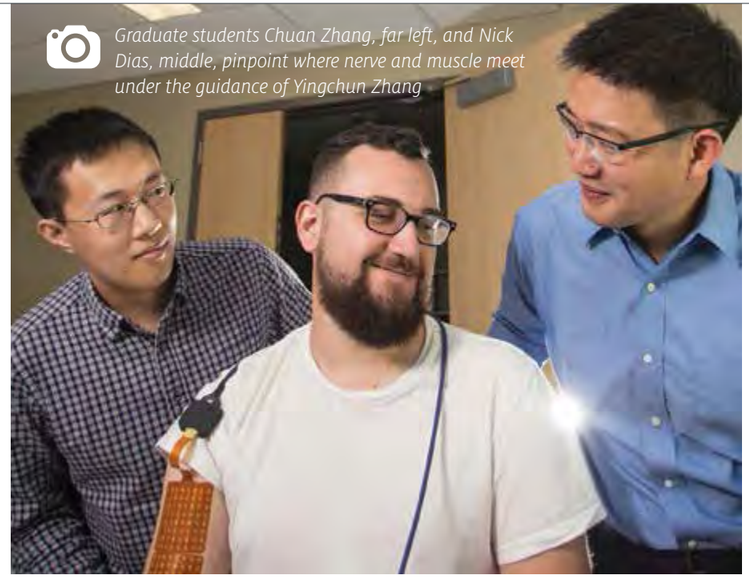
Their current models are up to 2 centimeters; Becker said the goal is robots that range from 0.5 millimeters to 2 millimeters. The average human hair, in comparison, is about 0.08 millimeters wide.

MRI provides enough magnetic force to steer the robots through the body's blood vessels but can't penetrate tumors or other tissue. This project is working with two designs, both powered by the MRI scanner, to address that problem, one based on the principle of mechanical resonance and the second modeled after a self-assembling surgical tool, a Gauss gun.

A key issue is real-time control, Becker said, noting that blood vessels move around in the body, making it crucial to be able to see both the anatomy and the robot as it moves in order to keep it moving correctly. Even the fastest current MRI scans are too slow for such control and have a time lag before the information is available. Developing such a system is a multidisciplinary task that must seamlessly integrate sensing with the MRI scanner, milli-robot control and close the loop by controlling the scanner to drive the milli-robots.

Ultimately, Becker said, the goal is to use the power of an MRI to steer large numbers of robots throughout the body. While one milli-robot could target a single lesion, delivering chemotherapy or another intervention, that isn't practical for a late-stage cancer, for example.

"Targeting delivery with dozens of microsurgeons is my goal," he said. In this case, those "microsurgeons" would be robots, guided by a physician.



Graduate students Chuan Zhang, far left, and Nick Dias, middle, pinpoint where nerve and muscle meet under the guidance of Yingchun Zhang

Treating Stroke Patients at the Intersection of

NERVE & MUSCLE

BY LAURIE FICKMAN

A UH biomedical engineer is zeroing in on the gap where nerve meets muscle to bring more precise treatment to stroke patients. The National Institutes of Health (NIH) awarded more than $434,000 to Assistant Professor **Yingchun Zhang** to delve deep into the neuromuscular junction, the connector of the nerve and muscle fiber, to calculate the exact spot to deliver the dose of motion-restoring Botox.

Yes, you read that right: Botox, or Botulinum neurotoxin (BTX), is not just for wrinkles.

The protocol

Botox has long been considered the first-line treatment to reduce spasms in post-stroke survivors, 20-40 percent of whom will suffer continual and crippling muscle spasticity that render them motionless. As a brain disorder, a stroke can cause the brain to send irregular high-frequency signals – through the nerves – to muscles, causing them to keep seizing.

A small gap exists at the neuromuscular junction where "the nerve talks to the muscle," according to Zhang, by releasing a nano-sized particle called a neuro transmitter. It is inside this gap that Botox must be injected to block the neuro transmitter.

There's just one problem: No one has ever been able to pinpoint the exact spot of the neuromuscular junction and to confound matters, it varies from patient to patient. To make sure the spot is covered, physicians may use a greater amount of Botox, probably more than necessary – and because Botox has to be repeated every few months, the success rate is not stable.

"Sometimes, even for the same patient with the same physician and same injection protocol – one time it works well, the next time it doesn't," said Zhang. He believes he can stabilize the results and reduce the cost of treatment by mapping where the nerve and muscle meet.

Making the map

"We can have an individual map for each patient receiving the injection," said Zhang. "We can have a 3D map of the gap so the physician will know exactly where the Botox should go. They won't have to guess or increase the dose." His 3D model should also be able to reduce the cost of the pricey injections by reducing the necessary dose by about 50 percent.

Zhang's noninvasive approach uses high-density electrodes placed on the surface of the skin. When muscles contract, an electrical discharge is created and he tracks the discharges to the middle point, which is the neuromuscular junction.

"The beauty of this proposal is that we can now go deep into the 3D space of the muscle fiber by using electrical source imaging," said Zhang.

Bridging the gap

Zhang's partner in the grant is TIRR Memorial Hermann, widely known as one of the best rehabilitation hospitals in the country.

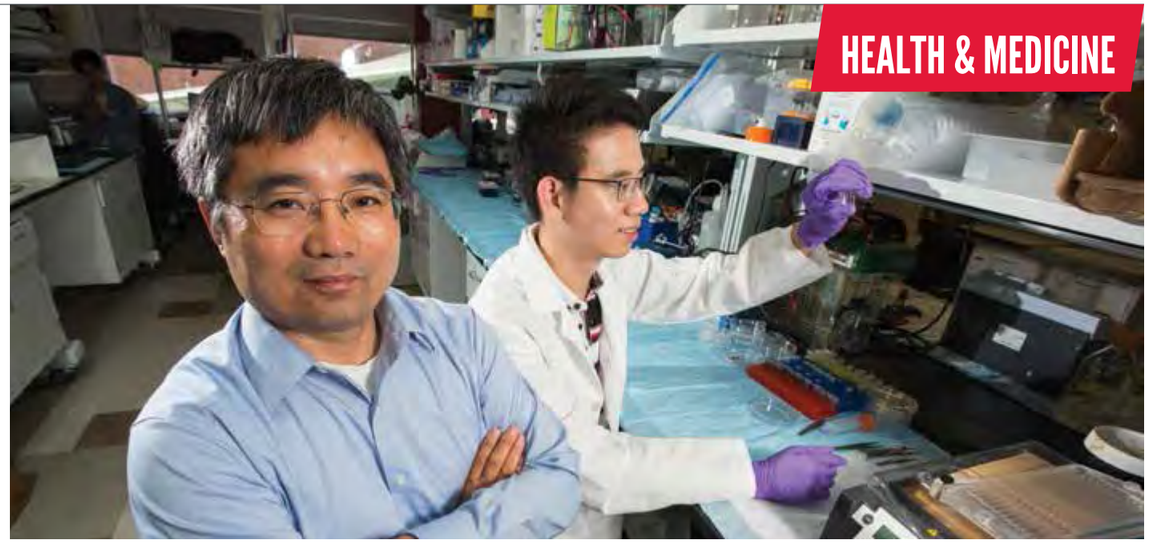
"We'll have two groups of patients," said Zhang. "One will follow the standard approach for the injections and one will use our approach. I think we're going to beat that group," he adds excitedly. The victory will come in reducing the costs and side effects while improving the outcome. Zhang's also excited to see his lab work have a direct and positive effect on people.

The study will continue for two years.

FINDING DISEASE AND TOXINS EARLY:

Tianfu Wu's Laboratory Creates Ultra-Sensitive Detection Tool

BY LAURIE FICKMAN



Tianfu Wu used to dream of the day when cancer could be detected long before it was diagnosed. Now he sees that day dawning because of a system his research group created called the ultra-sensitive polymeric sensing system (UPSS), which may detect biomarkers early – well before an illness strikes.

Wu, assistant professor of biomedical engineering, recalls a handful of years ago when he would chat with a colleague now and again on a train as they commuted to work. "She was in great condition, very active," said Wu.

"And then one day, within a couple of months, as if out of nowhere, I received an email that her funeral was being planned and she had died of pancreatic cancer. It seemed that quick."

The experience cemented his goal. "We want something for early biomarker detection, an ultra-sensitive biosensor," said Wu.

And now he has it.

You can read about the UPSS, composed of gold nanoparticle (gNP)-decorated polymer, in *Advanced Materials* (with a current impact factor of 19.791), which published the article about Wu's experiments with the UPSS. One of Wu's Ph.D students, Zuan-Tao Lin, is the leading author of "A nanoparticle-decorated biomolecule-responsive polymer enables robust signaling cascade for biosensing."

Multi-purpose tool

Wu's device can also detect the level of toxins in environmental samples.

"The early detection of pathogens, biomarkers or toxins in clinical or environmental samples is a great challenge, especially at ultra-low concentrations," said Wu.

Conventional technologies using chain reactions or mass spectrometry are tedious and time consuming so there is an increasing demand to develop the rapid-sensing strategy. "We are developing an ultra-sensitive device to detect biomolecules that could be biomarkers for disease or could be environmental toxins in fresh water," said Wu.

Using the UPSS Wu and his students tested Anatoxin-a, which can be secreted into water by blue-green algae.

It's small and usually the concentration is low in water, only trace amounts exist. But don't let that innocuous description fool you. Anatoxin-a is also known as "Very Fast Death Factor" (VFDF).

"It can have a very bad cumulative effect," said Wu. "Anatoxin-a has acute neurotoxicity, so even in trace amounts it is bad. If we can detect it we can alert people to be careful of this water source."

The tool

Wu created a signal amplification system for the UPSS to allow robust and accurate biomolecular recognition.

"The importance of this technology is that we designed and fabricated a sensor that is sensitive enough to detect biomolecules," said Wu. Indeed it detected the Anatoxin-a in a sample. It also detected thrombin (an enzyme which creates thrombosis) in another sample.

When a cyanotoxin or thrombin is present in a sample, it could bind to the specific molecular recognition core in the UPSS. That's how you know this new specific object does not belong and is potentially dangerous. "It will also cause the polymer to shrink, or make a morphology change," said Wu. Only in a diseased or affected specimen will this reaction take place.

Always the visionary, Wu thinks about this proof of concept and imagines the day when the UPSS will be included in regular medical exams.

"Even if you wanted to take a test today, no such test exists," he said. "We want to develop this test and include it in the regular medical check-up or visit. It's all about early detection."

Hadi Ghasemi

Wins Top

NASA PRIZE

for Frog-Inspired Surface

BY LAURIE FICKMAN

Of the almost 5,000 species of frogs around the world, one of them hops immediately to Hadi Ghasemi's attention.

You might wonder why the Bill D. Cook Assistant Professor of mechanical engineering has amphibians on his mind when he is so clearly a man versed in mechanics.

For Ghasemi, who is freezing out the competition in the field of anti-icing surfaces and has created better than state-of-the-art materials to repel ice, the link is this: Wood frogs are part of a small group of animals that can freeze, but not die. The species can tolerate freezing of 65 percent of their total body water and still survive in the winter.

So Ghasemi thought if frogs can do it, then he can, too.

He studied the frogs and built a new anti-icing material than can withstand critically low temperatures. His newly created adaptive surface works like a pair of glasses that change to sunglasses when you walk outdoors. In this case, Ghasemi's material performs normally at ambient temperatures, but when exposed to extreme cold, it becomes an anti-icing surface.

For this innovative idea, Ghasemi has been chosen as one of three winners of the NASA iTech initiative, an effort to "find innovative ideas that address challenges that will fill gaps in critical areas identified by NASA as having a potential impact on future space exploration," according to NASA.

Ghasemi's anti-freezing surface was chosen among entries from more than 130 organizations across the U.S. for its potential to broadly impact human life on earth and the future of space travel. "We think the idea of these anti-icing surfaces selected by NASA can be revolutionary for the aerospace industry," said Ghasemi. "We are delighted we can make contributions to future NASA missions."

Research jumping off the page

Ghasemi says a vast domain of knowledge has been overlooked and is hidden inside of living species.

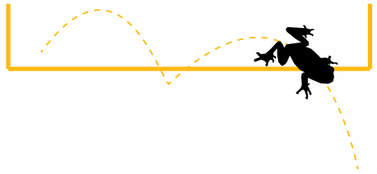
"We got the idea of these surfaces through nature. It is bio-inspired," said Ghasemi. "The wood frogs can tolerate the freezing of their blood and tissues while being alive. When we looked closely at the cell biology of these frogs we observed that the ice formation was restricted to the surface of their cells."

That means they protect themselves from freezing.

So he decided to use this knowledge of wood frogs to develop the new material that can have the same adaptive properties.

Developing a product based on animals is not as odd as it may seem. Ghasemi points to an adhesive material developed at UMass Amherst based on the mechanics of gecko feet, which was named one of the top five science breakthroughs of 2012 by *CNN Money*. In theory, if you applied GeckSkin to your hands you might be able to wall crawl like Spiderman. Or a gecko.

> "We think we can develop new surfaces for the next generation of aircraft and any infrastructure that is going to stand at really low temperatures subject to freezing."
>
> - HADI GHASEMI



But this is the first time someone has based a low-temperature material on a frog.

"We think we can develop new surfaces for the next generation of aircraft and any infrastructure that is going to stand at really low temperatures subject to freezing," said Ghasemi.

Only from the mind of Ghasemi can cold-blooded creatures warm up outer space.

Hadi Ghasemi Creates New Material,

BREAKS LIMITS

of Leidenfrost Phenomenon

BY LAURIE FICKMAN

UH engineer **Hadi Ghasemi,** Bill D. Cook Assistant Professor of mechanical engineering, is set to change history with his invention of a new material that provides efficient heat dissipation at high temperatures and eliminates a 250-year-old scientific event known as the Leidenfrost Phenomenon.

If you've ever cooked a meal on your stove, you're probably familiar with the phenomenon, though you may not realize it. It occurs when you sprinkle a few drops of water into a hot skillet to make sure it's heated to your satisfaction. In those precious moments when the little droplets dance around – rather than boil – you are witnessing the Leidenfrost Phenomenon, in which a vapor barrier is created when liquid touches a hot surface, and that barrier prevents the drops from boiling on impact.

Hadi Ghasemi is breaking records and pushing boundaries in the invention of new materials

Scientist Johann Leidenfrost recognized the dynamic in 1756. Since then, scientists have been trying to prevent it, because its impact extends far beyond the kitchen. Think re-entry of a spacecraft or the Fukushima Daiichi nuclear disaster, during which inadequate cooling led to three nuclear meltdowns.

"When you have a hot surface and you're going to cool it down with a liquid, you need contact of the liquid with the surface," said Ghasemi. "Otherwise the vapor becomes an insulating layer and it blocks the heat transfer."

Now, a scientist – among the hundreds around the world working to eliminate the vapor barrier – has succeeded, effectively working around the problem. That scientist is Ghasemi.

The heat is on

"We have developed a new approach to completely eliminate this phenomenon," said Ghasemi. His approach is the invention of a new metal surface called a "decoupled hierarchical structure" that removes the vapor barrier. His work has been published in the American Chemical Society's journal *Langmuir*.

The new structure is made of two layers: a micro-pillar surface with a nano membrane on top. The nano membrane keeps the droplet in contact with the surface while the micro-pillars take away the generated vapor. The new material allows unprecedented heat dissipation because there is direct contact with the liquid to the surface.

Ghasemi created the new surface in his Nano Therm Lab and currently has a patent pending on the product. Lab members Nazanin Farokhnia, Seyed Mohammad Sajadi and Peyman Irajizad contributed to the research project. Ghasemi is already onto phase two of the material, to be made of copper in order to lower the cost.

> "We envision these surfaces opening a new avenue in thermal management through spray cooling."
>
> - HADI GHASEMI

Compared to today's technology, no other surfaces come close to Ghasemi's new one, which removes the bottleneck for the heat transfer process.

"With current surfaces, the maximum temperature reported is 400 degrees Celsius when the Leidenfrost effect occurs. But in our surface we couldn't find any Leidenfrost, even at 600 degrees Celsius, and we believe we can go to much higher temperatures with no Leidenfrost effect," said Ghasemi. "It is unprecedented heat dissipation."

Infinity and beyond

Imagine one day when heat shields are made out of Ghasemi's material, or power generators and chemical reactors. He does, as he researches the widespread applications of the material.

"We envision these surfaces opening a new avenue in thermal management through spray cooling," he said.

Bionka Edmundson and Jameel Jordan

CULLEN COLLEGE *in the Community*

Engineering Students Become Teachers

BY LAURIE FICKMAN

When Jameel Jordan became a petroleum engineering student at the Cullen College he never dreamed he'd also become a mentor to elementary school students.

"It never crossed my mind," said Jordan.

But the opportunity found him when he learned of iEducate, a group that pays you to share your knowledge of STEM courses (science, technology, engineering and mathematics) with students in Houston's underserved communities.

It seemed a good fit. Turns out it was perfect.

As a member of the UH Chapter of the National Society of Black Engineers (NSBE), Jordan takes seriously the group's mission to breed culturally responsible black engineers by impacting the community. That's why you'll find him, two days a week, just a stone's throw from the University of Houston at Blackshear Elementary in Houston's Third Ward where he tutors third graders.

But the beauty of the program doesn't just come from the coursework the tutors teach – it also shows up in the life lessons they impart.

"I grew up in this community, from this neighborhood, and that's such a big part of this. These kids see someone like me, who looks like them, who they can relate to, who is getting an education at UH and people in their lives might not be doing that," said Jordan.

Scan the demographics of Blackshear Elementary and you'll see why the UH/iEducate partnership is such a perfect fit. Blackshear is a Title I campus where 100 percent of the 536 students qualify for the free or reduced lunch program. Title I schools, with high numbers of poor children, receive financial assistance through state educational agencies to help ensure that all children meet challenging state academic content and student academic achievement standards.

"These students just don't hear the word 'engineering' at home. They don't have the certain type of mentors that students at UH can provide," said Jordan.

The kind of mentors that the new principal of Blackshear, Alicia Lewis, can't praise enough when she talks about the impact on her students, who she calls "scholars."

"This program and the UH students provide the mentorship, the relationship and the consistency that some of our scholars don't have in their home life and we're giving them that," said Lewis. "We're giving them someone who will help them no matter where they are academically or what level they are on."

It's quite the gift. Lewis credits a new teacher along with iEducate and the tutors with a rise in test scores.

"We've seen a great difference with our science proficiency," Lewis said. When she arrived, only 27 percent of students passed the standardized science exams. Last year 46 percent passed.

Lewis herself plays a large role in the school's increasing success. She is part cheerleader, part force of nature, determined to push her school forward. After three principals in two years, the school scored Lewis, who committed to a five-year term and already says, excitedly, she wants more. As a former math specialist, she has goals for STEM courses at Blackshear.

"We're ashamed to say 'I can't read,' but we're not ashamed to say, 'I have a problem with math or science,' so we have to teach our scholars that math is as important as reading." iEducate and UH students are

making that happen.

Truth in numbers

Blackshear Elementary isn't the only school to boast an increase in proficiency because of Cullen College tutors connected to the iEducate program.

In 2013 Roopa Gir, a former physicist at Schlumberger, formed iEducate after tutoring with an alumni group. She found that her peer tutors weren't connecting with students as she hoped and decided to try college students in the classroom to see if they could better relate.

They entered their first school, Crockett Elementary, where 67 percent of fifth graders had passed the STAAR math exam (the state's standardized assessment). Quickly the scores began to rise. Last summer, all students – 100 percent – passed the test. You don't have to be a math whiz to understand those numbers.

"Most of these kids have no idea what engineering is or what they can do with math or science," said Gir's son, Arun Gir, who now runs iEducate. Passionate about lowering the student-teacher ratio significantly with the addition of tutors, Gir is equally excited about the collaboration with UH. Two-thirds of the 120 tutors come from UH and half of those are from the Cullen College.

"We don't ask just anyone to be a tutor," said Gir. "Our average tutor has a 3.5 GPA. We really want to offer this opportunity to students who are excelling in their STEM field."

The screening process for becoming an iEducate tutor is rigorous, but the rewards are greater.

Jordan talks about the amazement of building a relationship with a troubled student who is craving a male presence in his life and is beginning to turn a corner emotionally and academically. Plus, the experience has exposed Jordan to professionals who offered him an externship at Schlumberger. That's one of those cases you might call a win-win.

Back at Blackshear

Bionka Edmundson is a child prodigy. She is a first-generation college student, senior in petroleum engineering at the Cullen College and an iEducate tutor. She graduated high school at 16 and could have done it younger, but her mom said she was too young. While her mother knew continuing education was going to be vital for Edmundson, she wasn't sure how best to steer her. So Edmundson attended a couple of different schools before settling down at UH.

"I didn't have any real academic guidance, and I was just stumbling along until I decided to come to UH," said Edmundson.

It's that path that helps her guide others. "I love iEducate. They're taking kids and trying to give them a shot and, honestly, that's why I work so hard to give little kids who look like me, with the same story I had – no dad, single mom, food stamps – a better chance," said Edmundson.

Above: Cullen College students and iEducate tutors Jameel Jordan and Bionka Edmundson at work at Blackshear Elementary
Bottom left: In Houston's Third Ward, the proud UH/iEducate crew are (l-r) Arun Gir, Bionka Edmundson, Jameel Jordan and Blackshear Principal Alicia Lewis

She's now providing the kind of guidance she craved. While the youngsters study in class, she also studies on her computer for upcoming engineering classes. Surprisingly, the kids are more interested in what she has on her screen.

"They see my derivatives and formulas on my screen and the fact I'm doing something so foreign to them, they are so interested," said Edmundson. "The fact that I'm just here and they actually know engineering exists, it's like the Native Americans who never saw the boat coming because they didn't know what a boat was. Now these kids know what's out there," she says in a familiar refrain about the power of exposing children to the STEM fields.

For Edmundson, Schlumberger Midland is out there, where she began a position as a field completion engineer after iEducate's summer enrichment camp was completed in June.

ROBOTS TAKE OVER

UH Charter School

BY LAURIE FICKMAN

Aaron Becker isn't just playing with robots, he's teaching UH Engineering students and elementary students

Photos by Jose Cruz

OUTREACH

> *I believe the best way for students to learn is for them to teach.*
>
> - AARON BECKER

When **Aaron Becker,** assistant professor of electrical and computer engineering at the Cullen College, took seven engineering students to the UH Charter elementary school to play with robots, he wasn't just opening young minds – he was upholding the charter school's vision to help students fulfill their potential through

wonder and ***discovery.***

His college students came into the fourth grade class carrying robotic arms they had built in Becker's lab and little building blocks to show the youngsters how the robotic arm can pick up pieces. Each UH student had 3-4 youngsters in their small group, so each got plenty of chances to control the robotic arm.

"I believe the best way for students to learn is for them to teach," said Becker, who regularly takes his engineering students to the UH Charter School to show elementary students that science and engineering can be great fun.

His methods work, according to fourth grade teacher Gail Paul. "I see high-fives going around the room, so I know it's working," said Paul "It's a totally beneficial and hands-on experience, which is highly engaging and motivates them to want to learn to do more."

Proof positive of what Paul says: Fourth grader Paula screams out, "Can you please come back?!" as the Becker group is leaving.

EYES IN THE SKY:

Engineering the Future of Drones

BY LAURIE FICKMAN

In **Gino Lim's** estimation, drones will soon take over the sky, delivering medical kits and medicines to rural patients, relaying sensitive military information to troops and, yes, one day picking him up at his Pearland home and delivering him to his office at UH. In fact, the future as he sees it is something he could drone on about for hours.

"We're just at the infant stage with drones right now," said Professor Lim, chair of the Cullen College's department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow. "Imagine 15 years ago where iPhones were and now everyone uses them. I'll tell you right now, drones will be like that in no more than 15 years from today."

He touched on the relevance of drones in medicine with his Ph.D. student Seon Jin Kim in their article called "Drone-aided healthcare services for patients with chronic diseases in rural areas," published in the *Journal of Intelligent & Robotic Systems*.

Houston work will impact South Korean military

Kim's official title is Major Kim, engineer in the South Korean army. He's on a four-year leave of absence to work under Lim's tutelage.

"Here at UH, Dr. Lim is my commander," laughs Kim, and then quickly corrects himself: "No, he's my general!" Kim expects to take the lessons learned with Lim back to South Korea for practical use in the military. They've published another paper called "Drone relay stations for supporting wireless communication in military operations."

Lim initiated the concept of applying drones to real-world problems.

"We provided a template for drone routes to help healthcare services, especially targeting chronic patients in rural areas," said Kim. Their template includes the locations and number of healthcare centers in specific areas and determines the optimal number of drones needed in each center.

Because chronic patients need recurring treatment and rural patients live far from treatment centers, they propose that drones will close the healthcare disparity among those groups.

Lim says that older patients who live far from doctors or hospitals can actually put more lives at risk.

Major Seon Jin Kim, left, and Gino Lim are using drones to solve real-world problems

"They need medical attention and if they are forced to drive, they and others could be in jeopardy," said Lim. "When drones can deliver the necessary medicine or testing kits and be sent back, unnecessary traffic will be reduced."

If it sounds like a brave new world, that's because it is. And Lim is helping usher it in, setting up the mathematical models to better utilize drones for everything we do.

It's the future

Lim's drone work spans the highly imaginative to the minutely specific. "The mathematical models we are setting up will allow us to better utilize the drones and map drone routes across all applications. In Houston, for example, we could utilize drones to find out where flooding is happening in real time or where power needs to be restored," he said.

Lim says in military operations drones are better communication systems than satellites.

"Satellites are wonderful things, but there are delays," said Lim. "With drones, you get real-time information because they are so close to the ground and you control them 100 percent." Lim posits that drones, because they fly so low, can see real enemies or equipment on the ground and communicate those finds in real time, like a live television signal. Ultimately, Lim says, if the drone gets shot down, it's just the cost of doing military business. And that cost is greatly reduced.

"Imagine satellites and their cost – millions of dollars," said Lim. "A drone might be $500."

Science ascending

In Dubai they're testing drones you can ride on. Lim would love to take that ride, if even as a carpool to work. But mainly he wants to continue on the frontier of drone advancement.

"I know that drones have a great future, there's no doubt about it," he repeats emphatically. "I want to stay in the mainstream in improving the efficiency of drones, including extending battery life and improving their reliability."

Lim begins just about every other sentence with the word "imagine:"

"Imagine 15 years from now..."

"Imagine driverless cars as a concept years ago..."

Lim's vivid imagination combined with engineering prowess will create the kind of drone efficiencies that will aviate and soar for decades to come.

THE FUTURE OF DRONES

Lots of Things in the 'INTERNET OF THINGS' Need to Speed Up

BY ASHLEY SCHWARTZ

The National Science Foundation has awarded Cullen College's **Miao Pan,** assistant professor of electrical and computer engineering, and **Zhu Han,** professor of electrical and computer engineering, $300,000 to speed up the way your electronic ID badge communicates through the Internet of Things (IoT).

As life-changing events occurred over the last couple decades, the order seems simple. First came the internet. Then there were smart devices and then – linking them together – was the Internet of Things. Take for example the temperature in your home. Perhaps it's a hot Houston day and you're toiling from your desk at the University of Houston. As the clock slips closer to the end of the day, you decide you'd like your home cooled off before you walk through the door. So you grab your smart phone, open the app that accesses your smart thermostat and remotely program it for coolness.

How many ways are you connected?

You have not only set yourself up for a night of comfort, you've stepped through the magic Internet of Things to do so. Its name is pretty spot on: It's the internet connected to your things and it doesn't need human-to-human interaction, nor do your things need to be as grandiose as a thermostat and smart phone. They can be as simple are your card key. According to Gartner, Inc., a technology research and advisory corporation, there will be nearly 20.8 billion devices on the Internet of Things by 2020.

Through this grant, Han and Pan will zero in on enhancing connectivity and communication of ultra-low power applications.

They will be working alongside colleagues Riku Jantti, Kalle Ruttik and Ruifeng Duan of Aalto University in Espoo, Finland and Jukka Lempiainen of Tempere University of Technology in Tampere, Finland.

"The Internet of Things needs to incorporate almost everything, including simple sensors and devices," said Pan. "We often find ourselves at a paradox between needing high transmission speeds using simple, low-power devices while guaranteeing the sent messages are secure."

The project will specifically investigate ID card technology and how signals transferring to and from these simple cards can be transmitted more efficiently.

"The ID cards make everything more complex because there are a large number of cards communicating on the same network. We need to consider how we will be able to decipher between individual cards and if we want each one to access different things," said Pan.

The researchers hope to enhance IoT applications by creating new communication systems to pair with the ultra-low power devices, and then uncover the challenges of the signals, performance and security.

"Our team at UH will be developing and analyzing the new communications networks to find the best and most efficient design, while our colleagues in Finland will test if our designs will work in the marketplace," said Han.

This international project will also serve as a unique opportunity for UH engineering students to gain knowledge and develop their research skills abroad.

"We are excited about the prospect of our students participating to have the chance to learn from such accomplished researchers from other parts of the world," said Pan.

Miao Pan, left, and Zhu Han are cramming more efficiency into the Internet of Things

Theocharis Baxevanis is taking the "boom" out of sonic booms

Transforming

SUPERSONIC AIRCRAFT

for Commercial Use

BY AUDREY GRAYSON

Supersonic aircraft travel faster than the speed of sound, but these planes aren't likely candidates for commercial use because of their supersonic noise. Mechanical engineering Professor **Theocharis Baxevanis** is working with researchers from Texas A&M University and Boeing Research & Technology (BR&T) to take the sonic booms out of supersonic flight.

NASA selected the team for a five-year, $10 million grant as part of the NASA Aeronautics' University Leadership Initiative (ULI). The researchers aim to design a commercially-viable supersonic aircraft that can change shape during flight to meet noise and efficiency requirements for overland flight.

READ THE FULL STORY AT
engineering.tamu.edu/news/2017/06/27/researchers-working-to-create-a-quieter-transforming-supersonic-aircraft-for-commercial-use

This is an artist's concept of a possible Low Boom Flight Demonstration Quiet Supersonic Transport (QueSST) X-plane design. The award of a preliminary design contract is the first step towards the possible return of supersonic passenger travel – but this time quieter and more affordable. Credits: Lockheed Martin

The HOUSTON Dream

BY LAURIE FICKMAN

Every student at the Cullen College has a unique path that led them here.

My kids won't have the issue of me not having a college degree and not being an engineer.

ACHIEVE

PLAN

STUDY

COMMUNITY

I want to prove the people who believe in me right.

INTERNSHIP

FAMILY

My daughter is the reason I push myself so hard.

SUCCESS

In the following stories you'll read about three first-generation college students from vastly different worlds, yet all sharing the same dream of becoming world-class engineers.

Their needs might have been different when they entered school, but the resources were plentiful and each found a group or means to lead the way.

These are the stories of the UH engineers living the HOUSTON dream.

A Prodigy Finds His

PROMES

(Pronounced "Promise")

At the age of 13 **Nicolas Xiong** was the first in his family to attend a major university.

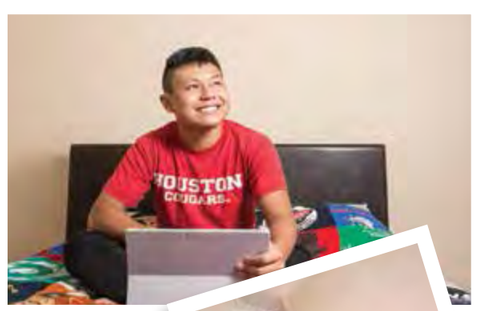
You read that correctly, he was 13.

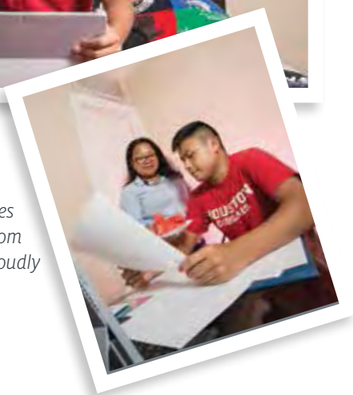
During his first year at the Cullen College, Xiong also earned an associate's degree in mechanical engineering (ME) at a community college. When he graduates from the University of Houston in December with a degree in ME, he will be 17, and likely employed at Williams Companies, one of the largest energy firms in North America, where he has interned for the past two years.

An amazing path for most people, it seemed so natural for Xiong, a prodigy, who read his first books, "The Chronicles of Narnia," at age 3, and who, by age 11, was president of a high school robotics club (after three years of membership). Your math is correct. He was participating in high school classes at the age of 8.

Xiong's road may have been short, but it hasn't always been smooth. At 13 his first year at the Cullen College was, admittedly, an eye opener. That's when, for the first time, he made a D, the first time he had ever even scored below 90 on a test. (Spoiler alert: he would later retake the course and make an A.)

But as a young freshman he was having a conflict of character, he said, and he leaned – hard – on the Program for Mastery in Engineering Studies (PROMES), one of the many first-year resources for student success offered by the Cullen College.





Nicolas Xiong studies hard in his dorm room while his mother proudly looks on

Student success is number one

If you review Dean Joseph Tedesco's Strategic Plan for 2014-2020, you will find the phrase "student success" after only a handful of other words under the heading "Strategic Goals." He is motivated by the reality that the better students do in their first-year core classes, the higher the chances they will graduate with engineering degrees.

"Creating opportunities for our students to become successful and nurturing their success along the way is critical to the long-term outlook for our students, the Cullen College and the engineering ranks at-large," said Dean Tedesco. "Before we launch the next generation of great engineers, we foster their ability to learn and belong in our engineering community. These are lifelong skills they will take with them."

In fact, when Dean Tedesco noted that students participating in PROMES have higher GPAs and higher graduation rates, he expanded the program.

PROMES

PROMES seems a fitting name for this acronym and homophone of promise. Its own promise is to help students grasp tough engineering concepts and study skills early. It's one of the most enduring academic programs, having formed in the early 1970s to help underrepresented minority students succeed and thrive in the engineering programs.

PROMES offers a specialized curricula that emphasizes academic success strategies and personal and professional skills development with special PROMES sections of some standard courses and intense focus on study skills, time management and other "best practices" for first-year engineering students.

Those were the kind of tools Xiong dearly needed.

"I used the studying habits taught in the PROMES classes extensively in my sophomore year to get myself back on track," said Xiong, who eventually became a PROMES workshop facilitator.

Now he's the one creating worksheets and leading sessions to develop and reinforce knowledge in students. Sweet victory this, working as facilitator for two semesters in the one class in which he stumbled, statics.

> *If it wasn't for PROMES, I don't know what I would have done. PROMES stepped in, saw I was having trouble with class and adapting to college and they really picked me up.*
>
> - NICOLAS XIONG

As for helping the young Xiong fit in, a former head of PROMES knew just what to do.

"When I was struggling they invited me to become an officer of the PAC, the PROMES Action Committee," said Xiong. It was a position that would require Xiong to interact with other freshmen to plan events and activities. He would go on to be president of the PAC for two years.

"If it wasn't for PROMES, I don't know what I would have done," said Xiong. "PROMES stepped in, saw I was having trouble with class and adapting to college and they really picked me up," he adds with pride. Now he considers the PROMES members as close as family.

ABOUT PROMES

A service of the UH Cullen College of Engineering, PROMES provides academic advising, workshops, scholarships and professional and personal development opportunities for engineering students. It is highly recommended for students who want to:

- Be the best engineering student they can be and are willing to adopt effective new ways to study
- Learn how to collaboratively work in groups
- Develop skills for professional development
- Learn how to maximize what they can accomplish in a day or week
- Give back to the community through fun engagements with K-12 students
- Take part in Excellence Workshops, which support key math, science and engineering courses
- Work in a diverse scholastic environment

LEARN MORE AT
promes.egr.uh.edu

Xiong celebrates with his peers at the annual PROMES Banquet

Growing up fast

Xiong's parents were political refugees from the Hmong tribe in Laos when they came separately to California as children in the early 1980s. That makes Xiong not only a first-generation university student, but also a first-generation American.

"I credit my parents because they were always giving me the opportunity to learn more," said Xiong. "They would always put me in situations to better myself because they didn't have those opportunities when they were children as refugees."

> *I credit my parents because they were always giving me the opportunity to learn more. They would always put me in situations to better myself.*
>
> - NICOLAS XIONG

The first opportunity came around in preschool, where Xiong recalls always getting fussed at because he didn't want to nap at naptime. Instead he'd walk around the room, choosing books to read. Reports to his parents came back unfavorably: "He's rowdy," or, "He's uninterested," were some of the teachers' comments. His parents realized he was bored and quickly put him in a school for gifted and talented children.

"It was such a refreshing feeling and I didn't feel like I was being alienated in the class," said Xiong. "And to know I wasn't just rowdy or whatever else they said they thought I was."

It was a rare 4-year-old's epiphany.

At 7 Xiong was working on freshman level high school chemistry. Unable to find a school that met his needs, Xiong's mother taught herself how to homeschool him.

Lest we not forget an 8-year-old boy is still a youngster, Xiong was also playing on a soccer team and hanging out with other homeschooled students. But he really loved Legos, especially the Lego robot kits, and so his mother found a high school robotics team that could teach him advanced concepts. He was an eager student and would end up leading the team through many contests. It was at these national and regional competitions that he began to meet Cullen College students and members of PROMES.

Off to college

When he was about 12, Xiong's mom announced that he had completed the high school curriculum and she had no more to teach him. When he became a Cougar, PROMES wasn't the only group that reached out to make him feel welcome.

"Imagine a Southeast Asian and I'm a member of SHPE (Society for Hispanic Professional Engineers)," laughed Xiong.

"One of my best friends going into my sophomore year was the SHPE president and she told me they welcome all engineering students and they were really friendly," said Xiong.

"I found a real sense of camaraderie and family like in PROMES," he said. He got so involved in their events and activities that by the end of his sophomore year he was voted "new member of the year."

He says it's probably no coincidence that also by the end of that year, between his membership in SHPE and activities with PROMES, his grades went back up.

"Research has shown that our engineering students who are more involved in the engineering community – whether through membership in student groups and professional societies, in PROMES or the Honors Engineering Program, or involvement in research activities – are far more likely to complete their engineering degrees," said electrical and computer engineering Professor Fritz Claydon, who serves as director of the college's undergraduate programs and student success initiatives.

And beyond

The active Xiong took the advice of the Engineering Career Center – to go to career fairs early and often in your college career – to heart. At one of his first, he met a PROMES alum working at Williams.

"I attended several résumé and interview workshops with the Engineering Career Center and student organizations like SHPE," said Xiong, who notes that Williams had to wait until he was of legal age, 16, to offer him an internship.

Now completing his second year as a paid intern, Xiong looks forward to the possibility of working there full-time in December when he graduates. They've treated him well, he says. "My first day a group of guys at Williams said they usually go out to have drinks to celebrate the new group of interns, but because of me, we all went to Chili's," he said.

Throughout his life playing out in fast forward, Xiong has dealt with some detractors, people he realizes may be envious of the abilities that he is humble about.

"As much as there are haters there are more people supporting you. I don't want to prove the haters wrong. I'd rather prove the people who believe in me right," said Xiong.

And he does, every day. With great promise.

FINDING HIS WAY:

In His Third Decade, He's a Third-Year Undergrad

Two years ago when **Taylor Huston** walked into the Cullen College of Engineering as a first-year student, he was 29 years old. He had already taken a few community college classes, but mainly he had been a rock musician, bartender, farmer in Ecuador, a husband and a father. It was this last title that inspired him to go to college and earn a degree.

Taylor Huston has been many things – a rocker, bartender, farmer and, most recently, father and electrical engineer

"The minute I found out we were pregnant, I kicked into dad mode and tried to figure out how I was going to provide," said Huston. At the time, he and his former wife were running a sustainable orchard in Ecuador, but that gig was about to end and if they stayed, manual labor – the only thing he said he was trained to do – paid $15 a day.

"That wasn't going to be an option for me, so I knew we'd have to move back," he said. In further thought, Huston examined his strengths.

"I'm curious, I've always had a math brain, I never stop asking questions and so engineering seemed a good fit," he said. And though both his parents earned associate's degrees, when he graduates he will be the first in the family to earn a four-year college degree, making him a first-generation college student.

At the Cullen College Huston found that the combination of the First Year Experience and Engineering Career Center would catapult him into the life he could only dream about.

> *"[My daughter] is the reason I push myself so hard now. The reason for that is I don't believe we remember what our parents and mentors say, I think we remember what they do. So if I want her to push herself and chase her dreams, then I better be doing it myself."*
>
> - TAYLOR HUSTON

Making it fit

Huston readily admits he felt like an outsider coming in, but acknowledges that he was fine with that.

"Because I'm older I had less of a desire to fit in and I felt it was okay if I didn't, but at the same time there are two things UH offers that make it unique and really helped me," said Huston. "Houston is such a diverse city that our university is incredibly diverse – not just culturally, but in age range, too. There are plenty of people returning to school like me, so right away I found people in the engineering disciplines that were older with a similar mindset like me and at the same place in their lives, and we're still good friends, still going through school together."

And then came the First Year Experience with its two mandatory courses for all beginning engineering students: Introduction to Engineering (ENGI 1100) and Computing and Problem Solving (ENGI 1331), both the price of entry to your career in the Cullen College.

ABOUT THE FIRST YEAR EXPERIENCE

When it comes to success in engineering studies, the data is clear: the better students do in their first-year core classes, the greater the odds that they will complete their engineering degrees. That's why the First Year Experience (FYE) was established at the UH Cullen College of Engineering. All of the college's eight undergraduate majors now share the exact same curriculum in the first year, fostering a community of support among engineering students during their critical first year of college while allowing for a seamless transition between engineering majors for students who wish to shift focus after their first year. Two critical introductory engineering courses – Introduction to Engineering (ENGI 1100) and Computer and Problem Solving (ENGI 1331) – were shifted to project-based and team-based learning environments. Students in the courses are placed into multidisciplinary groups and must propose solutions to the National Academy of Engineering (NAE) Grand Challenges using problem-solving principles and lessons learned in their classes.

LEARN MORE AT
firstyearexperience.egr.uh.edu

"In 1100 we got a look at what we will be learning, but 1331 is where it gets a lot harder and they start to test you; it can be a very grueling class," said Huston. "If you make it through it feels like you've made the cut and they'd like to have you around to see what else you can do."

Even with his co-parenting responsibilities and need to make a living, Huston persevered and made it through 1331 with an A.

"That First Year Experience Course had an impact on me, making me feel I'm doing the right thing. I got my A and I really liked it and I wanted to learn more and be an electrical engineer, so it was a good sign," said Huston, who wants to work at the intersection of power and space exploration one day.

"If I could find a way to do both, I'd be a happy boy," he said.

All in a day's work

A typical day for Huston is atypical for most students. At the Calhoun Lofts, before the mere thought of his 14-hour course load or internship creeps in, Huston gets 4-year-old Aryana up, showered, fed and ready for her school day on the UH campus. He's made his schedule fit to spend extra time in the morning with Aryana before he walks her to her preschool class at the UH Children's Learning Center on campus.

Then it's his turn to go to class, followed by his internship at NASA with Stinger Ghaffarian Technologies. During the spring and summer semesters he worked for chemical giant LyondellBasell at their Matagorda plant through the Engineering Career Center's co-operative education program, which enables college students to receive career training with pay. As an added bonus, the co-op program is usually used as a recruiting tool by the companies involved, so future employment is highly possible.

At LyondellBasell he worked under a project engineer assisting on a new weather station and small thermoelectric energy harvesters. Then he transferred to work under a senior engineer on large capital projects like the addition of a new power switchgear building and motor control center on site.

For Stinger Ghaffarian Technologies he will work under the Integrated Mission Operations Contract II (IMOC II) to provide mission and flight crew operations support for the International Space Station and future human space exploration. When Huston got the offer, he was shaken.

"I humbly admit I cried a little bit when they called me," said Huston. "I was at the Matagorda plant in a weight room of all places and thankfully no one else was around because, you know, there are some big dudes there and I was getting tears."

> *"That's the golden question people ask, how I have gotten so many great internships. It comes back to the Cullen College's Engineering Career Center – they have a great program that's really helped me."*
>
> - TAYLOR HUSTON

Huston drops off his daughter, Aryana, at the UH Children's Learning Center before heading to his classes at the UH Cullen College

ABOUT THE ENGINEERING CAREER CENTER

The Engineering Career Center is a comprehensive career services department that offers all students in the Cullen College of Engineering resources to help develop and achieve their career goals. Workshops and information sessions with industry professionals are offered throughout the year. Engineering career fairs are held biannually with hundreds of companies looking to hire for full-time, part-time, fellowship and internship positions. Begin your engineering career search by scheduling an appointment with an engineering career counselor and register with eConnection, a web-based system designed to increase contact between students and potential employers.

LEARN MORE AT
career.egr.uh.edu

So many opportunities

"That's the golden question people ask, how I have gotten so many great internships," said Huston. "It comes back to the Cullen College's Engineering Career Center – they have a great program that's really helped me."

Some of the best advice, Huston says, is the career center's insistence on going to career fairs.

"They suggest you get right out there and go to those career fairs and put out applications and interview as soon as possible, even before you think you're eligible for a position," said Huston. He did and he said the process can be disheartening, recalling his first career fair where he put out a dozen applications and didn't hear back from a single one even though he had experience already as a tutor and assistant to a professor earlier in his life.

"I didn't even hear 'No,'" he said. "But don't be discouraged by that, you just have to keep going," he adds, from experience.

"I talked to the staff at the career center about it and that's where they stepped in and I got some advice and counseling from them," he continued. He learned that many times companies are looking for specific coursework to have been completed before they take interest. In his case, as an electrical engineering student, he said they wanted to see circuit analysis.

"As soon as I had circuit analysis on my résumé, boy, I got offers! I may have even heard that before but it didn't resonate until I sat down at the career center and really listened to their advice," Huston said.

Huston poses with his 4-year-old daughter, Aryana

His future student

Huston is thrilled to be a returning student, happy with his place in life, but sometimes wishes he had gotten to the Cullen College sooner.

"I hope not everyone takes as long of a path as I have to get to school," said Huston. "I hope some people can figure out what they want to do a lot sooner and though I'm grateful I waited to go back when I did, what I wouldn't give to be a little younger finishing my degree."

Still he won't force his daughter into college when it's her time. Rather, he said, he thinks his experience will show her.

"Aryana is the reason I push myself so hard now," said Huston. "The reason for that is I don't believe we remember what our parents and mentors say, I think we remember what they do. So if I want her to push herself and chase her dreams, then I damn well better be doing it myself."

A+ in fatherhood for that.

First-Generation Student Andrea Pettaway's Secret to Success:

JOIN! JOIN! JOIN!

As a member of a military family, **Andrea Pettaway** had moved around the country five times by high school, enough to make her feel she would never find a place to truly call home.

That is until she walked into the UH Cullen College of Engineering as a first-generation university student and began joining extracurricular groups like the UH chapter of the American Society of Civil Engineers (ASCE).

"Everyone goes into college with a kind of uncertainty about whether they've made the right choice," said Pettaway. "But going to those ASCE meetings really solidified that I was in the right place and on the right career path."

Her words echo those of the Cullen College of Engineering Dean Joseph Tedesco's about student success and involvement: "Getting involved in student organizations and professional societies not only increases chances for success in engineering, but gives students access to leadership and networking opportunities that help prepare them for life after college."

"I totally agree," said Pettaway, now a junior and a student of the Honors College. "I don't even think I'd still be majoring in civil engineering if I hadn't been involved in ASCE." As far as the networking part, she scored her internship at LJA Engineering after meeting a friend at an ASCE meeting who recommended her to the company.

She says company presentations at the ASCE meetings also expanded her view of civil engineering and opened her mind to possibilities.

"When you go into civil engineering you just think buildings and bridges," said Pettaway. "I didn't know flood control was part of civil engineering. I didn't know civil engineers could design airport runways or build transmission lines." Her new knowledge made her aware she was totally intrigued with her major.

First-generation, first-year success

The United States might boast one of the highest college attendance rates in the world, but according to the Pell Institute for the Study of Opportunity in Higher Education, large gaps remain in college success with only 11 percent of first-generation students earning an undergraduate degree compared to 55 percent of their peers.

In the Cullen College, out of 3,700 enrolled undergraduates in 2016, 971 were first-generation university students, or just over one-quarter.

"What we find is first-generation students haven't had some of the opportunities we're providing in the First Year Experience, like study groups or tutors," said Jerrod Henderson, director of the First Year Experience (FYE) Program, which requires all incoming engineering freshmen to take two courses – Introduction to Engineering (ENGI 1100) and Computing and Problem Solving (ENGI 1331).

"The common experience of 1331 allows different disciplines to work together on a broad project," said Instructional Assistant Professor Dan Burleson who teaches the project-based course. "By the end of the year they will have learned the engineering problem-solving process and how it applies to all these different disciplines."

> *"Everyone goes into college with a kind of uncertainty about whether they've made the right choice. But [ASCE] really solidified that I was in the right place and on the right career path.*
>
> - ANDREA PETTAWAY

That was Pettaway's takeaway from the course as well.

Her first group project in the class was to build a bridge out of balsa wood. Thrilled about her team's success, she excitedly posted on social media that her bridge held weight and she was in the right major.

As for the problem-solving steps that she says they "drill into you" during the FYE courses – now she uses them daily at her paid internship.

"If I get stuck on something I go to the five steps of problem-solving in my head because it's so ingrained in me now," she laughs, happy now for the first-year "drill."

ENGI 1331: THE FIVE STEPS OF PROBLEM-SOLVING

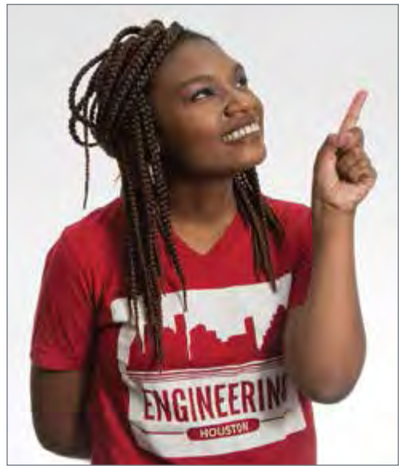
(1) Define Problem

(2) Collect Information

(3) Generate Solution

(4) Refine and Implement

(5) Verify and Test



> *I feel like I've come full circle. Even if I help just one person decide to major in engineering down the line I'll be happy because that's one more than there was before.*
>
> - ANDREA PETTAWAY

ABOUT OUR 30+ ENGINEERING STUDENT ORGANIZATIONS

Getting involved in student organizations and professional societies increases your chances for success in engineering and gives you access to leadership and networking opportunities. It's also a great way to meet fellow engineering students and connect with your classmates for study groups and academic support. The Cullen College is home to award-winning chapters of the Institute of Electrical and Electronics Engineers (IEEE), the National Society of Black Engineers (NSBE), the Society of Women Engineers (SWE), the Society of Hispanic Professional Engineers (SHPE), the Society of Mexican American Engineers and Scientists (MAES), the Society of Asian Scientists and Engineers (SASE), the Society of Automotive Engineers (SAE), the Subsea Engineering Society (SES) and many more!

LEARN MORE AT
www.egr.uh.edu/people/engineering-student-organizations

More organizations, more opportunities

Pettaway, who says she's always enjoyed being busy, is a tutor for iEducate, a group that pays college students to share their knowledge of STEM courses (science, technology, engineering and mathematics) with elementary school students in Houston's underserved communities. She is also part of the Bonner Leaders Program in the Honors College and chair of the pre-college initiative of the UH chapter of the National Society of Black Engineers (NSBE). She's looking forward to reaching out to disadvantaged youth and introducing the idea of engineering to them.

"I feel like I've come full circle," said Pettaway. "If I hadn't joined ASCE or NSBE I don't know where I'd be, so I think it's important to do whatever I can. Even if I help just one person decide to major in engineering down the line I'll be happy because that's one more than there was before."

At just 20 years old she is a mentor, the kind she feels she could have used in high school as she prepared to be the first in her family to go to a university. Though her parents always encouraged her to go to college, it was an older woman in her church who first spoke to her about civil engineering.

"I went home and did some research and began to envision myself as a civil engineer," said Pettaway. "It just seemed right for me." As did college when her parents encouraged her.

Andrea Pettaway found success by joining student groups like the American Society of Civil Engineers and the National Society of Black Engineers

"My kids won't have the issue of me not having a college degree and not being an engineer," she said. Though they did not attend university, Pettaway's parents are the reason she'll be getting her diploma.

"I've always been motivated by wanting to make them proud."

OTHER ENGINEERING RESOURCES

UNDERGRADUATE RESEARCH

The Cullen College and the University offer a wide array of research opportunities for undergraduate students to get involved in. These programs provide enhanced learning opportunities to students through hands-on projects developed by faculty as well as valuable experience for students looking to pursue advanced degrees. Many of these undergraduate research opportunities are funded fellowship positions. The Professor Stuart Long Undergraduate Research Fund was recently launched by the UH Cullen College and Honors College, expanding the available funding for undergraduate research programs in both colleges. Current undergraduate research programs include:

- Summer Undergraduate Research Fellowship (SURF)
- Houston's Early Research Experience (HERE)
- Provost's Undergraduate Research Scholarship (PURS)
- Senior Honors Thesis
- UH Research Experience for Undergraduates (REU)
- Senior Capstone Design Projects

LEARN MORE AT
www.egr.uh.edu/research/undergraduate-research

HONORS ENGINEERING PROGRAM

The Honors Engineering Program (HEP) is jointly offered by the Cullen College of Engineering and the Honors College as a program that cultivates community among Honors students who are pursuing engineering degrees and provides an enhanced academic experience through project-based courses, mentorship opportunities and visits with industry partners. Designed to promote innovative thinking, HEP combines team-building activities (such as building Habitat for Humanity homes or visiting local companies) with more intensive classroom lessons. The program also gives academically-gifted students a larger selection of more comprehensive versions of existing engineering courses in smaller classroom settings taught by leading Cullen College faculty. Cullen College students currently make up about 20 percent of the Honors College enrollment.

LEARN MORE AT
www.uh.edu/honors/Programs-Minors/honors-minors-programs/hep/

WOMEN IN ENGINEERING PROGRAM

It's no secret that women are gravely underrepresented in the engineering fields. The UH Cullen College hopes to curb these trends by fostering a community of support among women in engineering. That's the inspiration behind the Women in Engineering (WIE) Program, which brings together female engineering students, faculty and alumnae to inspire and encourage each other. Originally known as the Women in Engineering Learning Community for Maximizing Excellence (WELCOME), the program was established in 2005 at the Cullen College. Supported by a grant from the Texas Engineering and Technical Consortium (TETC), the vision for the program is to serve as a forum for women to network on both social and professional levels. WIE also offers professional and academic development workshops, student-to-student and professional-to-student mentoring programs and a series of seminars geared toward providing insight for women at every stage of their academic careers.

LEARN MORE AT
www.egr.uh.edu/wie

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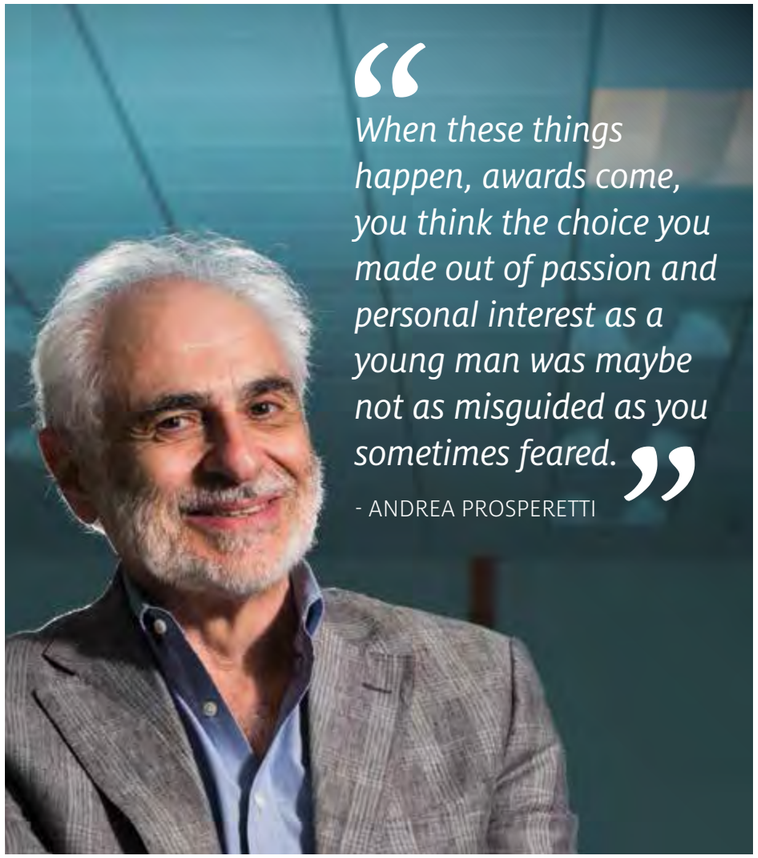

ANDREA PROSPERETTI WINS CAREER AWARD

From One of the World's Oldest Scientific Organizations

BY LAURIE FICKMAN

For much of his career, **Andrea Prosperetti** has been called "Mr. Bubble" by his students for his intense focus on multiphase flows including bubble dynamics and cavitation, the formation of bubbles in a liquid.

With more than 8,000 citations on the Web of Science database and 15,000 on Google Scholar, you might say his work on fluid mechanics, the motion of liquids and gases, is effervescent. "I have done an awful lot of work on bubbles," Prosperetti says modestly.

Now he can add to his sparkling résumé the title of international winner of the Cataldo Agostinelli e Angiola Gili Agostinelli International Prize, given by the Accademia dei Lincei in Rome, Italy. The exclusive organization was founded in 1603 with one of its early members no less than Galileo Galilei, the great scientist who first pointed a telescope to the heavens.

Not a bad organization to have its sights on Prosperetti, Distinguished Professor of mechanical engineering at UH, the Berkhoff Professor of applied physics at the University of Twente in the Netherlands and an elected member of the National Academy of Engineering.

Galileo is said to have been thrilled with his induction into the academy. Prosperetti has a thoughtful reaction to the award.

"What we do is a lonely activity," said Prosperetti. "We do calculations, we think about abstract things and it's not obvious that any of that amounts to anything. We do it because we like it and have a genuine faith in science. So when these things happen, awards come, you think the choice you made out of passion and personal interest as a young man was maybe not as misguided as you sometimes feared."

Glimmering in his field

As Prosperetti speaks, nearby is a textbook, "Advanced Mathematics for Applications," he wrote in 2011. Prosperetti also serves as the editor-in-chief of the *International Journal of Multiphase Flow* and serves on the editorial board of the *Annual Review of Fluid Mechanics*.

He's keen on describing multiphase flows, wherein liquids, solids and gases are together.

"In a sandstorm you have sand particles suspended in the wind. Coastlines and rivers are remodeled by the small solid particles transported by the water current. Mixtures of gases and liquids are ubiquitous in the oil industry. If I have all of these entities dispersed in a carrier fluid, how do you handle that system? How do you describe it? How do you model it? You have to understand the physics."

And through all of his career accomplishments, Prosperetti says that's the consistent element. "My attention to fundamental physical principles is really what I've always tried to do, to have an eye for those aspects of physics out of which everything else comes."

Like scientific cataloguing, engineering expertise, mathematical explanations and, in this case, scholarly recognition.

ZHU HAN:

He Wrote the Book on Big Data

BY ASHLEY SCHWARTZ

Zhu Han, professor of electrical and computer engineering at the UH Cullen College of Engineering, along with colleagues Mingyi Hong of Iowa State University and Dan Wang of Hong Kong Polytechnic University, have published the first comprehensive book on the use of signal processing for big data applications.

> *I hope to continue to create books that not only serve as valuable resources to students and professionals, but also contribute to the field.*
> - ZHU HAN

The book, titled "Signal Processing and Networking for Big Data Applications," was published by the Cambridge University Press last April.

This unique text helps make sense of big data in engineering applications using tools and techniques from signal processing. It presents fundamental signal processing theories and software implementations, reviews current research trends and challenges and describes the techniques used for analysis, design and optimization.

When asked why a comprehensive book on signal processing for big data is so important, Han explained, "Different researchers have different perspectives for big data analysis. This book is the first one to give a comprehensive view for the story, so that the researchers can select the appropriate signal processing tools for specific problems."

The book is ideal for researchers and practicing engineers looking to solve practical problems involving large amounts of data, and for students looking to grasp the fundamentals of big data analytics.

"We hope that this book is a great resource for graduate students who want to pursue big data analysis, as well as engineers and data scientists who want to know the current state-of-the-art data applications," said Han.

Just as with any unprecedented venture, the authors experienced a few bumps in the road along the way. "It was quite a learning curve for such a dynamic and diverse field. I was lucky to have two active, young researchers involved with whom I have collaborated and studied on many occasions."

Han has published an impressive eight books by prestigious publisher Cambridge University Press and plans to release another soon.

"I hope to continue to create books that not only serve as valuable resources to students and professionals, but also contribute to the field," he said.

A GIANT IN THE FIELD OF CATALYSIS,

UH's Lars Grabow Elected to Helm Two Journals

BY AUDREY GRAYSON

In the field of catalysis, which uses one material to initiate or speed up a chemical reaction, there are few researchers in the world as well-known or respected as **Lars Grabow.**

Case in point: Grabow, assistant professor of chemical and biomolecular engineering at the UH Cullen College, was recently elected to the advisory boards of two prestigious journals in the catalysis field, *ACS Catalysis* and *ChemCatChem*.

ACS Catalysis, a publication of the American Chemical Society, announced the launch of its first-ever Early Career Advisory Board this April. Grabow was one of 18 members elected to the inaugural board from a pool of candidates recommended by the journal's associate editors.

Members of the ACS Catalysis Early Career Advisory Board represent outstanding emerging researchers who work in different areas of catalysis around the world. Their roles include advising the journal of emerging trends in their research areas and ensuring the journal's content reflects the latest and greatest in new developments in the field of catalysis.

ChemCatChem, published by Wiley, elected Grabow as a member of their International Advisory Board. Grabow is one of 10 members hailing from the U.S. out of the 70 total board members representing more than 18 countries. International advisory board members provide editorial guidance on the journal's publications.

"Membership in these two advisory boards is an honor and a milestone of my career," said Grabow. "I couldn't be more excited to have the opportunity to shape the future of these journals and, in turn, influence the direction in which the field of catalysis is headed."

Grabow has been awarded millions of dollars by private energy companies and government funding agencies to find safer, cheaper and more effective catalysts for a variety of industrial processes and environmental applications. He currently serves as vice chair for the Catalysis and Reaction Engineering (CRE) division of the American Institute of Chemical Engineers (AIChE).

Yashashree Kulkarni's Twinning Work Garners her a

SINGULAR AWARD

BY LAURIE FICKMAN

When **Yashashree Kulkarni** isn't singing opera (her latest pursuit), the associate professor of mechanical engineering is singing the praises of twinning, the process by which interfaces known as twin boundaries are introduced in metals to make them stronger.

Twin boundaries are created when layers of atoms in crystalline materials are arranged in pairs of mirror images (twins) stacked on top of one another.

"For all structural applications, we want a material that is both ultra-strong and not brittle – we call it ductile – and that is what we do with twinning," said Kulkarni.

> "It's a very prestigious award. It is national-level recognition and I am really humbled by it."
>
> - YASHASHREE KULKARNI

Here's what she also does: Picks up awards for her work on nanotwinned metals, most recently from the American Society of Mechanical Engineers (ASME). The organization chose her as winner of the 2017 Sia Nemat-Nassar Early Career Award for her "pioneering work on twin boundaries in crystalline materials and their role in next-generation nanostructured materials," according to ASME.

"It's a very prestigious award. It is national-level recognition and I am really humbled by it," said Kulkarni.

Early achievements

Kulkarni received her Ph.D. in 2007 and has a career reel of highlights in the field of computational modeling of twins in nanostructured materials.

She has explored the ability of specially fabricated nanotwinned metals to withstand prolonged exposure to high radiation through a grant from the National Science Foundation; and she is an early pioneer of studying twin boundaries at the molecular level to understand their role in imparting high strength, ductility and mechanical stability to nanotwinned metals.

But the overarching focus of her work, she says, is to understand how twin boundaries interact with other defects because, as she notes, there are always going to be defects in materials, and they ultimately determine the mechanical behavior of the material.

"Whenever a material deforms or ultimately fails, it all starts at the scale of atoms, where defects are formed breaking the crystalline order," said Kulkarni. "My work has been mostly on how these unique twin boundaries interact with the defects that are already present or formed during deformation to make the material stronger."

She recalls a quote by Sir Colin Humphreys, a famous materials scientist, that she works and lives by: "Crystals are like people; It is the defects in them that tend to make them interesting."

Sounds almost operatic.

Cullen College's Director of Engineering Programs in Katy Honored With

DUAL AWARDS FROM SPE

BY LAURIE FICKMAN

Even among the largest oil and gas organization serving managers, engineers, scientists and other professionals worldwide, **Phaneendra Kondapi** stands out. The Society of Petroleum Engineers (SPE) Gulf Coast North America Region honored Kondapi, founding director of engineering programs at the UH Cullen College's Katy campus and director of subsea engineering, with two of its highest awards for regional distinguished faculty and technical achievements.

Award-winning Phaneedra Kondapi

The SPE Regional Distinguished Achievement Award for Petroleum Engineering Faculty recognizes superiority in classroom teaching, excellence in research, significant contributions to the petroleum engineering profession and/or special effectiveness in advising and guiding students.

It's not the first time Kondapi impressed the SPE judges. In 2013 he was awarded the SPE Teaching Excellence Award.

This time around, Kondapi grabbed the prestigious faculty award for the highest of reasons – he has been involved in developing the only two subsea programs in the nation (at UH and Texas A&M University).

"It's a great honor to receive this award. I feel this award is given to encourage such unique programs and the faculty supporting them," said Kondapi. "So this honor truly goes to both UH and Texas A&M."

The SPE Regional Technical Awards acknowledge exceptional contributions to SPE at the section or regional level and recognize singular devotion of time and effort to the programs and development of technical expertise.

Kondapi was awarded the SPE's Regional Projects, Facilities and Construction Award for spearheading the flow assurance technical section of SPE and promoting awareness of industry best practices related to flow assurance and subsea engineering among upstream oil and gas professionals. He also successfully organized the SPE global forum "Flow Assurance: Future State of the Art" and is actively involved in the SPE global training committee and organizing many successful flow assurance and subsea processing sessions at the Offshore Technology Conference.

"It's truly rewarding for the work done over the years and I am really thankful to SPE for appreciating and recognizing what I have done," said Kondapi.

Kondapi blends academic and industry experience with more than 20 years of engineering at FMC Technologies and KBR.

"It's well-deserved recognition for this pioneer of subsea engineering," said Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College. "Dr. Kondapi is uniquely suited to expand the Cullen College's engineering programs in Katy while continuing to provide the city of Houston a vital workforce of highly-skilled subsea engineers."

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WHAT A FELLOW!

Gino Lim Honored by Institute of Industrial and Systems Engineers

BY LAURIE FICKMAN

If you've ever evacuated your home in the Houston area because of a threatening flood or hurricane, you've felt the impact of **Gino Lim's** work. If you or someone you know has ever been treated with radiation for cancer therapy, you've also felt the impact of Gino Lim's work. Among many career highlights, Professor Lim, chair of the Cullen College department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow, has developed efficient evacuation routes with Harris County and Houston Transtar and developed mathematical algorithms used to determine how much radiation will heal rather than hurt you.

That's just how the world-renowned industrial engineer rolls, improving different areas of life with his skill at engineering industrial solutions.

In an office full of awards, Lim says he is thrilled to receive his latest, the distinction of becoming a Fellow of the Institute of Industrial and Systems Engineers (IISE), an honor that usually goes to older engineers capping a lifetime of achievement.

"I'm pretty young to be awarded and it's nice to hear that people appreciate what I've done," said Lim. "Plus this is not something I initiated. People from outside, not even from UH, initiated this on my behalf."

At most, 20 engineers become IISE Fellows annually. This year Lim is among only a dozen. The stringent criteria takes full account of a candidate's success in management, technical innovation, practice innovation and leadership in promoting industrial engineering.

Exceeding qualifications. And then some.

By every measure, Lim exceeded the qualifications.

In the area of management, Lim has increased enrollment in industrial engineering (IE) with unprecedented results. During his tenure at the Cullen College as chair since 2011, the IE department has experienced a 300 percent increase in master's students, a 31 percent increase in bachelor's students and a 66 percent increase in doctoral students graduated per faculty each year. He, himself, has graduated 16 Ph.D. candidates in the last 13 years – well above the average number among his academic peers. He has also taken management and leadership roles on the Industrial and Systems Engineering Research Council, serving as program chair for several annual conferences including IISE's Industrial and Systems Engineering Research Conference (ISERC) and INFORMS, the world's largest professional association dedicated to best practices and advances in operations research, management science and analytics.

Considered a leading researcher in proton-based radiation treatment planning in the IE community worldwide, Lim has excelled in the field of technical innovation, such as his pioneering work on Gamma Knife radiotherapy optimization for brain cancer patients. For developing the mathematical algorithm determining the optimal amount of radiation needed at cancer sites, he won the 2002 Pierskalla Best Paper Award from INFORMS.

Lim's work in developing innovative practice methods for scheduling nurses in operating suites was tested and adopted at MD Anderson Cancer Center and published in *IIE Transactions on Healthcare Systems Engineering*.

A happy accident

Lim's accomplishments seem unbelievable, especially because he said he got into industrial engineering "by accident." Actually, it was less accident and more a good career counselor in Korea.

"Initially I was looking at chemical engineering, but I was also interested in management and using people skills," said Lim. "The career counselor said to consider industrial engineering if I wanted to work with people, and I did. Working with people makes me happy."

It obviously delights others, too. His peers' recommendations from across the United States surely weighed heavily on IISE's decision to name him a Fellow.

THE ENERGY OF YAN YAO:

Creating New Batteries and Becoming a Scialog Fellow

BY LAURIE FICKMAN

If there's one thing **Yan Yao** gets a charge out of, it's the idea of creating a better battery.

The Cullen College assistant professor of electrical and computer engineering is known for being the most current in the battery industry. A Google search yields more than 16,000 citations of papers by Yao. If you read any of them, you'll learn that if all goes as Yao has it planned, soon there will be safer batteries that last longer. In fact, he may just be responsible for saying goodbye to your old jumper cables and stopping your hover board from exploding.

Having built this kind of reputation in the energy storage field, it's no surprise that the Research Corporation for Science Advancement came calling, naming Yao a Scialog Fellow in their newly created category – wait for it – "Advanced Energy Storage" (AES). According to Scialog (a mixture of science and dialog), AES is a program involving early career rising stars interested in pursuing collaborative, high risk, highly impactful discovery research on untested ideas applicable to creating breakthroughs in energy storage.

"I am honored to be named a Scialog Fellow. The program director invited me to apply. A senior professor in the battery community had nominated me based on my work over the last five years," said Yao. "I think it's recognition of my prior work."

Beyond lithium-ion

For his work in creating better, safer batteries, Yao has won 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. His battery research program has been well funded through the National Science Foundation, Department of Defense, Department of Energy and, most recently, NASA.

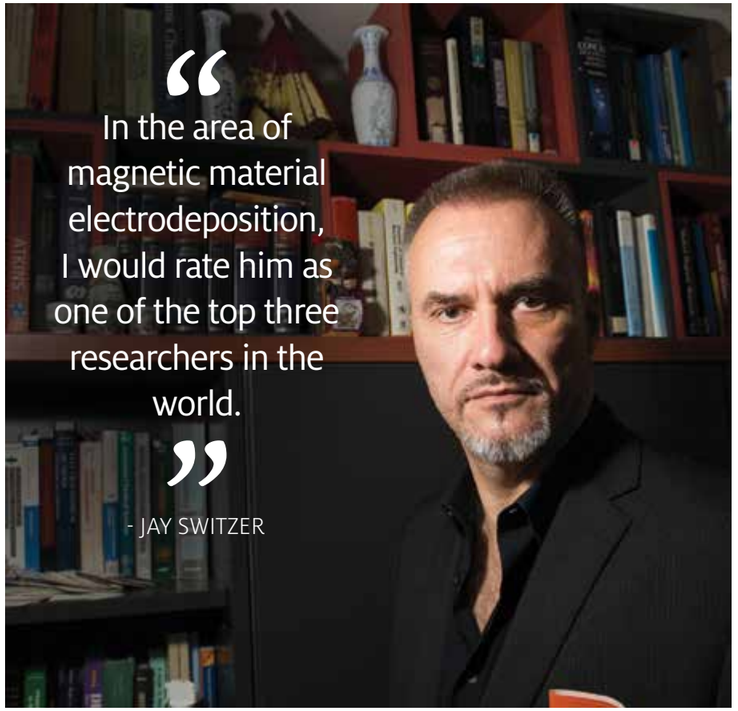
Now, as a Scialog Fellow, Yao will set out to meet their challenge – to search for and discover truly transformative energy storage systems. Fortunately, he's already on track. In his laboratory he's already developing the next generation of aqueous (water-based) batteries, which will last 10 times longer and be five times more powerful than the ones currently in your car.

No battery slips his attention

"The traditional lithium-ion battery technology is approaching its limits and could be dangerous in situations when the flammable electrolyte catches fire," said Yao, seemingly disturbed by the mere thought. He is working with those and the aqueous batteries, which are safer but have a limited life cycle. Think, again, of your car battery, which never fails to surprise you with its need to die at the completely wrong time.

"The energy is not dense enough," said Yao. "You want to combine the safety of aqueous batteries with the high energy density of lithium-ion batteries – that would be ideal." Yao will work with a team of other Scialog Fellows to use computational analysis and experiments to add more perspective on the fundamentals of his research on aqueous batteries, magnesium batteries and all-solid-state lithium metal batteries.

And eventually he will, no doubt, reach his ultimate albeit high-powered goal: "To not only change technology, but to change people's lives and the world," he says.



STANKO BRANKOVIC WINS TOP AWARD

in Field of Chemical Engineering

BY LAURIE FICKMAN

If there were Academy Awards in the field of electrochemical material science, **Stanko Brankovic,** associate professor of electrical and computer engineering at the Cullen College and past chair of the materials science division of the International Society of Electrochemistry, would be taking home an Oscar. He's been named the 2017 winner of the Electrodeposition Division Research Award by the Electrochemical Society (ECS), known as the top organization globally for scientists and engineers with more than 10,000 members from over 100 countries.

Electrodeposition is the electrochemical process of synthesizing a thin layer of metal on top of a different substrate, or conducting surface, to modify its external properties. It provides the basis for an array of industrial applications, including refining and metal plating.

The award places Brankovic among a small group of electrodeposition leaders around the world, recognizing his success in straddling the boundaries between nanoscience and nanotechnology and working in some of the discipline's most significant areas: magnetic materials and devices, and surface-limited reactions for catalysis and other applications.

Brankovic recently discovered the controlling phenomena of speed in which catalysts are formed, which may result in building better catalysts, the fundamental substance that speeds up reactions in all industries from petrochemical to manufacturing.

Of the award Brankovic said, “It's a hardcore scientific contest where they evaluate your impact in the field and for this I am very flattered.”

The feeling for Brankovic among his peers is not simple flattery, but uncompromising admiration for the man who created no less than an entire new field of study. Proof comes in the comments of five professors around the world who nominated him for the prestigious award.

“He contributed critically to electrocatalysts science and technology by inventing and patenting the use of atomic monolayer deposition on nanoparticles and, with that, de facto created the now-flourishing field of core-shell electrocatalysts,” said Plamen Atanossov, Distinguished Professor of chemical and biological engineering at the University of New Mexico.

Jay Switzer, Donald L. Castleman/FCR Missouri Endowed Professor of discovery in chemistry at the Missouri University of Science and Technology, noted Brankovic's ability to bridge different areas of science with his magnetic materials research: “In the area of magnetic material electrodeposition, I would rate him as one of the top three researchers in the world.”

Daniel Schwartz, ECS Fellow and Boeing-Sutter Professor of chemical engineering at the University of Washington, added that Brankovic “seems to have a depth of knowledge that is boundless.”

Said Brankovic, “I am proud that the people who nominated me recognized that I may have changed the electrochemical material science field with my work for the better.”

About the award

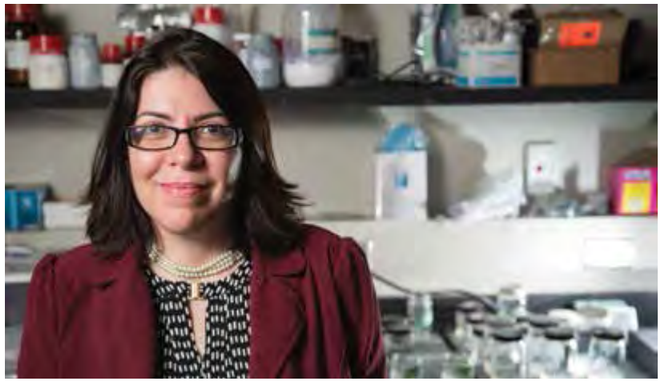
Established in 1979, the Electrodeposition Division Research Award recognizes outstanding research and encourages publication of high quality papers in the *Journal of the Electrochemical Society*.

The annual winner has made a recent outstanding achievement in, or contribution to, the field of electrodeposition.

THE BEST OF OUR BRIGHTEST:

Outstanding Service Awards Given in Cullen College

Excellence in engineering took center stage as Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College, recognized the outstanding performances of faculty, staff and students in teaching, research and service at the spring faculty and staff meeting.



Haleh Ardebili, Bill D. Cook Associate Professor of mechanical engineering, received the W.T. Kittinger Teaching Excellence Award, the highest teaching award given in the college, recognizing outstanding teaching and service to students. It carries a $2,000 stipend.

David Shattuck, associate professor of electrical and computer engineering, received the Career Teaching Award. Given intermittently, this award is reserved for faculty who have shown a lifetime commitment to Cullen College students. Shattuck's award carries a $2,000 stipend.

TEACHING EXCELLENCE AWARDS

Yuhua Chen (ECE)

Jae-Hyun Ryou (ME)

Yi-Lung Mo (CEE)

Xuemei Chen (ME)

Aida Khayatian (IE)
Teaching Assistant

RESEARCH EXCELLENCE AWARDS

Cunjiang Yu (ME)
Junior Faculty Research Award

Saurabh Prasad (ECE)
Junior Faculty Research Award

Yi-Lung Mo (CEE)
Senior Faculty Research Award

UH HONORS
CULLEN COLLEGE PROFESSORS
for Excellence in Teaching and Research

Each spring the University of Houston shines a spotlight on the faculty's best and brightest, honoring them with teaching and research awards. The winners were presented with their awards on April 20 at the Faculty Excellence Awards Dinner hosted by President Renu Khator and Provost Paula Short.

Read more about the Cullen College of Engineering professors who earned the distinction below!

Hanadi Rifai, associate dean for research and facilities at the Cullen College as well as professor of civil and environmental engineering, was named the 2017 recipient of the John and Rebecca Moores Professorship. The Moores Professorship is a university-level honor awarded annually to a University of Houston faculty member who has made outstanding contributions in research, teaching and service. Each Moores Professor receives a stipend, and the professorship is renewable every five years.

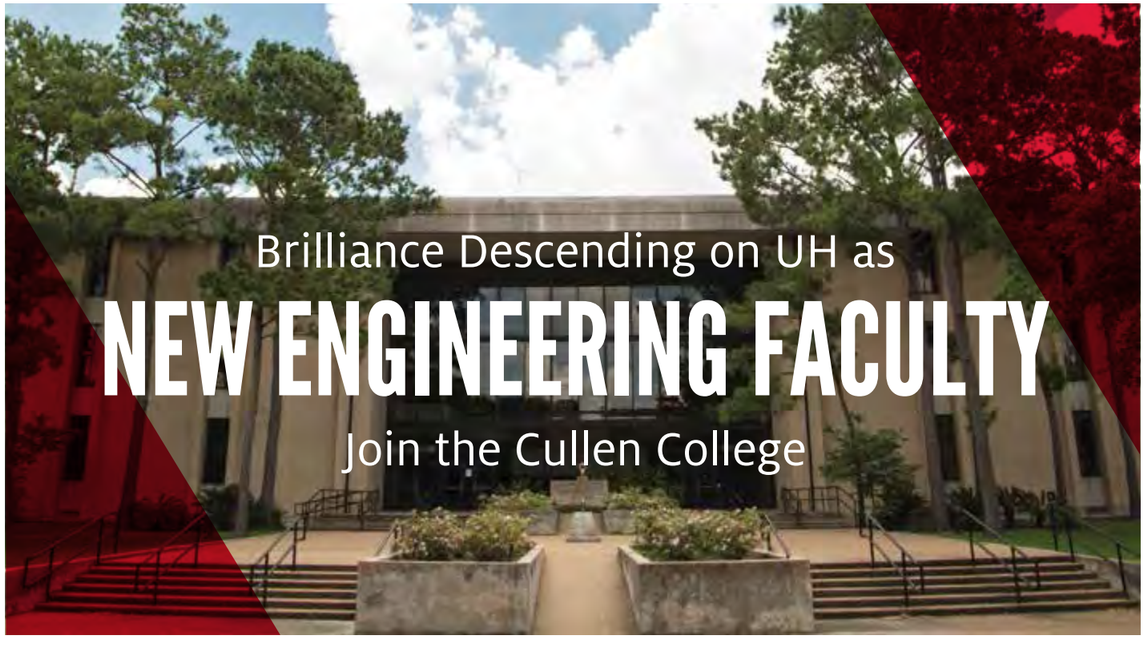
Len Trombetta, associate department chair of electrical and computer engineering, received a W.T. Kittinger Teaching Excellence Award, the university's most prestigious teaching honor. Trombetta focuses on the characterization of metal-insulator-semiconductor (MIS) systems, particularly mechanisms of defect generation at the insulator-semiconductor interface. He has directed numerous M.S. theses and Ph.D. dissertations. Trombetta has been at UH since 1986.

Hadi Ghasemi, Bill D. Cook Assistant Professor of mechanical engineering, received a W.T. Kittinger Teaching Excellence Award, the university's most prestigious teaching honor. Ghasemi runs the UH Nanotherm Lab, which explores learning and research in the field of thermodynamics, heat transfer and nanotechnology.

Karolos Grigoriadis, John and Rebecca Moores Professor of mechanical engineering and director of the aerospace engineering program, is no stranger to winning these excellence awards. He received the Excellence in Research, Scholarship or Creative Activity Award for his work teaching modelling and controlling aerospace systems, internal combustion engines, active/passive vibration isolation of structural systems and intelligent biomedical systems. Recently he earned both the Fluor Corporation Faculty Excellence award, the highest honor given by the Cullen College, as well as the W.T. Kittinger Teaching Excellence Award, the College's most prestigious teaching honor.

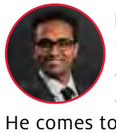
Lars Grabow, assistant professor of chemical and biomolecular engineering and chemistry, received the Excellence in Research, Scholarship or Creative Activity Award for his work teaching the importance of catalysts in the production of fuels, chemicals and the abatement of harmful emissions.

Megan Robertson, assistant professor of chemical and biomolecular engineering, received the Undergraduate Research Mentoring Award, which recognizes the mentorship efforts of UH faculty at all stages of their careers. The award acknowledges faculty who are making a significant impact in their field by supporting and mentoring undergraduate students in research and scholarship endeavors and who have demonstrated at least five years of mentorship involvement.



Throughout the Cullen College of Engineering new faces and brilliant minds are joining the faculty in the 2017-2018 school year. The Cullen College proudly welcomes them to its ranks of excellence in academia.

Chemical & Biomolecular Engineering



Praveen Bollini joins the Cullen College of Engineering as an assistant professor of chemical and biomolecular engineering. He comes to UH from the University of Minnesota in Minneapolis where he served as a postdoctoral research associate in the field of catalysis, studying methanol to olefins conversion on zeotype catalysts.

Previously Bollini served as senior engineer for catalysis and process research at the Dow Chemical Company in Freeport, Texas. In 2013 Bollini earned his Ph.D. in chemical engineering with a minor in chemistry from the Georgia Institute of Technology in Atlanta.

Alamgir Karim becomes a Dow Professor of chemical and biomolecular engineering at the Cullen College of Engineering. He previously served as the Goodyear Tire and Rubber Company Professor in polymer engineering and co-director of the Akron Functional Materials Center at the University of Akron in Ohio. Additionally Karim was associate dean of research and director of the Maurice Morton Institute of Polymer Science and Polymer Engineering. Between 2010 and 2015 Karim was also director of materials at the Akron Functional Materials Center. He earned his Ph.D. in physics from Northwestern University in 1991.

Karim's areas of expertise include polymer surfaces, interfaces, thin films, blends phase separation, nanocomposite films, block copolymer ordering, nanoparticle patterning, organic photovoltaics, combinatorial materials science and tissue engineering.

Mehmet Orman joins the Cullen College as assistant professor of chemical and biomolecular engineering. He comes from the Memorial Sloan Kettering Cancer Center in New York where he was a postdoctoral research fellow studying DNA repair mechanisms in cancer cells.

From 2011 to 2015 Orman served as postdoctoral research associate in the chemical and biological engineering department at Princeton University where he focused on bacterial persisters, which are rare, phenotypic variants that are temporarily tolerant to high concentrations of antibiotics. He earned his Ph.D. from Rutgers University in 2011.

Civil & Environmental Engineering

Devin Shaffer joins the Cullen College as an assistant professor of civil and environmental engineering in spring 2018. For

the past year Shaffer has served as materials research engineer in the functional polymers group at the materials science and engineering division of the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland.

At NIST Shaffer studied the structure and transport properties of water treatment membranes with a goal of improving the selectivity of thin-film composite desalination membranes through better understanding of how the structure and characteristics of the membrane selective and support layers affect the membrane performance. Shaffer's previous experience includes a position as a professional engineer designing water and wastewater treatment systems. In 2016 Shaffer earned his Ph.D. in chemical and environmental engineering from Yale University.

Electrical & Computer Engineering

Harish Krishnamoorthy joins UH as an assistant professor of electrical and computer engineering. His specialization is in power and energy and his major areas of research and teaching focus on subsea/downhole power systems, power electronics for extreme environment applications, renewable energy power conversion, power electronics for utility interface and medium and high frequency magnetics-based power converters.

In 2014 Krishnamoorthy earned his Ph.D. in electrical and computer engineering at Texas A&M University, where he remained as a research assistant performing research in high density power electronics energy conversion.

Rohith Reddy is a new Cullen College assistant professor of electrical and computer engineering with a keen interest in biomedical imaging. Reddy served as a postdoctoral fellow at Harvard Medical School and Massachusetts General Hospital in Boston. He completed his Ph.D. in bioengineering in 2013 at the University of Illinois at Urbana-Champaign.

Reddy has a compelling interest in building new medical devices for early cancer detection based on infrared optics. Reddy believes that by studying the reflected light (laser or other types) off human tissue, a picture of what is happening inside the tissue can be painted. By studying the microscopic cellular structures and creating high resolution images, he says it is possible to determine if the tissue has a certain disease.

In 2016 he won an innovation award from the Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) for the most innovative and outstanding new research advancement for his postdoctoral work on a swallowable capsule endoscopy for Barrett's esophagus diagnosis based on optical coherence tomography.

Industrial Engineering

Ying Lin comes to the UH Cullen College as assistant professor of industrial engineering from the University of Washington in Seattle where she was a research assistant in industrial and systems engineering.

Lin's research interests include big data analytics, quality engineering and medical decisionmaking. She specializes in statistics, machine learning, data mining and operations research.

In May 2017 Lin was awarded her doctorate in industrial and systems engineering from the University of Washington.

Mechanical Engineering

Zheng Chen moves to the Cullen College of Engineering as assistant professor of mechanical engineering from Wichita State University in Kansas, where he is an assistant professor in electrical engineering and computer science.

From 2012 to 2013, Chen was a research and development engineer for pressure pumping equipment at Baker Hughes in Houston. He received his Ph.D. in electrical engineering from Michigan State University in 2009 and conducted postdoctoral work in mechanical and aerospace engineering at the University of Virginia.

Chen has special interest in dynamics and controls, bio-inspired robotics, smart material sensors and actuators, biomedical devices and renewable energy systems.

Rodolfo Mónico becomes an assistant professor in mechanical engineering at the Cullen College. Most recently he was a postdoctoral researcher at Harvard University. His research is primarily in the field of computational fluid mechanics and he is interested in convective flows, the human olfactory system, vortex ring collisions and other canonical turbulent systems.

He obtained his doctoral degree in the physics of fluids at the University of Twente in the Netherlands. He earned a degree in aerospace engineering from the University of Sevilla in Spain and a master's in aerospace dynamics from Cranfield University in England.

During his free time Mónico plays bass guitar, juggles and travels the world.

Petroleum Engineering

Kyung Jae Lee joins the Cullen College as an assistant professor of petroleum engineering. She comes from the Lawrence Berkeley National Laboratory in Berkeley, California, where she was a geological postdoctoral fellow participating in U.S. DOE projects. Her projects included research on thermal processes for enhanced shale oil production and CO_2 push-pull in enhanced geothermal sites to improve imaging and characterization of faults and fractures.

She received her Ph.D. in petroleum engineering in 2014 from Texas A&M University. Her research interests include unconventional resources, environmental effects of hydrocarbon production, pressure transient analysis, geologic carbon sequestration, control and protection of water, diverse processes of cleaner and safer energy production, enhanced geothermal systems and subsurface energy resources.

Ahmad Sakhaee-Pour comes on board as an assistant professor of petroleum engineering from the University of Oklahoma where he held the same position in the Mewbourne School of Petroleum and Geological Engineering in the College of Earth and Energy. He also served on the curriculum committee of the graduate program of petroleum and geological engineering and the undergraduate advising committee of petroleum and geological engineering.

Sakhaee-Pour's research interests include thermodynamics, fundamental processes, pore-scale modeling and nanomechanics. He received his Ph.D. in petroleum engineering from the University of Texas at Austin in 2012.

LOOKING AHEAD TO 2020

30% FACULTY INCREASE

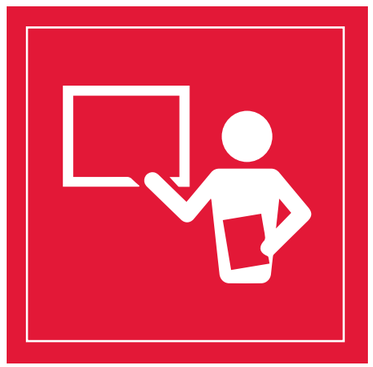
(From 122 in 2015 to 160 in 2020)

Instructional Faculty

Phaneendra Kondapi, one of the pioneering instructors in the college's subsea engineering program, returns to the Cullen College after serving as director of subsea engineering at Texas A&M University. Kondapi will take on multiple key roles, including director of UH Engineering programs in Katy and director of the subsea engineering program. With more than 20 years of experience managing engineering projects at energy industry giants FMC Technologies and KBR, Kondapi brings a unique and invaluable skillset to his new roles in the college.

Hung Le comes to the Cullen College of Engineering in spring 2018 as an instructional assistant professor in electrical engineering. It's a return for Le, who earned his Ph.D. in electrical engineering in 2004 from the Cullen College of Engineering. He worked for 14 years at Hewlett Packard as a master technologist and designer. Most recently he worked at Buoy Health as a technology consultant.

Brian Metrovich joins as an instructional associate professor in the Division of Undergraduate Programs and Student Success. He comes from Case Western Reserve University where he has been an associate professor of civil engineering since 2010. He has held similar positions at the University of Miami and Tulane University in New Orleans. Metrovich specializes in teaching statics and strength of materials.



Industrial Engineering Student's

Disney Dreams Come True

at Disneyland Internship

BY AUDREY GRAYSON

When industrial engineering undergrad **Britney Shum** was a child, nothing cheered her up quite like Pluto, the impossibly affable and loyal canine companion to Disney's Mickey Mouse.

"All our dreams can come true if we have the courage to pursue them."

– WALT DISNEY

The same holds true today. After a particularly stressful day at her internship last fall, Shum liked to walk the 500-or-so-feet from her office to the bustling heart of Mickey's Toontown, where her favorite childhood cartoon character stood in the flesh, happy as ever to put a smile on her face.

Shum is now back in Houston after completing her internship with The Walt Disney Company in Anaheim, California, where she worked with the Industrial Engineering Department's Project Development Team inside of the Disneyland theme park, just steps away from the magical world she was helping to bring to life.

And there, in the land of Pluto and Mickey, Shum says she not only found her passion for industrial engineering, but also the career of her dreams.

"The flower that blooms in adversity is the most rare and beautiful of all."

– THE EMPEROR, "MULAN"

For Shum, the Disney dream was a long time coming.

Growing up, Shum always dreamed of going to Disney World. When she graduated from the University of Texas at Austin with a bachelor's degree in business in 2011, Shum's parents surprised her with a trip to Disney World in Orlando, Florida.

"It was the best time of my entire life," Shum said. "So many adults are running around as if they're children. Disney has such a positive impact on so many people, no matter how old or young they are."

From that moment on, Shum said her mind was made up: "I knew this was my dream. I wanted to work for Disney."

At that time, Shum had never heard of industrial engineering. She was also unsatisfied with the current direction of her career.

Then, while surfing the internet, she did something so many of us do multiple times a day – she accidentally clicked a link on a website she didn't mean to click on. It was an innocuous mistake that would change her life forever.

Shum had stumbled upon the website of the industrial engineering department at UH by accident, but once she arrived there, she never really left. She applied to the undergraduate program and enrolled at UH in 2015.

When she arrived at UH, Shum says her dreams for the future began to multiply.

"Even miracles take a little time."

– FAIRY GODMOTHER, "CINDERELLA"

Prior to her internship with Disney, Shum had already gained professional experience in both energy and healthcare through prestigious internships with Cameron and MD Anderson. Despite her wide range of technical experience, Shum said nothing prepared her for her internship at Disney quite like the industrial engineering courses at UH.

"Industrial engineering at Disney is very specific to Disney. The projects I worked on were very unconventional, so nothing I could have learned through textbooks could have prepared me," Shum said. "I was prepared for the position because the industrial engineering department taught me analytical thinking skills."

While at Disney, Shum would often recall something that Gino Lim, chairman of the industrial engineering department, said in his linear optimization course: "It's one thing to know the right answer, but it's another thing to know what it means."

"Dr. Lim taught us that you have to understand the technical side and translate that to non-engineers, and that takes a lot of creativity," Shum explained.

At a place like Disney, where, according to their website, "Imagineers bring art and science together to turn fantasy into reality and dreams into magic," creativity is a commodity in high demand.

For instance, Shum recalls working with a senior industrial engineer on a project involving "Cars Land," a land inside of the theme park which, as the name implies, is devoted entirely to the Disney-Pixar movie franchise "Cars."

There was only one problem: Shum had never seen any of the "Cars" movies. Despite all of the industrial engineering experience she brought to the table, Shum had a full plate of homework to get through if she wanted to succeed at her new internship: Watch "Cars" and "Cars 2" as closely and as soon as possible.

Beyond just enjoying the movies – which she did, thoroughly – Shum said the experience made her an all-around better engineer. "No detail is overlooked with Disney. You have to understand the Disney storylines to be able to understand the characters we're bringing to life," Shum said.

These are the invaluable engineering lessons that Shum says she's brought back to Houston with her: No detail is too small to overlook and always, always engineer with the end-user in mind.

The experience connected-the-dots for Shum, lighting a fire inside of her that brought new focus and clarity to her career. "I saw this is where my passion is," she said.

"In every job that must be done there is an element of fun."

– MARY POPPINS, "MARY POPPINS"

Back at UH to tackle the final year of her bachelor's degree, Shum says she has a new appreciation for the industrial engineering field and her future in it.

"At its core, industrial engineering is about connecting the technical side of things with the people side of things," Shum said. "You have to present information to someone who doesn't care about your spreadsheet or your graph, so you have to tell them a story in a creative way that they would care about."

Shum said she felt compelled to share her newly found passion for her field with other students. A member of the UH chapter of the Institute of Industrial and Systems Engineers (IISE), Shum launched a mentorship program within the organization to help new industrial engineering students choose classes, find study groups and get advice on professors and activities.

"I'm so excited about what I'm doing now, but it scares me that I sort of stumbled on it by accident," Shum said. "I wanted to find a way to inform other students about what the industrial engineering field can offer much earlier than I found out about it."

"Venture outside your comfort zone. The rewards are worth it."

– RAPUNZEL, "TANGLED"

After deciding on a career change and arriving at the UH industrial engineering department, things didn't get easier for Shum right away.

"Your first year as an engineering student is tough. Finding a mentor who's farther along in the program and can give you advice is crucial," she said.

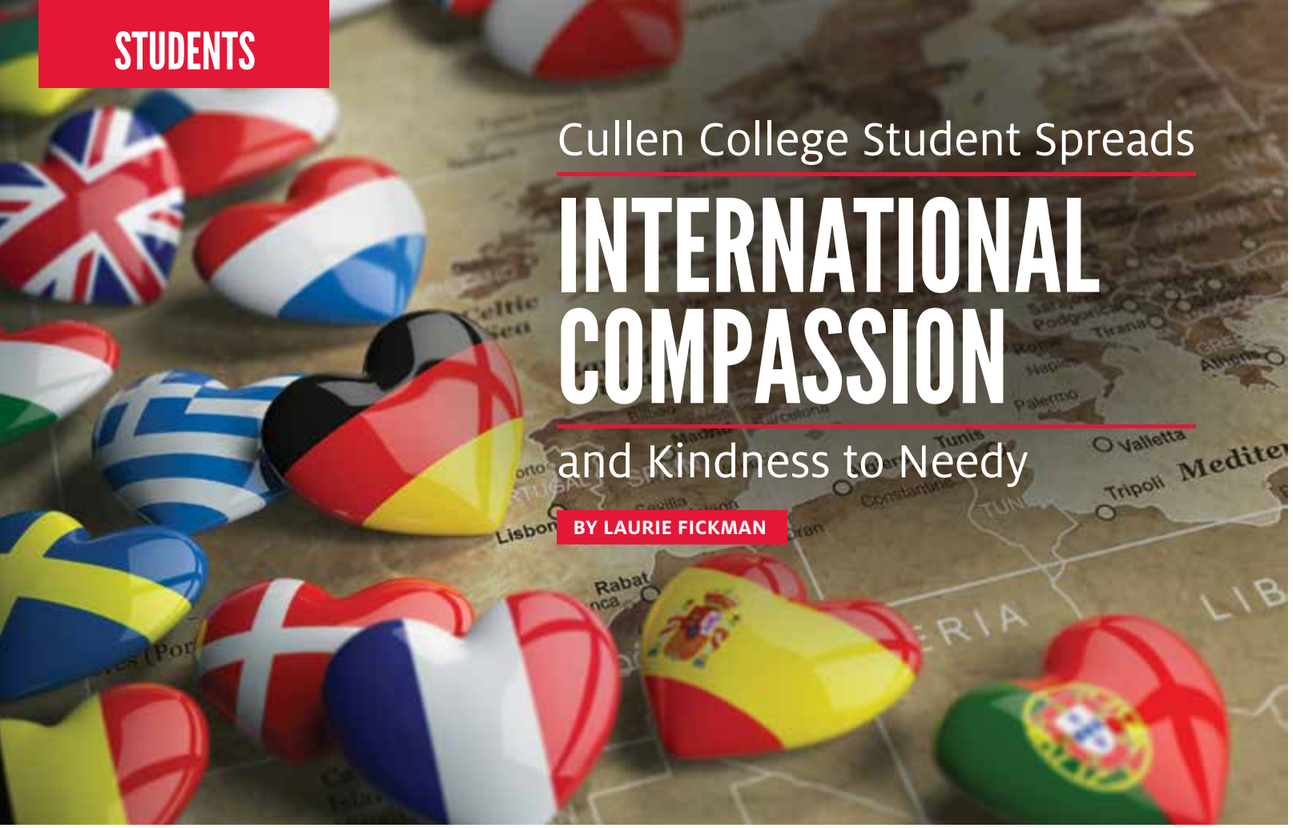
Shum and other chapter officers paired seven first-year students with upperclass mentors through the IISE mentorship program, now in its second year. They also launched a welcome orientation for all first-year industrial engineering students.

"We're a small department, so I really wanted to leverage that smallness to be more like a family – to know everyone else's name and help each other out," Shum said. It's just the type of dream for the future that you'd expect from a Disney enthusiast.

In a fantasy future, Shum says she'd be working full-time as an industrial engineer with Disney. It's extremely competitive – there are usually only a few openings for hundreds of well-qualified candidates – but she's not willing to give up on the Disney dream quite yet.

Shum just wrapped up another Disney internship, this time at the Disney World theme park in Orlando, Florida. It seems in Shum's case, Cinderella's advice was right:

"If you keep on believing the dream that you wish will come true."



Cullen College Student Spreads

INTERNATIONAL COMPASSION

and Kindness to Needy

BY LAURIE FICKMAN

HAITI

In the summer of 2015 UH biomedical engineering student **Pietro Cicalese** found himself surrounded by astonishing squalor in Haiti. The area was densely populated yet there was no water or medical resources for the sick. And the houses – if you could call them that – were shacks.

"I have never seen anything like that. It was very eye opening to see poverty of that scale," said Cicalese.

Fortunately for Cicalese, he was a visitor, a volunteer with the Friends of Haiti group, learning how to take basic vital statistics and creating impromptu triage areas for doctors to treat the impoverished patients.

Cicalese says the trip was a moment in time he will never forget. In fact, he's based much of his present life on what he saw there, founding the Global Humanitarian Student Initiative (GHSI) group to offer student services for humanitarian relief efforts around the world.

> "It's important for students to invest energy to develop themselves as opposed to just developing their résumés."
>
> - PIETRO CICALESE

By the time Cicalese graduates in 2018 from the Cullen College of Engineering, he'll have earned two degrees – a bachelor's and master's in biomedical engineering through the accelerated master's fellowship program.

He'll also be a noted humanitarian.

Doing it themselves

Not content with merely being a part of a non-governmental organization like the Red Cross, for example, Cicalese yearned to have students run their own humanitarian program, set their own schedules and recruit their own medical professionals to assist them.

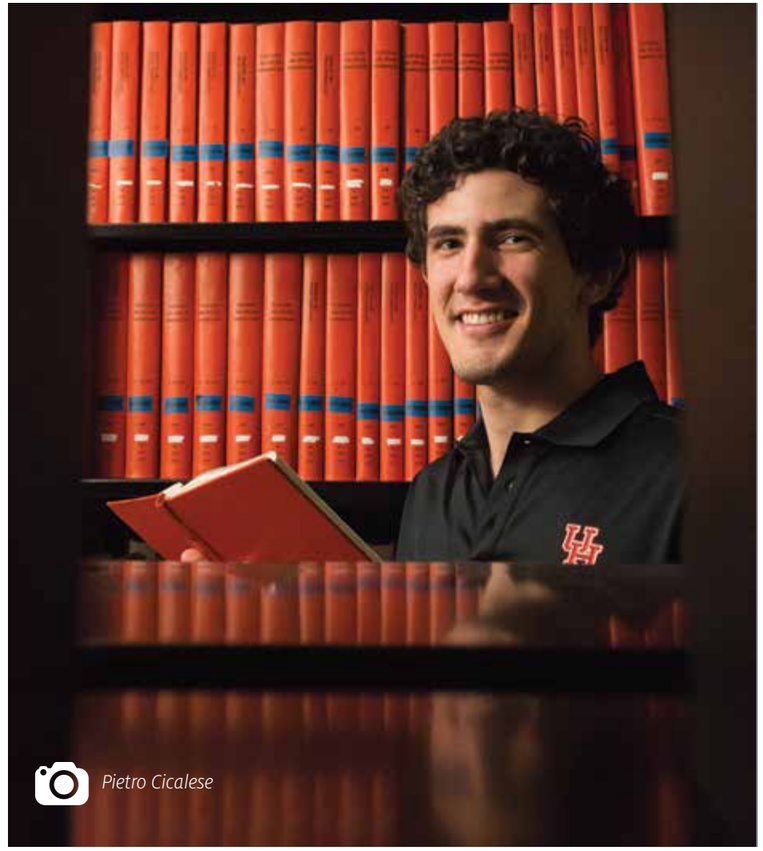
"I think students should be actively trying to better themselves in terms of leading these kind of initiatives, especially students interested in going to medical school. It's important for those students to invest energy to develop themselves as opposed to just developing their résumés," Cicalese says straight from the heart, because he is one of those students.

No doubt, his application to medical school will look stellar.

A natural

Born in Italy to two doctors, Cicalese and family moved to America when he was a baby, and as early life experiences tend to inspire, he was compelled to both travel internationally and become a doctor. His parents' dedication to their patients impressed him from a young age.

"Their role in inspiring me to do this kind of work was their philosophy on medicine and how the well-being of a person should be put above all else," said Cicalese. With that strong sense of compassion, he moved forward, founding GHSI along with a fellow student at the time, Dennis Kunichoff, to do what they could, as undergraduates, to empower students to coordinate and conduct their own humanitarian service trips at home and around the world. From the pair of founding members, GHSI now has 30 students on its roster.



Pietro Cicalese

ITALY

First stop: Sicily

For the first trip, in the summer of 2016, Cicalese and nine other students traveled to the island of Sicily in Italy for 11 days to help the migrant and refugee populations there. They took along one U.S. doctor, Cicalese's father, and they teamed with the University of Palermo and a non-profit Mediterranean research institute, which provided additional doctors and assistance.

In the remote area he visited, Cicalese said there is a lot of mistrust toward medical professionals among the migrant populations, but students were able to build the trust by simply being honest.

"We would have open discussions that would last hours, just discussing what we wanted to do and how we wanted to help, and really highlighting the fact it hadn't been done before and we had no model to follow, and that we were just doing our best with what we had," said Cicalese.

No surprise that the model they created, having kind and interested young students pre-screen patients, turned out to be highly effective.

GREECE

On to Greece

In the summer of 2017 the group traveled to Greece with two UH professors, Anjali Kanojia of comparative cultural studies and Bradley Smith from the psychological health and learning sciences department.

The focus of the Greece trip was to study the Syrian migrant crises and its impact on Greece.

"The vast majority of what we saw in Greece was mental trauma," said Cicalese.

As a side project Cicalese has launched a research migration program to delve into his Italian heritage. "We're doing research on the migration of Italians to the United States to understand what caused them to move from Italy and if they've found what they're looking for in the U.S.," he said. His pet project was funded by the Italian government.

Sounds like autobiographical work for this budding doctor born in Italy, and he'd probably answer in the affirmative. He's found exactly where he belongs, at the corner of healthcare and humanitarianism.

SPEEDING TO THE FINISH LINE:

UH Senior Wins Prestigious Automotive Award

BY LAURIE FICKMAN

Grant Mottershaw, a senior in mechanical engineering at the Cullen College of Engineering, received the 2016 Rumbaugh Outstanding Student Leader Award in Detroit at the Society of Automotive Engineers (SAE) International World Congress. SAE is a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries.

Annually, SAE identifies and recognizes an outstanding student leader and, through the award, encourages "a vision within the recipient to become an SAE leader during his/her adult career," according to SAE. Among the honors, Mottershaw becomes a lifetime member of the organization.

SAE cited Mottershaw for demonstrating outstanding leadership skills for his involvement with the UH Formula SAE (FSAE) project, in which the team designs and builds a Formula One-style race car from the ground up to compete in the Formula SAE Series (FSAE) races.

When Mottershaw joined the group, it was sputtering. There had been one group started in the College of Technology and one in the Cullen College, but neither group was positioned yet to get out of the starting gate.

So Mottershaw took the wheel and revved up the operations, financial management and new member recruitment. He also is on the team building the car's chassis, which is the frame of the vehicle.

FSAE-UH team members pose next to their hand-built Formula One-style race car

Setting it on cruise

"The goal from the beginning was to build a sustainable organization," said Mottershaw. "I like to think of FSAE as a microcosm of what goes on in the real world – you have to raise the money, allocate your resources, deal with politics and you still have to have a product at the end of the day."

And so he went to work, studying other FSAE models of success to perfect a plan for the UH team. He recalls a quote that helped drive his success: "First you must finish, then you can finish first," said Mottershaw. And to finish, they needed money. No coincidence that if Mottershaw wasn't an engineer he says he'd like to be a financier. Since he took control, the organization has raised $115,000 in cash and in-kind services.

An Eagle Scout at 16, Mottershaw has always combined leadership skills with his love of building things and solving problems.

Even after returning from the whirlwind award ceremony in Detroit, Mottershaw says winning hasn't sunk in. Admittedly, he says, "it's awesome," but what was greater for him was presenting to the groups of industry professionals and getting the opportunity to meet them.

Mottershaw has high hopes of becoming a professional in the auto industry.

Naturally. He's geared for it.

WE'RE #1!

IEEE-UH is Outstanding Large Branch

BY ASHLEY SCHWARTZ

The Institute of Electrical and Electronics Engineers (IEEE) student chapter at the University of Houston Cullen College of Engineering (IEEE-UH) received high honors at the 2017 IEEE Region 5 Annual Conference and student competitions held in Denver, Colorado in April.

IEEE-UH received the Outstanding Large Student Branch Award for achievements in outreach and programming in 2016, beating out branches from the University of Texas, Rice University and the Colorado School of Mines.

The award is based on overall branch activity, including social events, fundraising, service projects, academic performance and participation in IEEE initiatives.

IEEE-UH graduate chair, Jesus Cruz-Garza, spearheaded the application process.

"We have been working closely with the IEEE Houston Section in event programming, so they were well aware of our work and recommended that we apply for the IEEE Region 5 award," said Cruz-Garza.

According to the group's president, Moriah Hargrove-Anders, IEEE-UH plays an integral role in the Cullen College's electrical and computer engineering department.

"We serve as a source of student opinion both in department affairs, through our Student Advisory Committee, as well as with outreach events, by providing university students the opportunity to teach younger students about electrical engineering," Hargrove-Anders said.

"Our organization works as a bridge for IEEE national to work with undergraduate, graduate, national and international students at the University of Houston," said Cruz-Garza. "We host engineering workshops, seminars and international competitions on campus, spread the word for grants and scholarships and provide our members a link with industry representatives."

Len Trombetta, associate chair of electrical and computer engineering and faculty advisor of IEEE-UH, is impressed by the achievements of the organization and believes it is a testament to the consistent dedication of the students. "This year's IEEE-UH members and officers have exceeded my expectations. I have enjoyed advising these students as they transform into leaders," he said.

When asked about her hopes for the future of IEEE-UH, Hargrove-Anders explained, "As a student organization, I hope that we can continue to show our classmates and the electrical and computer engineering department that IEEE-UH is an indispensable resource."

TO LEARN MORE ABOUT IEEE-UH AND HOW YOU CAN BECOME A MEMBER, VISIT
http://ieee.ece.uh.edu/

BEING THE BEST:

National Society of Black Engineers at UH is

#1

in U.S.A

BY LAURIE FICKMAN

Sometimes you're just born knowing what you want to do.

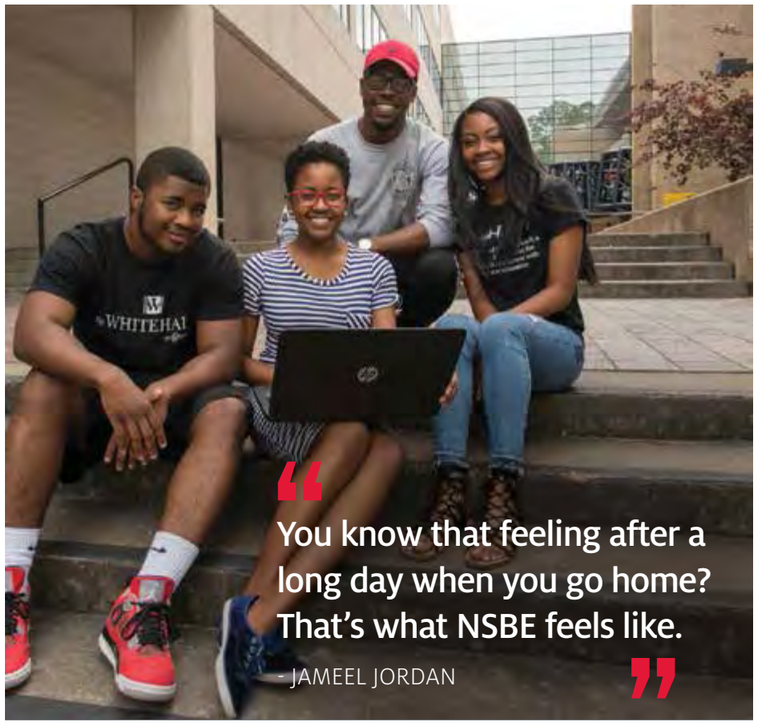
"In fourth grade I wrote a paper on being an architectural engineer, and I wasn't quite sure if that really existed," said **Jameel Jordan,** senior petroleum engineering student at the Cullen College and president of the National Society of Black Engineers (NSBE) at UH.

So now, to make sure fourth graders – and others – know exactly what engineering is, Jordan and his executive team of NSBE at UH conduct outreach programs, student mentoring sessions and other pre-college initiatives to introduce the heady concepts of engineering to youngsters.

"Our overall goal of national NSBE is to reach the graduation of 10,000 black engineers yearly by the year 2025," said Jordan. "So, as a part of that, each chapter should be geared to helping achieve that goal and that's where we come in."

That advocacy for engineering caught the eye of the NSBE national board at the annual conference in Kansas City, Missouri. It's one of the reasons national officials selected the UH group as Outstanding Chapter of the Year, chosen from more than 250 others. NSBE at UH sent 56 engineering Cougars to the convention, a large showing by any measure.

NSBE is one of the largest student-governed organizations based in the United States. Its mission is "to increase the number of culturally responsible black engineers who excel academically, succeed professionally and positively impact the community." A quick review of its UH roster and you can see they are well on their way to completing that mission.



From left: Jameel Jordan, Amira Spikes, Nnamdi Emebo and Kayla Nash

The dream executive team

Amira Spikes, membership chair for NSBE at UH, is the only Gates Millennium Scholar on the UH campus. Funded by a grant from the Bill & Melinda Gates Foundation, the Gates Millennium Scholars program promotes academic excellence, provides opportunities and reduces financial barriers for a select group of outstanding students of color.

Like Jordan, Spikes wanted to be an engineer since she was in elementary school. Also like Jordan, she wanted to be an "architectural engineer," a job title she, too, thinks she might have made up.

"I remember when I was in seventh or eighth grade people would say, 'That doesn't even exist.' But then others said engineering was a great field," said Spikes. In her early high school years in Denton, Texas, she attended an Upward Bound Math and Science camp and her goal gelled. Now she's an environmental science and biology major.

It took **Kayla Nash,** a junior in civil engineering, only until her senior year of high school in Spring, Texas, to decide on engineering. Even though she went to a specialized career high school, she said she felt lost when she first came to UH until she joined NSBE.

"This is definitely a family environment," said Nash. "I remember when I first came in as a freshman, I didn't know anybody. I just knew I wanted to get involved and everyone was welcoming and so I was able to find my mentor. Any time I had a question about anything – a résumé or a career fair – people that had been through it before were able to help me."

None of them seemed to need family more than **Nnamdi Emebo,** a junior in petroleum engineering and NSBE UH treasurer, who left his parents in Nigeria to study here. In an effort to develop himself professionally, he joined NSBE at UH.

"The more I got introduced to the members and the executive board I felt we became friends and they became my mentors who were actually guiding my path in school," said Emebo. He met Jordan through NSBE, and they became fast friends.

"Now we're like brothers. We study together and go everywhere together and it was through NSBE that we developed that brotherhood and true friendship," said Emebo.

Professional benefits, too

Nash credits her activity in the organization with scoring an internship with civil engineering firm Cobb, Fendley & Associates.

"I know if it was not for NSBE I would not have gotten that internship," says Nash. "I didn't really know how to talk to professionals and I learned that all through NSBE."

Added Spikes, "I like to think of NSBE as connecting your education to your professional life so you'll be well rounded and prepared for your career. We bring professional engineers in to discuss what recruiters want to see from you and how you can best present yourself, even how to dress."

Equally prestigious internships abound on the executive team. Jordan nabbed a position at Northrop Grumman in Los Angeles, and Emebo at Goldman Sachs in New York.

But not all members of NSBE at UH are ready yet to score the big job or internship. For the younger students or those that need extra tutoring, the chapter provides collaborative studying environments and study nights where anyone in need can learn from their peers. All of them say they have been through that period, where assistance is needed.

Jordan says it's a comfortable environment that breeds success.

"You know that feeling after a long day when you go home? That's what NSBE feels like," said Jordan.

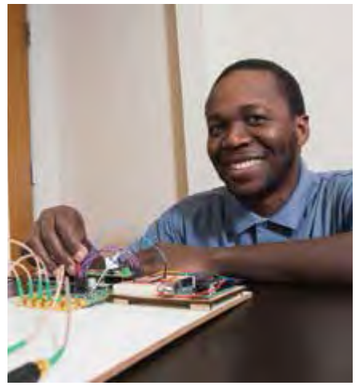
Home indeed. And recognized as one of the finest addresses in the U.S.

CHARGING BATTERIES?

A Thing of the Past Says Cullen College Graduate Student

BY ASHLEY SCHWARTZ

It's hard to imagine a world where you don't have to worry about charging your cell phone or changing the batteries in your smoke detector. According to electrical and computer engineering doctoral student **Fahira Sangare,** that world may be closer than we think.



In a recent presentation to NASA, Sangare discussed his research in energy transfer and harvesting techniques that can be used to power the next generation of wireless networks.

"What we are trying to do is harvest signals from the air," said Sangare. "Instead of using a power source through a plug or battery, we are trying to get energy from radio signals that we can harvest and convert into a DC voltage used to power the device."

This emerging technology involves state-of-the-art circuitry that allows the device to search proactively for the strongest radio signals and a super-capacitor that stores the energy within the device.

"When we find the energy, there are two ways for us to store it. We either use the energy directly to operate or we get the energy and store it in the device," said Sangare. "The advantage of using a super-capacitor is that it can be charged very fast and it has more recharge cycles. It also lasts longer, making it more environmentally friendly."

> "I just want to do something that makes an impact on the world."
> - FAHIRA SANGARE

The device must also be multichannel, so if a Wi-Fi signal becomes weaker over time the device is able to search to find another frequency that it can channel and harvest.

"Currently we are looking at low power devices. For example, a carbon monoxide sensor that is embedded in your house," said Sangare. "This sensor could have a tag that harvests the energy needed to operate and communicate with your cell phone to alert you if something is wrong."

When asked about the future, Sangare said he hopes to continue this research and expand its applications.

"I just want to do something that makes an impact on the world. My dream is to find a way to get low amounts of energy in the air to power bigger devices like cell phones."

Why This Grad Student Who Studies Batteries is

CHARGED UP

BY ASHLEY SCHWARTZ

Karun Kumar Rao, a first-year chemical engineering doctoral student in the UH Cullen College of Engineering, has been offered a place in the esteemed NASA Space Technology Research Fellowship (NSTRF) program for his research on solid-state batteries.

Standard lithium-ion batteries, which power much of the modern world, are composed of two solid layers, called electrodes, separated by a membrane infused with a liquid or gel electrolyte. Recent research has explored replacing the potentially flammable liquid layer in these batteries with a solid electrolyte, which can increase the safety and energy storage density of the batteries.

But several challenges remain before all-solid-state batteries can takeover their lithium-ion counterparts. As a NASA Space Technology Research Fellow, Rao will further develop computational methods used in chemistry and material science to build a fundamental understanding of solid-state batteries and verify the simulations experimentally. NASA is particularly interested in Rao's research because it may yield safer, lighter and more temperature-resistant batteries, which can eventually be used in space exploration.

> "[Karun's] motivation and initiative is rather remarkable and something I haven't seen with many students. - LARS GRABOW"

"We want to take materials that we know work and apply computational models to understand their properties at an atomic level," said Rao. "Once we know how those materials work, can we design better ones for these batteries."

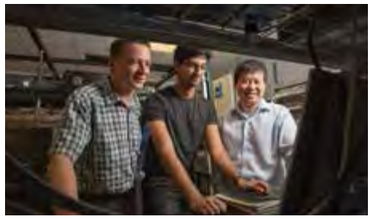
Together NSTRF and NASA sponsor U.S. citizen and permanent resident graduate students who show significant potential to contribute to NASA's goal of creating innovative new space technologies for the nation's science, exploration and economic future. Each student will be matched at a NASA location with a technically relevant and community-engaged researcher, who will serve as the student's professional research collaborator. The research collaborator will serve as the conduit into the larger technical community corresponding to the student's research interests.

The fellowship spans the 2017-2018 academic year with the potential of a three-year extension. Fellows have the opportunity to spend 10 weeks each year researching at a NASA facility or center and are given a travel budget to attend conferences.

"I was extremely excited to hear I was accepted into this program," said Rao. "NASA's work has impacted so many people in so many ways, and to be able to both contribute to, and learn from that, is an amazing opportunity."

Rao is co-advised by electrical and computer engineering Assistant Professor Yan Yao and chemical and biomolecular engineering Assistant Professor Lars Grabow, both of whom were impressed with the quality of his research and character.

"I am not surprised that he was offered this fellowship," said Yao. "Karun is an extremely gifted student whose research in solid-state batteries and how they can be improved for space applications is of special interest to NASA."



Top: Karun Kumar Rao
Bottom: Lars Grabow, left, and Yan Yao, right, guide Karun's research

Grabow, equally impressed with Rao's research, added that his self-starter attitude sets him apart from the crowd.

"Karun is incredibly independent. He identified Yan and I and approached us with his own project idea," added Grabow. "He has used his creativity, his imagination and his independent thinking in preparing the NASA fellowship proposal. His motivation and initiative is rather remarkable and something I haven't seen with many students."

When asked about what he hopes to learn during his fellowship, Rao explained, "NASA researchers have expertise in a wide range of fields, from fundamental electrochemistry to manufacturing principles and techniques. I am eager to learn from them, and can't wait to work with so many different amazing researchers and laboratories."

SUCCESS SWARMS

Around Electrical and Computer Engineering Students

BY ASHLEY SCHWARTZ

Last April a team of four undergraduate students from the UH Cullen College of Engineering's electrical and computer engineering (ECE) department competed in the 2017 NASA Swarmathon at the Kennedy Space Center in Florida. The team placed second out of 19 teams.

The team was made up of undergraduate students **Austin Dodge**, **Luis Robles**, **Steven Ventura** and **Vinh Vu**. Master's student **An Nguyen** and Assistant Professor Aaron Becker advised the students.

The NASA Swarmathon challenges college and high school students throughout the country to compete in developing algorithms and computer code to control large numbers of small robots, known as "swarms," to perform specific tasks on the surface of Mars.

"Every year the competition organizers add a new element to the contest, so this year our swarmies had to pick up cubes and deliver them to a home base while roaming the surface of mars," said Dodge.

This year's competition required teams to use the swarms to find and collect resources without using maps. Provided only with robots that are programmed for specific uses, such as cleaning up hazardous waste or rescuing people in disaster areas, the competitors had to write algorithms that allowed the robotic swarms to perform the new tasks.

With only two months to prepare for the competition, the UH team found the project to be a crash course in engineering, computer science and robotics.

"In two months we had to learn about the robot operating system," said Vu. "Since you cannot modify the robot, we had to rely solely on our software skills."

The Swarmathon competition also doubled as the UH team's senior design project, helping the undergrads connect-the-dots between classroom lessons and their real-world applications.

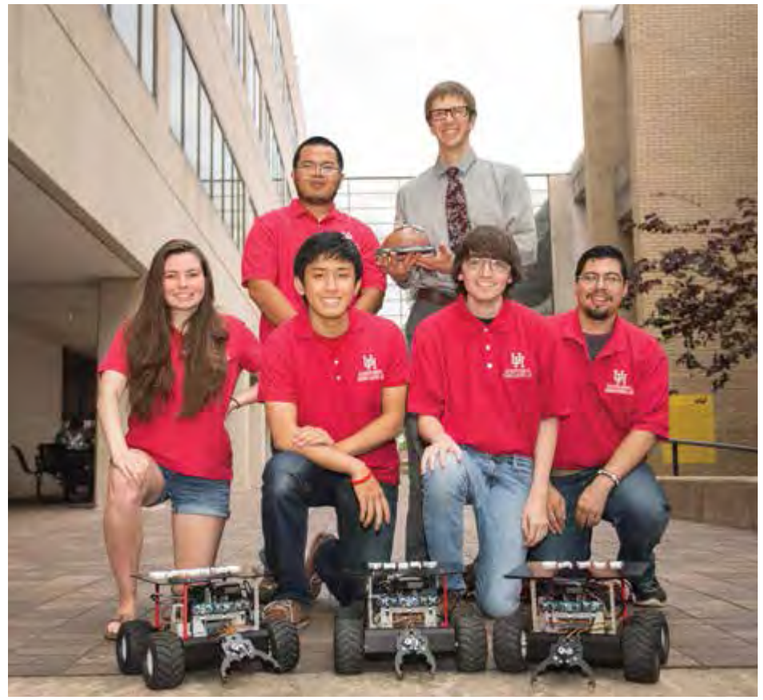
"I liked the connection to NASA and that the project went beyond hardware and explored the programming of robots," said Robles.

The team also appreciated the opportunity to meet fellow future engineers while attending the competition.

"I made friends with other students and we talked about the algorithms and the code we were given by NASA, so that was great" said Ventura. "We were also able to talk to the NASA engineers and that made me want to work with NASA one day."

Becker said the most rewarding part of working with the team was watching the students work through the problems and grow in the process.

"I love when the students say, 'We got this demo ready and it works!' Seeing their victories is the fun part. They broke down a big problem into a set of small challenges, then added these components together to build a winning combination," Becker said.

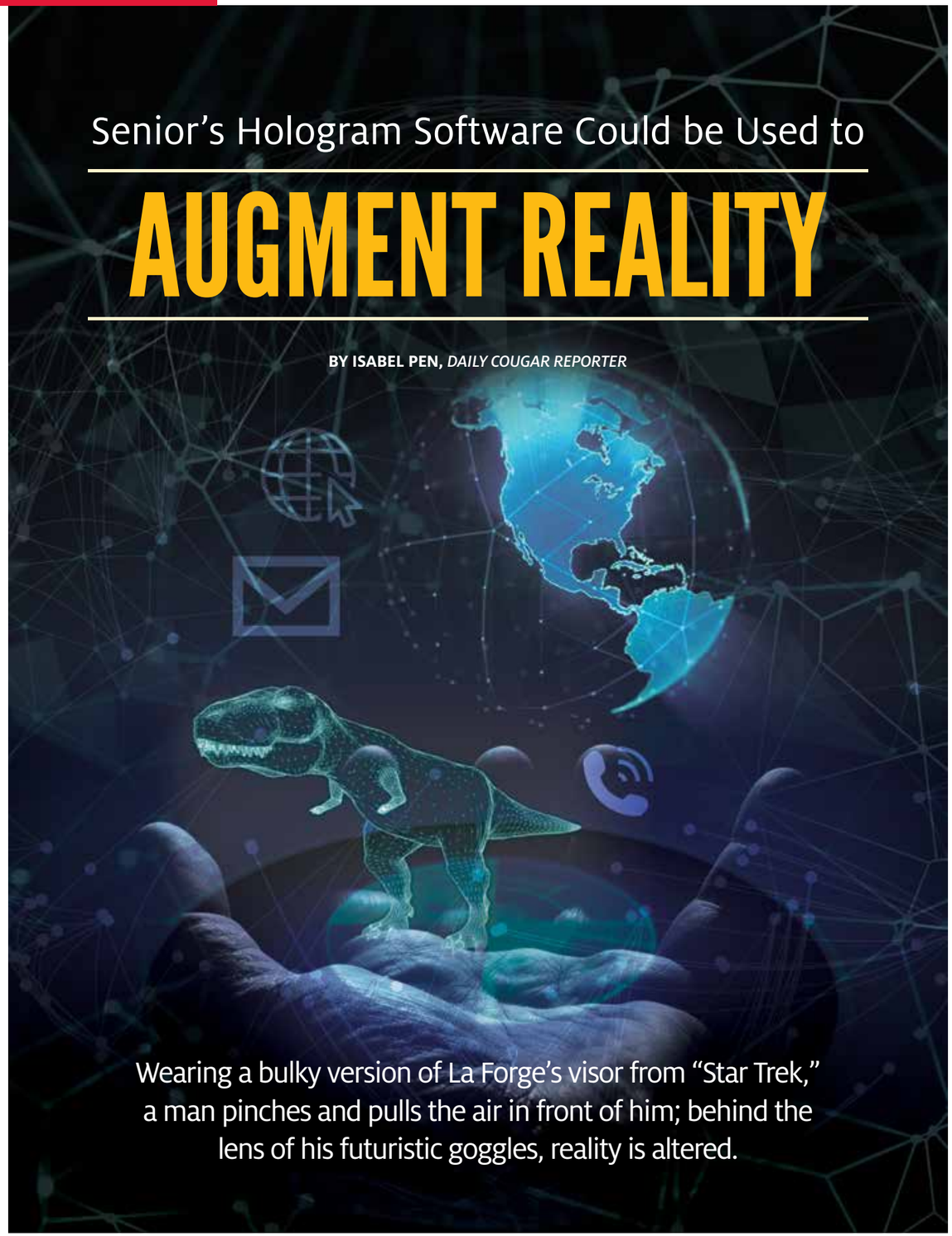


Top: UH Swarmathon team with advisors Aaron Becker, top right, and An Nguyen, top left
Bottom right: credit - NASA/Dmitri Gerondidakis

Senior's Hologram Software Could be Used to

AUGMENT REALITY

BY ISABEL PEN, *DAILY COUGAR REPORTER*



Wearing a bulky version of La Forge's visor from "Star Trek," a man pinches and pulls the air in front of him; behind the lens of his futuristic goggles, reality is altered.

University of Houston mechanical engineering senior **Evan James** is developing software for a device that creates an immersive augmented reality experience. The Microsoft HoloLens can be used to aid engineers in visualizing and interacting with their ideas in three-dimensional space.

"HoloLens is the true and most superior first-generation mixed-reality device that projects for a user a layer of relevant information on top of the physical objects or environment," said computer science research assistant professor Chang H. Yun.

The technology enables the wearer to see holographic versions of objects or people and view them from all angles as if they were in the same room.

"As a mechanical engineer, it's all about developing technology that can help our work process," James said. "So, what I've built is a holographic topographical map of the Gulf of Mexico to visualize where the oil pockets are."

James is no stranger to getting creative with technology; his creative insights were recognized after making it to the finals in the U.S. Microsoft Imagine Cup 2015. Windows Insiders, a select group of developers given the first opportunity to experiment with new Microsoft technology, invited James to be a member.

Once approved, James received a developer edition of the Microsoft HoloLens in order to begin designing applications to see the technological world in a whole new dimension.

Though James uses the wearable computer to generate three-dimensional models of the ocean floor, he says the applications of this technology are limitless.

"Right now, the field is taking off," said computer science graduate student Daniel Biediger, who researches augmented reality for visualization, education, simulation and training. "There are many projects that involve construction, planning, medicine, data visualization and even games. It's much more natural to interact with higher-dimensional data in higher dimensions."

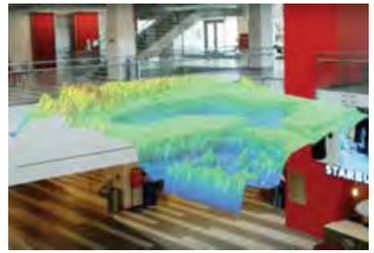
James said the HoloLens could prove to be useful in providing a three-dimensional full-size blueprint, which contractors could build on top of to ensure precision construction. Holograms could help medical students understand how the human body works by zooming in on specific organs to observe their function.

The technology could even host a game that scans the room and layers virtual walls and objects on top of the real world to create an immersive augmented-reality video game.

Virtual holograms could also revolutionize the way people live their daily lives.

> "IT'S THE IMAGINATION THAT COMES FIRST. Everybody who created something started with a GREAT IMAGINATION."
>
> - EVAN JAMES

"Unlike watching TV, which requires you to sit or stand in front of the device, or talking on the phone, which requires you to hold the device to your ear, this technology requires no specific posture," said James. "Your hands are completely free and you're not required to sit down; you can look at the data while you're working on something else."



James can manipulate the size and position of a hologram – in this case, a 3D topographical map. Photo courtesy of Evan James

James imagines a world where someone wearing a HoloLens, which is controlled either by in-air hand motions or voice commands, can pull up the user manual while they're fixing their car, or have a recipe from a cookbook in their field of vision while they're trying to prepare a new meal.

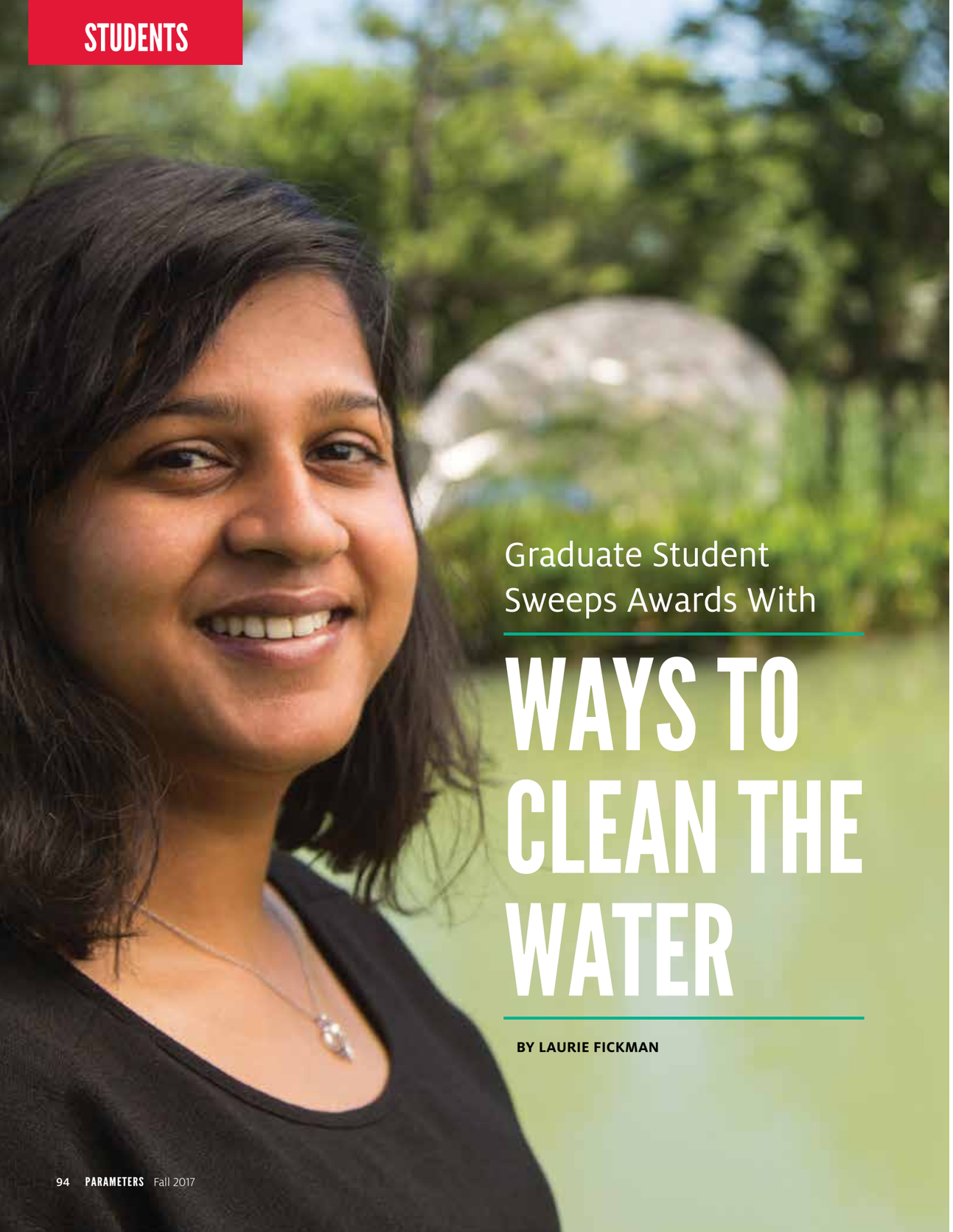
With his military background, James envisions a future in which he can communicate with his loved ones while overseas via "holoportation." By fitting a room with special cameras, he would be able to see the holographic form of his mother and children using the HoloLens as a viewing device.

While they haven't had any takers in the big oil world, they have piqued the interest of a drill bit company. In the meantime, James develops other apps that utilize this holographic capability. In the not-so-distant future, mixed reality could become a part of the everyday experience for the American household, Yun said.

"You can make a lot of stuff with this technology," James said. "It's the imagination that comes first. Everybody who created something started with a great imagination."

This article was originally published in the Daily Cougar.

READ THE ORIGINAL STORY AT
http://thedailycougar.com/2017/03/22/seniors-hologram-software-used-augment-reality/



Graduate Student Sweeps Awards With

WAYS TO CLEAN THE WATER

BY LAURIE FICKMAN

Aparna Balasubramani poses between her proud parents

While completing her doctorate in environmental engineering **Aparna Balasubramani** found that carbon nanotubes may be the one of the best ways to stop poisonous polychlorinated biphenyls, or PCBs, from entering waterways. Officials at the Texas Water Convention noticed the gravity of her work and awarded her first place at the annual university forum for her paper called "Influence of carbon content in sediment towards sequestration of polychlorinated biphenyls (PCBs) by carbon-based materials."

In her study, Balasubramani compared emerging nanomaterials with existing carbon-based materials to see which best adsorbs PCBs to reduce contamination. (Absorption is when molecules become assimilated throughout a solid or liquid. Adsorption is when molecules gather on the surface of a solid or liquid.)

"We found that carbon nanotubes performed better than the other four sorbents tested," said Balasubramani. "If there was a decrease in the organic carbon then higher concentrations of PCBs are seen in the water." That was proof that carbon nanotubes were adsorbing PCBs, which pose human and environmental concerns.

To get that proof, Balasubramani tested historical samples of Galveston Bay water and used computer modeling.

Where they come from

Back in the day, before stricter environmental laws, poisonous man-made organic chemicals – PCBs – seemed to flow into the water at full strength, unchanged by anything in their way. Domestically manufactured beginning in 1929, they were banned in 1979, after decades of this electrical byproduct had polluted waterways. Because of their presence in lakes and rivers, PCBs eventually made their way into the food chain, consumed first by fish and eventually by people who ate the fish. And though they're not manufactured anymore, there is an enormous amount of PCB residue that continues to infect waterways.

Those are some of the issues that Balasubramani is prepared to base her life's work on remediating. It was at the heart of her dissertation, and this is not the first time she's won an award for a study on ridding waters of toxic chemicals. Previously the Battelle organization awarded her at their Ninth International Conference on Remediation and Management of Contaminated Sediments, one of the most prestigious professional gatherings in her field.

Now that she's won first place on the state level, the Texas Water Convention will send her to the American Water Works Association Annual Conference and Exposition in Philadelphia. There she will represent the state in the Fresh Ideas Poster Session competition.

Then she'll publish her findings in a journal article so the rest of the world can benefit from her discovery.

Controlling the poison

With her findings, Balasubramani says release of PCBs into waters can be controlled by mixing carbon into sediment. In fact, by doing so she found the amount of PCB could be reduced by 35 percent.

"It gives you an idea of what can be achieved," she said, excitedly, about the future.

She's a good one to talk about achievements and the future. With her doctorate in hand, she'll be testing the waters and making many more of them for years to come.

Advanced Computing Summer Course

TAPS INTO TALENT EARLY

BY LAURIE FICKMAN

Andrea Prosperetti, Distinguished Professor of mechanical engineering, takes pride in discovering talent in unusual places. Like, for instance, the pool of freshman students at the UH Cullen College of Engineering and the College of Natural Sciences and Mathematics. For a National Academy of Engineering member who mostly teaches seniors and graduate students, soon-to-be sophomores are an untapped resource, and one for which he created an advanced summer program, "Vistas in Advanced Computing."

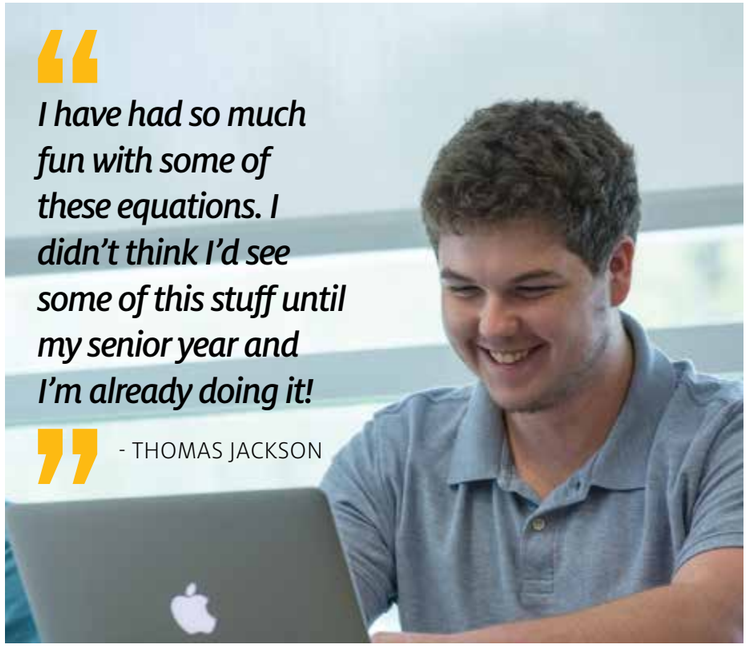
His logic regarding throwing them into the figurative deep end of science is pitch perfect.

"If you start playing the piano, you have scales for months and that doesn't help you fall in love with the piano," says Prosperetti, launching into poetic expression about the science that sparks his passion. "So what we are doing is giving them the easiest pieces by Chopin earlier than they would get them, to whet their appetite for science and numerical simulation."

Now nine students who exhibited advanced skills in calculus and physics during their first year of college are part of Prosperetti's eight-week, eight-hour-a-day summer program at the UH Center for Advanced Computing & Data Systems (CACDS). Each student has been awarded a $4,000 scholarship to learn coding, mathematics and computer architecture, an opportunity many of them would have never gotten so early in college.

"The idea is that we are giving them a compass to guide them in their future careers," said Prosperetti. "We are going to open their minds to the breadth of advanced computing and explain to them how cool computing is."

Funny thing, some of them already understand that part.



When Jon Genty, an 18-year-old computer engineering major and student of the Honor's College, heard about Prosperetti's new class, he had one thought: "I had to get in!"

"This is exactly where I want to go with my career and most students don't even get into coding until their junior or senior years," said Genty, one of those rare freshmen who already knows where his future lies. His plans include a Ph.D. in computer engineering and then the discovery of something in his field because, as he said, "It'd be cool."

Now's the time

According to a 2014 report by the U.S. National Academies, there is an urgent need "to prepare, nurture and grow the national scientific workforce for creating, utilizing and supporting advanced cyberinfrastructure."

And the only way to do that, according to Prosperetti, is to teach, and maybe to catch students early.

"The University of Houston has such great diversity," said Prosperetti. "In the underserved populations there could be the next Einstein, who would never have a chance to blossom as a scientist." That's why Prosperetti went door-to-door in math and science classes, searching for his students. His summer program will help them, but it just might help the rest of us, too.

"At this point the only way to get more results out of computers is to be smarter in programming them," said Prosperetti. "Instead of relying on the brawn of computers, you have to rely on the brain of the programmers."

Thomas Jackson, a 19-year-old UH physics major, is one of the students Prosperetti found and is now taking the course. Jackson did his homework, even before the class started.

"I found a senior-level mathematics course and this was going to be the same kind of stuff," he said, excitedly. When Prosperetti came around to his class and explained the program, he had a similar reaction to Genty's. "I jumped at it," said Jackson. "It's great to do what you want to do for once, you know, instead of bagging groceries," which he's done for a while.

But mainly, he's having a great time.

"I have had so much fun with some of these equations. I didn't think I'd see some of this stuff until my senior year and I'm already doing it!"

Computing the future

For Prosperetti, computing is "one of the greatest things that has happened in science in centuries," helping solve some of the world's most complicated problems.

And as his young students are learning, it demands rigorous study.

"These students are so motivated, and that goes a long way," said Prosperetti. "They've also learned the fun of computing and now they're launched. We are going to read news about these students one day. They're going to stick with science and they're going to love it and lead wonderfully productive lives."

What more could you ask from a summer computing course?

Industrial Engineering Students Awarded for Thinking Like CAPTAINS OF INDUSTRY

BY LAURIE FICKMAN

A team of four Cullen College master's candidates in industrial engineering is quick to tell you that industrial engineers make the best CEOs.

"Sundar Pichai," throws out **Dhinesh Thiru Narayanan Muralitharan**, who also is a teaching assistant in the C.T. Bauer College of Business. No less than the CEO of Google is Muralitharan's pick when talking about industrial engineers and their business prowess.

"Of course the CEO of Microsoft is an engineer, too," adds **Dinesh Babu Sivasamy**, citing Satya Nadella as his illustrious example.

"Oh, and they're both from India, too!" said Muralitharan, as the group laughs in agreement that as Indian Americans they are in good company.

Muralitharan, Sivasamy along with **Srivignesh Somasundaram** and **Anand Krishnamoorthy** have reason to be counted among their prosperous peers. Collectively called "Team Bottomliners," they brought home first place in the annual Institute for Supply Management's Houston Case Competition.

A case for change

In the competition, the group was presented with an actual business case that had really taken place in a company's history. In this case, Scotts Miracle-Gro was under pressure due to high plant and labor costs at their plant in Temecula, California.

The winners of Team Bottomliners are (l-r) Srivignesh Somasundaram, Anand Krishnamoorthy, Dinesh Babu Sivasamy and Dhinesh Thiru Narayanan Muralitharan

Faced with the choice of outsourcing, the team went to work like a well-oiled C-suite of executives, identifying cost drivers, calculating variable costs, performing statistical analyses and analyzing risks. In the end, they proposed staying put to benefit the long-term prospects of the company, though a move would have saved $7 million in the short term. As the team concluded, "Supply chain is all about value creation and not just cost cutting."

"We acted as the owners of the company, not as consultants, and that helped us a lot," said Somasundaram, who served as team lead. He said the judges indicated that kind of thinking propelled them to first place among 12 Texas teams.

Building the team

Before ending up in the same class and heading to the competition, the four members of Team Bottomliners were all neighbors in Houston's Linkwood area, but they didn't know each other well. Since they formed the team, they all became best friends.

"Oh, we probably spend too much time together now," laughed Sivasamy.

Krishnamoorthy admits his presentation skills were a little rusty when he joined the team. "I last participated in a competition in second grade," he said. "So I was a little nervous, but it was a very good experience and we even beat a team where someone had 20 years of experience."

He says winning gave him a direction for his future. "Since winning the competition I have confidence I can go in this path of supply chain management," he said.

The Research Experience for Undergrads Inspires Students

BY LAURIE FICKMAN

Jacinta Conrad (center) with REU student Phuong Bui (left) and UH student mentor Vivek Yadav

For 10 weeks during the summer, 12 undergraduate students from across the country got the chance of a lifetime on the UH campus, becoming engineering researchers in the Cullen College's Research Experience for Undergraduates (REU).

The UH engineers leading the program, **Haleh Ardebili**, Bill D. Cook Associate Professor of mechanical engineering, and **Jacinta C. Conrad**, Ernest J. and Barbara M. Henley Associate Professor of chemical and biomolecular engineering, share a motivation for leading students into the future. The National Science Foundation designated the University of Houston as an REU site and awarded Ardebili and Conrad $360,000 for three years to reach students early in their college careers.

"Nationwide there is a critical objective to increase the number of students pursuing careers in the STEM fields," said Ardebili. She thinks the REU program will inspire students to continue in the science, technology, engineering and mathematics (STEM) fields.

"There's a large body of research that shows we lose students at all stages in the pipeline," said Conrad. "Typically for students you need role models and research experience early."

The REU students are getting plenty of both in the program, each working under a UH engineering professor and graduate student mentor as they conduct their daily research.

Sustainability is key

The theme of the UH REU sight is "Materials for Sustainability in Energy and Manufacturing." Other universities in the United States designated as REU sites have other themes.

"Making sure future generations have sufficient resources is one of the most critical topics in our society," said Ardebili. Sustainable energy means renewables; sustainable manufacturing means using nanotechnology and science to improve the large-scale processes that create them.

"A common theme in both of those topics is that we require materials that can be sustainably derived," said Conrad. "And there are research needs in every step."

Jennifer Bernard, a senior chemistry major from Hastings College in Nebraska, is one of Conrad's student researchers in the REU program and is co-advised by **Jeremy Palmer**, assistant professor of chemical and biomolecular engineering. She is deeply immersed in computer simulations of materials made of glass.

"We're trying to figure out why glass does what it does, because glasses are not normal solids or liquids, they're in between," said Bernard. "When we find out then we can make better and stronger glass."

Conrad said the success of the program will be measured quantitatively.

"We're focused on two outcomes: Does our program change the goal of our student participants to enter careers in science and engineering? We're also asking our graduate student mentors how they feel about mentoring younger students and whether mentoring affects their career plans," said Conrad.

From left: student mentor Mengying Yuan, REU student Kimi Bourland and Professor Haleh Ardebili

Those questions get easy answers from Bernard and her student mentor, Cullen College chemical and biomolecular engineering Ph.D. candidate Ryan Roberts, who says Bernard is doing well and, in fact, mentoring her benefits him, too.

"What I like about the REU program is being able to communicate overall research objectives and methods to someone who would be considered a layman going in and getting them to competency when they leave the program," said Roberts.

As for Bernard, yes, the program has made an impact.

"It's made me really want to go to grad school and do more research," she said.

A similar story

Kimi Bourland, an REU chemical engineering senior from the University of Colorado Boulder, sings a familiar refrain.

> "[Haleh Ardebili is] fantastic; I love her! She's one of my new role models."
>
> - KIMI BOURLAND, REU STUDENT

"The program just solidified that I want to continue to do materials for sustainability and that I can definitely go to grad school," she said.

She works under Ardebili performing experiments at the interface of electrolytes and electrodes in flexible lithium-ion batteries to improve their performance. As Ardebili is well known in this field, Bourland is plenty impressed with her teacher.

"She's fantastic; I love her!" exclaimed Bourland. "She's one of my new role models in terms of women in STEM as a whole; just to meet her is so cool. Especially in engineering, you just don't meet a lot of women who run labs and let you work in their labs."

If excitement and passion is the yardstick, REU is paying off. But there's little wonder – it was conceived of passion.

"I'm in science partly because I had a transformative research experience when I was in high school," says Conrad, recalling a summer research camp at MIT that lit her fire. "REU is a long pathway in paying it forward."

PACKING FOR GRAD SCHOOL

as a National Science Foundation Research Fellow

BY LAURIE FICKMAN

The chances of not winning a National Science Foundation (NSF) research fellowship are much greater than walking off with the coveted award. The odds go down substantially if you're still an undergraduate who hasn't yet been accepted to graduate school. But **Rawan Almallahi**, a Cullen College senior majoring in chemical and biomolecular engineering and student of the Honors College, is accustomed to winning; and so as she continues to hear back from graduate schools, she lets them know that she'll be coming aboard with the NSF prize wrapped up.

The NSF fellowship is often credited with helping recipients become life-long influencers who contribute meaningfully to both scientific innovation and teaching. Many Nobel Prize winners are past fellows, as are Google founder Sergey Brin and "Freakonomics" co-author Steven Levitt.

"Rawan is a talented undergraduate researcher in my laboratory and highly deserving of this prestigious award," said Megan Robertson, assistant professor of chemical and biomolecular engineering. "The NSF graduate research fellowship will provide many opportunities to Rawan as she pursues her doctoral degree."

This year more than 13,000 applicants competed for 2,000 awards. Of the winners, 700 were seniors in college. The fellowship includes three years of funding at $34,000 per year, plus $12,000 in cost-of-education allowances paid to the school. Almallahi won her award for research in the field of deriving epoxy resins from a renewable source, the subject of her senior research paper.

"Epoxy resins have a wide variety of applications," said Almallahi. "They go from being

used as composites in wind turbine blades to adhesives and electrical and automotive components." The problem with the traditional epoxy resins used in industry today, Almallahi says, is that they are developed from bisphenol-A, a non-degradable chemical that is harmful both to human health and the environment.

Almallahi is working to find a new source that is degradable and not harmful.

> "I want to inspire more people to do research, especially minority students and female students."
>
> - RAWAN ALMALLAHI

A full-time winner

Along with her research proposal about epoxy, Almallahi had to submit a personal statement for the NSF application. She chose to talk about her photography.

She was a freshman when she won first place in a photography competition called "Open the Door." Her winning entry was a photo featuring keys peeking out beneath a doormat with an accompanying quote she wrote offering that your success, or open door, may be right beneath your feet. You just have to keep looking.

Almallahi never stops looking for her chances to succeed. Last summer she attended a prestigious summer biotechnology research program at Harvard. She was also a finalist for a Marshall scholarship. Now she's set on convincing more students to conduct research.

"I want to inspire more people to do research, especially minority students and female students," she said.

With all her successes, her inspiration will probably stick. Like epoxy.

AWARDS & ACCOLADES

Writing Papers Tips the Scales for Chong Dai

Chong Dai, Ph.D. candidate in environmental engineering at the Cullen College of Engineering, has won the American Chemical Society (ACS) Environmental Chemistry Graduate Student Award. The prestigious honor is bestowed on 25 students, at most, annually. The award recognizes graduate students working in areas related to environmental chemistry. That's Dai's passion. No doubt the award committee saw it.

"My dream is to clean-up special pollutants. In some developing countries the environment is pretty bad, so I'd like to help find a way to eliminate the hazards," said Dai.

To clean the environment, Dai focuses on nanoparticles made of iron hydroxide.

"I study how we can use nanoparticles to treat environmental pollutants," said Dai. "The material is very cheap and it is not harmful." She'd like to develop new materials that could one day be sent out to industry to help oil and chemical production become less expensive and more environmentally friendly.

READ THE FULL STORY AT
www.egr.uh.edu/news/201704/environmental-graduate-student-wins-highest-acs-honor

International Organization Sees the Light, Awards Cullen College Ph.D. Student

Chen Wu, Cullen College Ph.D. student in biomedical engineering, is the winner of a $2,500 Optics and Photonics Education Scholarship from SPIE, the international society advancing light-based science, engineering and technology. SPIE (formed as the Society of Photographic Instrumentation Engineers) honors those, like Wu, for potential contributions to the field of optics, photonics or related fields.

Wu's research focuses on the development of new optical techniques for various biomedical applications. His goal is to balance resolution and penetration depth in current imaging techniques.

"Optical coherence tomography (OCT) developed in our lab can achieve high resolution and satisfactory imaging depth at the same time," said Wu. "I have made several technical improvements to make OCT more suitable for mouse embryonic research, and also investigated the possibilities of applying it to elastographic study for crystalline lens."

READ THE FULL STORY AT
www.egr.uh.edu/news/201705/international-organization-sees-light-awards-cullen-college-phd-student

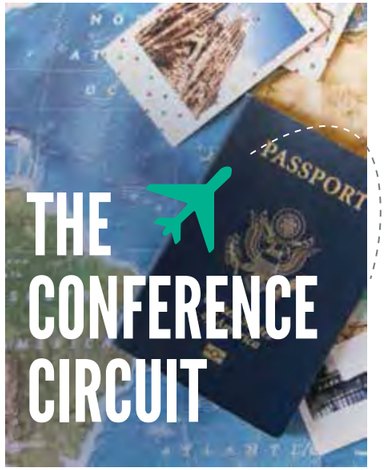
Doctoral Student Wins IEEE Superconductivity Award Second Year in a Row

For the second year in a row, a Cullen College graduate student has won a prestigious award in the field of superconductivity. **Meysam Heydari Gharahcheshmeh,** a materials engineering doctoral student, received a 2017 graduate study fellowship in applied superconductivity from the Institute of Electrical and Electronics Engineers (IEEE) Council on Superconductivity Committee (CSC) on the heels of taking home the same prize in 2016.

The annual fellowship is awarded to full-time graduate students who have made significant contributions in the field of applied superconductivity. Applicants are selected based upon the quality of their prior research, impact of their current research and potential impact of their future research. As a recipient of 2017 IEEE-CSC graduate study fellowship, Heydari Gharahcheshmeh received a complimentary membership in the IEEE and a $5,000 honorarium.

Heydari Gharahcheshmeh works on fabrication of second-generation high temperature superconductors under the supervision of Venkat Selvamanickam, M.D. Anderson Chair Professor of mechanical engineering and director of the Texas Center for Superconductivity Applied Research Hub.

READ THE FULL STORY AT
www.egr.uh.edu/news/201707/doctoral-student-wins-ieee-superconductivity-award-second-year-row



THE CONFERENCE CIRCUIT

1

TAMPA, FLORIDA

Ryan Poling-Skutvik, a Ph.D. candidate in chemical and biomolecular engineering at the Cullen College, took first place in the graduate student poster competition at the Society of Rheology Conference in Tampa, Florida. Poling-Skutvik presented research on understanding the behavior of nanocomposite materials. Nanocomposites are materials that combine nanoparticles with polymers.

2

BARCELONA, SPAIN

Of all the concepts that a Ph.D. candidate in biomedical engineering has to grasp, grasping is at the top. "Grasping is one of the most important hand movements performed in daily life and a hand neuroprosthetic should be able to achieve this function with high accuracy," said **Tianxiao Jiang,** whose research paper on hand flexing was selected as a best paper at BRAININFO, the First International Conference on Neuroscience and Cognitive Brain Information held in Barcelona, Spain.

3

SAN FRANCISCO, CALIFORNIA

Vivek Yadav, studying for his Ph.D. in chemical engineering at the Cullen College, earned third place for his presentation at the "Excellence in Graduate Polymer Research" session at the American Institute of Chemical Engineers (AIChE) 2016 Annual Meeting held in San Francisco. Yadav's research involves polyelectrolyte brushes used in applications including drug delivery, enhanced oil recovery and antifouling coatings.

4

ABU DHABI, UNITED ARAB EMIRATES

Petroleum engineering Ph.D. student **Youssef El Waziry** nabbed first place in the Society of Petroleum Engineers (SPE) Gulf Coast North America regional student paper contest and represented UH at the international contest. El Waziry's paper, "DFIT/MiniFrac analysis of hydraulically fractured dual-porosity formations," tells the story of how to analyze fractured rock to make sure no oil is left behind in the extraction process.

5

DENVER, COLORADO

Three Cullen College chemical engineering Ph.D. students have returned from Denver, Co. where they were special guests at the 25th North American Meeting (NAM25) of the North American Catalysis Society. **Sashank Kasiraju,** who studies under the direction of Assistant Professor Lars Grabow, **Wendy Lang,** who studies under Mike Harold, chair of chemical and biomolecular engineering, and **Wei Qin,** mentored by Jeff Rimer, Ernest J. and Barbara M. Henley Associate Professor of chemical and biomolecular engineering, were all Richard J. Kokes Travel Award winners, which allowed them access to the prestigious meeting and the opportunity to make presentations to the esteemed audience.

6

WASHINGTON, D.C.

Doctoral candidate **Sara Pouladi** won the Best Poster Award for her work on thin film solar cells at the 44th IEEE Photovoltaic Specialists Conference in Washington D.C. Titled "Flexible GaAs single-junction solar cells based on single-crystal-like thin-film materials directly grown on metal tapes," the work offers that III-V compound semiconductor materials are the top candidates for thin-film photovoltaics.

Credit: 20th Century Fox

SIGNIFICANT FIGURES:

Reflection on the film 'Hidden Figures' by an engineering student who hides her figure

BY RUQAIYA SHIPCHANDLER,
CHEMICAL ENGINEERING STUDENT,
VP-EXTERNAL, SOCIETY OF WOMEN ENGINEERS

I had high expectations as I walked into the theater with 20 of my fellow UH Society of Women Engineers (SWE) members to watch "Hidden Figures." Our SWE counselor, Cullen College alumna Cynthia Oliver Coleman, saw the film twice and encouraged us to watch it as a group. The movie is about three African American women, Katherine G. Johnson, Dorothy Vaughan and Mary Jackson, who each made extraordinary contributions to NASA during the Space Race in the early 1960s. The film sheds light on their struggles as African Americans in a segregated America and as women in a male-dominated workplace.

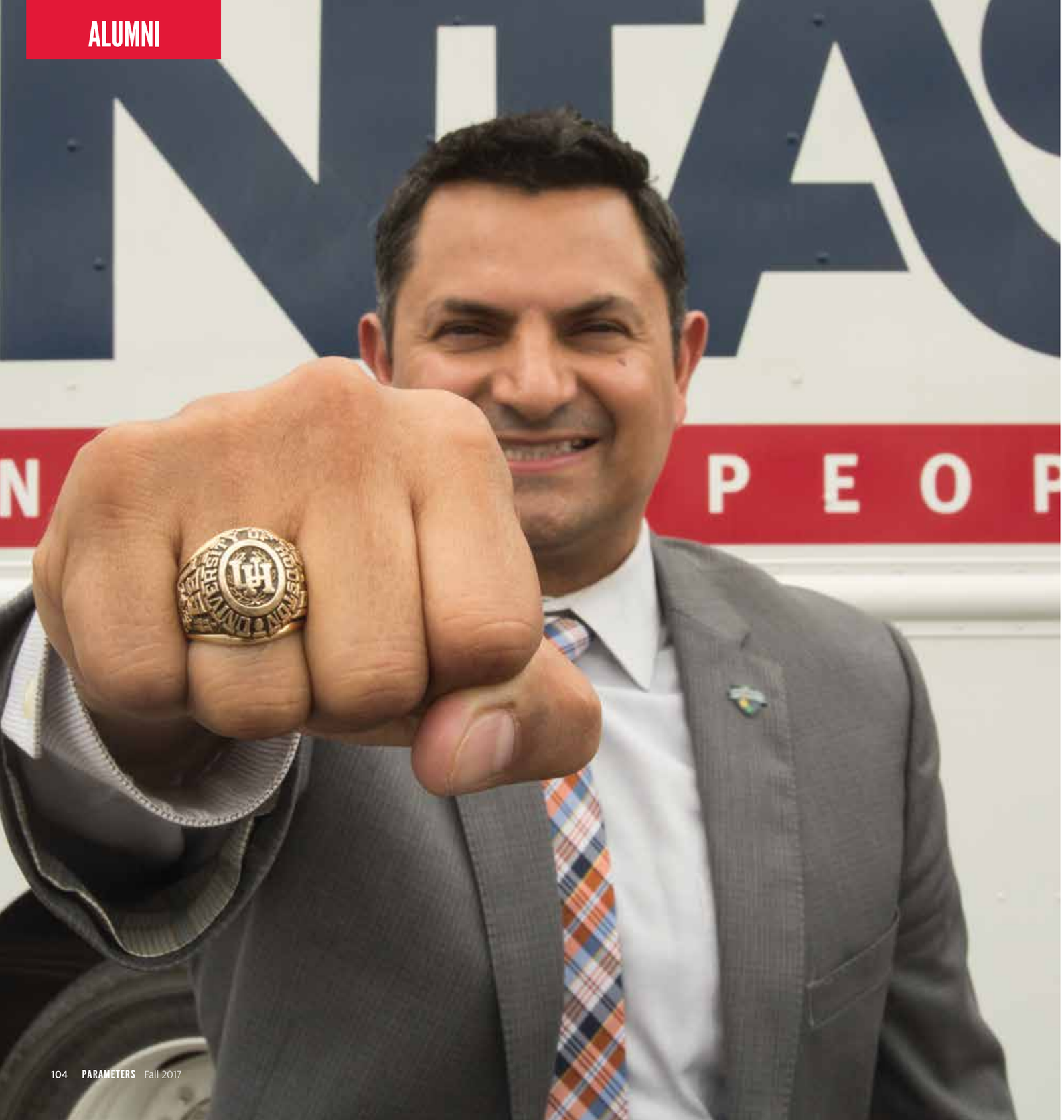
Members of SWE-UH pose for a photo after seeing "Hidden Figures" in the theater

As the film's closing credits rolled, I admittedly had to wipe away a few tears. As both a minority and a female engineer, I could relate to some of the adversities the three protagonists faced – particularly the feeling of being outside of your comfort zone, which is not unfamiliar to me. I wear a two-piece dress, called a rida, which consists of a colorful hooded-poncho and a matching full-length skirt. My wardrobe guarantees that I stand out in any professional setting. Like the women in the film, I am perpetually outside of my comfort zone. I am usually the only female in engineering groups or teams, and I am always the only person wearing a rida. There's a scene in the movie where a room full of male engineers stop working to stare at Katherine Johnson as she walks into the room – a scene I've seen played out in real life many times over.

As a graduating engineering senior with two internships under my belt, I have learned to be comfortable outside my comfort zone. "Hidden Figures" is important because it shows what you can accomplish if you do just that. Katherine Johnson overcame demeaning colleagues to become a prominent NASA mathematician. Dorothy Vaughan mastered a computing language no one else knew and was promoted to head of the Analysis and Computation Division at Langley Research Center. Mary Jackson fought in court for the right to study engineering at an all-white school and became NASA's first black female engineer. All three women faced immense discrimination and resistance. They aspired to opportunities that were not available to African American women at that time. They persevered, securing their own success while paving the way for others to follow.

Now I aim to stay outside my comfort zone. I try to surround myself with people who challenge me. I seek projects and leadership positions that intimidate me. I do not shy away from opportunities that are unconventional for a rida-clad female engineer. And when I want to be comfortable, among engineers I most relate to, I have my Society of Women Engineers family.

I encourage everyone to watch "Hidden Figures." Man or woman, engineer or not, everyone can glean inspiration from those three incredible women to push their boundaries and achieve their potential.



IE Alumnus

ERIC AYANEGUI

Engineers Safety, Reliability and Lifelong Relationships

BY AUDREY GRAYSON

It was 1995 and **Eric Ayanegui** (BSIE '95) was an industrial engineering undergraduate student at the University of Houston Cullen College of Engineering. He found himself in unfamiliar surroundings – at the Cintas Facility and Uniform Services plant a few miles from UH – nervously presenting findings from his class project on improving quality control in their garment inspection department.

The presentation went well, you could say: Ayanegui was offered an internship at Cintas that day.

Now, 22 years later, he walks by the conference room inside Cintas and remembers standing at the head of a long conference table, delivering the first presentation of his professional career to the group of Cintas managers.

"This conference room has a lot of significance to me," said Ayanegui, director of quality and engineering at Cintas Corporation. "This is where it all started."

And where it has continued ever since. Through the opportunity afforded him as a Cullen College student, he was allowed into a growing company he is still working for today.

Combining engineering with industry and education

"I'm an extrovert – a very people-oriented guy," Ayanegui said. Originally inspired to follow in his father's footsteps by becoming a chemical engineer, a pamphlet on industrial engineering changed the course of his career forever.

"The pamphlet explained what industrial engineering is, how the field focuses on people and processes. It listed the courses for the curriculum – human factors, facilities planning, analysis of industrial activities. It was a mix of engineering and business, which really attracted me," he said.

Ayanegui excelled in his engineering coursework, devoting himself to the field while working full-time to pay his way through school. "I only went to one UH football game," he said. "I had rent and tuition to pay. But that hard work brought a sense of maturity."

Project-based learning is the rule at the UH Cullen College of Engineering. In many undergraduate courses, students are assigned projects – often sponsored by industry – to find solutions to critical engineering challenges faced in the field.

While pursuing his bachelor's degree, Ayanegui worked on projects proposed by NASA, a local machine shop and an oil company before tackling the quality control project at Cintas that landed him an internship with the company.

Working as an industrial engineering scholar at Cintas in his final year of college, Ayanegui took on projects streamlining and improving processes in the Houston plant.

"As I was learning at UH, I was literally applying it at Cintas," Ayanegui said.

In addition to the technical work he was doing at Cintas, Ayanegui said his supervisors provided him with opportunities for management training and leadership experience.

"I learned about motivation, leadership, different engagement phases employees go through as they learn and how to get different personality types to be top performers. We are a very people intensive industry, so they teach you that very early on," he said.

The experience ignited Ayanegui's passion for his field. "My internship completely rounded me out and solidified the fact that industrial engineering was the degree for me."

Ayanegui's focus and drive at Cintas caught the eyes of his supervisors, as did his ability to speak fluent Spanish. Cintas operates plants in North America, Canada, Mexico, Honduras and China, and Ayanegui's way with people and lack of language barriers helped him quickly move up the company ranks.

Cintas and you

You might not know it yet, but Cintas is a company that likely touches many aspects of your workday.

The uniform you put on for work, the entrance mat you wipe your feet on in front of the office, the fire extinguisher you walk past in the hallway, the hand soap and paper towel dispenser you use in the public restroom – Cintas designs and distributes all of these products and much more, providing specialized services to businesses.

The company is one of the largest in the industry, employing more than 35,000 people to service more than 900,000 business customers. Cintas has grown tremendously in recent years, most recently acquiring its third largest competitor, G&K Services, last March. Known for their commitment to impeccable customer service and employee relations, Cintas has been named among the "Most Admired Companies" for eight consecutive years by *Fortune Magazine*.

At the center of Cintas' success is its position that people always come first. "At Cintas, if you don't have the people behind you the process isn't going to work the way you want. The results won't be there," Ayanegui said.

And in that place where people and processes meet, Ayanegui thrives, employing his industrial engineering skills to increase the safety, quality, reliability and efficiency of the company's processes while maximizing employees' trust, happiness and room for personal and professional growth.

Cougar climbing the corporation

After his internship, Ayanegui was hired on full time as a production supervisor, overseeing plant processes and rolling out new ones to increase efficiency. From there he moved to the Cintas headquarters in Cincinnati to assist in the construction of new plants. Another promotion took Ayanegui to the manufacturing division, where he implemented process improvements at garment manufacturing plants in South America, Central America and Mexico before moving to California to manage plants in San Diego and Los Angeles.

> "The biggest piece of advice I give to engineers early in their careers is to choose a company with a corporate culture that fits your personality and your values. It's very important to find out what a company's values are and how they align with yours."
>
> - ERIC AYANEGUI

"Around every corner when they'd change my assignment I had some sort of basic understanding of that topic from my coursework at UH, so my learning curve was shorter," Ayanegui said.

In the early 2000s, Cintas began an effort to improve safety processes across the company's global plants and offices. Ayanegui's industrial engineering skills were once again put to the test when he accepted the position of regional health, safety and environmental coordinator in 2004 – a job that would bring him back to the Cintas offices in Houston where he gave his first professional presentation as a University of Houston undergraduate student.

Engineering safety, reliability and diversity

Employing a combination of the technical engineering skills he gained in college and the leadership skills he learned during his time with Cintas, Ayanegui analyzed several processes to improve safety across all of its plants. Once new processes were developed, Ayanegui and the Cintas safety team were responsible for training employees and managers on the new safety measures being rolled out.

"I had to influence leaders to buy into new ideas. I was applying the leadership skills I learned over the years to people who didn't directly report to me. I had to influence their decisionmaking process and earn their trust and buy-in," Ayanegui said.

Since 2007, Cintas' total recordable injury rate fell more than 67 percent, with 36 Cintas locations achieving the Voluntary Protection Program Star Certification, the highest safety designation by the Occupational Safety and Health Administration.

For the last 10 years Ayanegui has served as director of operations engineering, providing technical direction for plants across North America and China. He currently oversees the professional development of engineers and develops and coordinates implementation of reliability programs to reduce equipment downtime and maximize throughput across Cintas' plants.

To ensure the proper implementation of safety measures, Ayanegui provides hands-on training to Cintas' over 500 plant technicians. As you can imagine, he's learned a lot about leadership and management in his current role.

"One of the things that works well with me is I never see myself as your boss. I see myself as your most effective assistant," he said. "I'm the person that will work really hard to make sure you have all the tools you need to be successful."

Ayanegui is now applying the skills and lessons he's learned as a member of the company's executive diversity committee, which is charged with ensuring its workforce, suppliers and customers are inclusive and ethnically diverse.

"Cintas has a very deliberate and active diversity initiative. I'm extremely proud to be involved in employee resource groups devoted to improving diversity at all levels," he said.

The science of relationship building

It seems that one of Ayanegui's natural strengths is bridge-building. At Cintas, Ayanegui connects-the-dots between high-level engineering principles and the people and processes they impact the most. He connects managers to the workers on the floor of the plants; he effectively communicates technical information to non-engineers, bridging the gap between the technical side and the people side of business operations.

So it only makes sense that Ayanegui would also build bridges between Cintas and the UH Cullen College of Engineering, where he actively recruits students and alumni for internships and full-time positions.

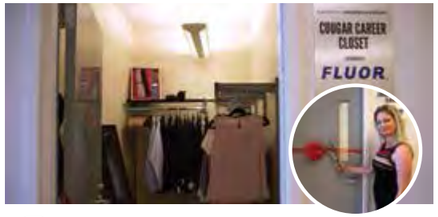
That's not the only reason Ayanegui says he keeps coming back to his alma mater. "Being around industrial engineering students at UH energizes me. It reminds me why I chose this field and fell in love with this work." He serves as a member of the Industry Advisory Board for the Cullen College's industrial engineering department and has served as the industry advisor for the regional student conference of the Institute for Industrial and Systems Engineers.

In a recent workshop for students in the Program for Mastery of Engineering Studies (PROMES), Ayanegui offered career advice: "The biggest piece of advice I give to engineers early in their careers is to choose a company with a corporate culture that fits your personality and your values. It's very important to find out what a company's values are and how they align with yours."

In the case of Cintas, a company that prominently displays its corporate values, policies and goals on its website, Ayanegui couldn't have found a better fit.

DRESSING FOR ENGINEERING SUCCESS

With Help From Cullen College Career Closet and Fluor



Fluor project manager Allison Welch cuts the ribbon on the Cougar Career Closet

BY LAURIE FICKMAN

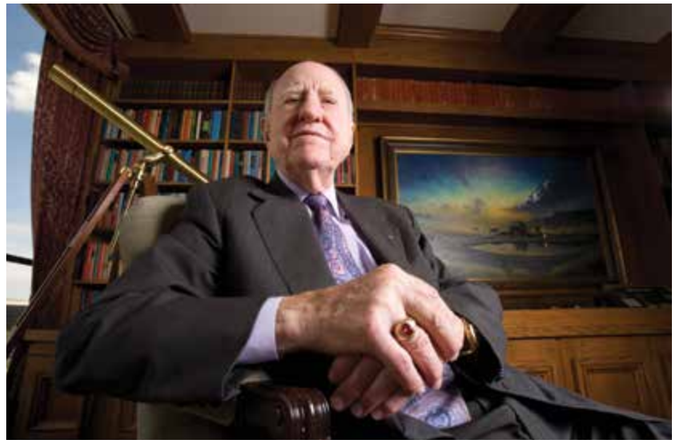
Just yesterday it seemed to be an empty office space you probably ignored as you walked off the elevator on the third floor of the Cullen College of Engineering Building Two. What a difference a day – and the Engineering Career Center – can make. Now, with the support of Fluor Corporation, the transformed space is a filled-up closet, ready to offer engineering students the finest apparel for interviews, career fairs and work-related mixers, where they might need to dress to the nines but don't even have that much of a budget.

"Every year we give an annual donation to the University of Houston and this is such a unique idea. It was something that the students wanted and when we heard students might need clothes to help get jobs, we thought it was a wonderful idea," said UH Engineering alumna Allison Welch, Fluor project manager and executive sponsor of the company's partnership with UH.

This is the second such closet opened on the UH campus. In March the first closet opened for campus-wide use in the Student Service Center.

When the ribbon was cut on the engineering closet, the door was opened to reveal a beautiful selection of men's and women's suits, shoes and accessories. Eventually the closet will take donations and alumni seem especially excited to help.

"We've had a lot of alumni express their interest in giving to the closet so students can have access to the professional wardrobe they need," said Russell Dunlavy, chief advancement officer at the Cullen College.



Remembering Proud UH Engineer

WILLIAM C. MILLER, JR.

BY LAURIE FICKMAN

UH alumnus and prominent South Texas oilman **William C. Miller, Jr.** (BSPE '55) died April 16, 2017. He was 94.

Miller was a lifelong supporter of the UH Cullen College of Engineering. In 2004 he received the Distinguished Engineering Alumni Award and in 2012 he was honored with the Lifetime Achievement Award from the UH Engineering Alumni Association. His family said he was inspired at UH by Professor Charles V. Kirkpatrick, the second dean of the Cullen College, to study petroleum engineering. In 2008 Miller honored his mentor by donating $1 million to establish the William C. Miller Endowed Chair in honor of Charles V. Kirkpatrick at the UH Cullen College, a position currently held by Mohamed Soliman, chair of the department of petroleum engineering.

"I want to share my gratitude for Dr. Miller and his generous gift, which makes it possible for me to support students performing cutting-edge research in petroleum engineering," said Soliman.

Farm hand to roughneck and beyond

Miller grew up on his family's farm in Freestone County, a couple hours north of Houston, where he tended mules and tilled the land, readying it for corn and cotton harvesting. He often credited his hard-working upbringing for the grit it took him to succeed as an independent oil producer and his UH education for taking him from roughneck to executive.

After army service in World War II, Miller attended the University of Houston, graduating with a degree in petroleum engineering. With several years of corporate experience under his belt, he formed the San Antonio-based W.C. Miller Operating Company, which has successfully explored for oil and gas in South Texas for 50 years.

Miller is survived by his wife, two children and two grandchildren.

WILLIAM A. BROOKSHIRE

Leaves Legacy of Generosity and Dedication to the Cullen College

BY LAURIE FICKMAN

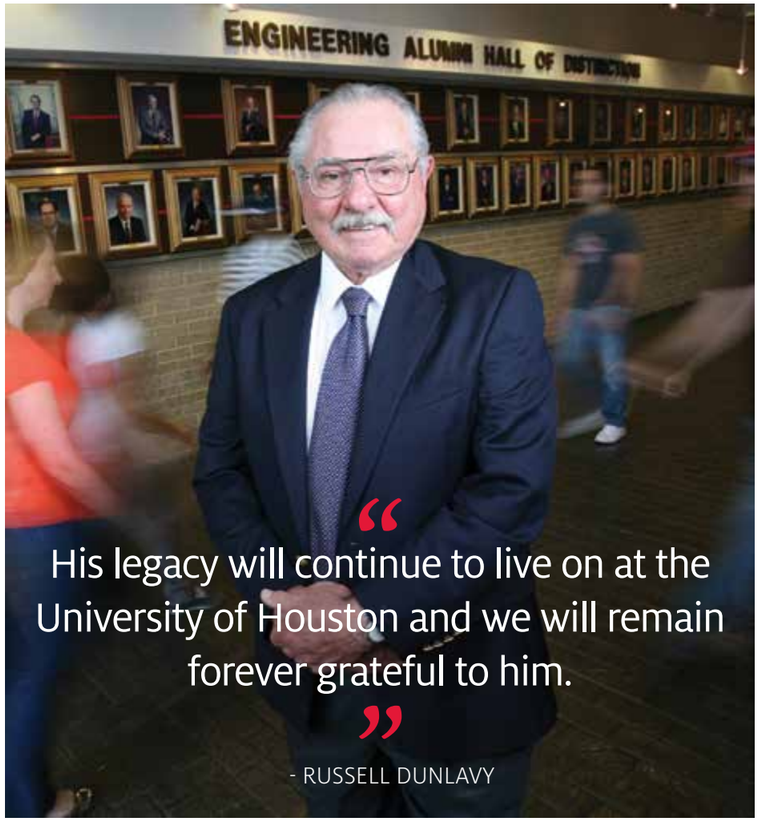
UH alumnus **William A. Brookshire** (BSChE '57), co-founder and chairman of the board of S&B Engineers and Constructors, died on April 21, 2017.

Joseph Tedesco, Elizabeth D. Rockwell Dean of the Cullen College of Engineering, said, "Dr. Brookshire was a fine gentleman and one of our great philanthropists, always in search of new ways to help students and professors. We will forever feel his generosity and his loss in equal measures."

Brookshire graduated from the University of Houston in 1957 with a bachelor's degree in chemical engineering. He went on to earn his master's of science and Ph.D. in chemical engineering from Louisiana State University, but his roots were firmly planted in Houston, where he founded S&B Engineers and Constructors in 1967 with his partner James Slaughter, Sr. At that time, the pair made up the entire roster of a company that would grow to employ 7,500 people around the world.

It seemed the UH Engineering Alumni Association's Distinguished Engineering Alumni Award, won by Brookshire in 1989, was tailor made for him. His work to improve the lives of UH engineering students and faculty alike was legend.

"Dr. Brookshire was an inspiration to so many people around him. He truly believed in hard work, dedication and earning your stripes," said Russell Dunlavy, chief advancement officer at the Cullen College. "His gifts have helped hundreds and will one day help thousands of students complete their dream of obtaining an engineering degree. His legacy will continue to live on at the University of Houston and we will remain forever grateful to him."



That legacy includes a recent donation of $1 million to the Cullen College of Engineering to create the William A. Brookshire Teaching Excellence Award Endowment. The annual distributed income honors faculty members in the Cullen College "who demonstrate an unwavering commitment to exemplifying the highest levels of teaching excellence inside the classroom."

Brookshire understood well the significance of classroom mentors. Raised without means, he was the first in his family to earn a high school diploma. College wasn't encouraged, but he made it happen, mostly at night. "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 has said.

It was a hardship he overcame and sought to reward in others. Brookshire founded two scholarships to help ease financial burdens of working students while recognizing their continued dedication to their engineering education. Students who qualify for the William A. Brookshire Scholarship take a full course load (12 hours) and work at least 20 hours a week. Another of his endowments, 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.

In 2016, the lives of 85 UH Engineering undergraduate students changed drastically when they received scholarships donated by Brookshire's incredible largesse. On Feb. 9, the students had the opportunity to meet and thank the man who helped fund their education and made such a lasting impact in their lives at the annual Brookshire Scholarship Luncheon held at the UH Hilton.

LIENHARD'S LENS

BY JOHN LIENHARD

If you ever doubted that football was a game where centimeters and milliseconds counted, consider this:

The Houston Cougars opened their 2016 season against No. 2 ranked Oklahoma University (OU). We miraculously led by two points when we were 8:35 minutes into the third quarter. Then OU attempted a 53-yard field goal and missed. Our Brandon Wilson caught the ball at the back of the end zone and ran it back for a touchdown. He was credited with a 109-yard run, but he began with his foot barely on the grass. His 110-yard run broke OU's back, and we sailed on to win the game, 33 to 23.

But let's look at a photo that I took just seconds before Wilson's historic run. I took it just as another great Cougar athlete, Cameron Malveaux (No. 94), broke through OU's defensive line and leapt to block OU's kick. There he is, alone on this side of the OU line, rising up, his arm outstretched. See his hand, then see the ball. See Malveaux's arm rising to meet it.

Football is indeed a game of centimeters. Had the ball been lower by centimeters, we would've blocked a field goal that would have missed in any case. We would have cheered, of course; but we would still be clinging to a two-point lead. Two great athletes were on the field that day and we triumphed because one of them could not quite make a marvelous block. We quite possibly won that game because OU's kick was high by centimeters.

There's more: OU coach Bob Stoops had tried to call a time out before the kick. But he was too late by a fraction of a second. The referee had already set the play in motion. But the kicker had seen him, and that threw his rhythm off – probably the reason the kick was low.

Had the kick been just a bit higher, OU would have made the field goal. Had Stoops called for a timeout a fraction of a second sooner, they might well have done so. Had Malveaux managed to just touch the ball...

Any of a host of ifs, and everything would have been different. OU probably would have won the game. Tom Herman would likely still be our coach. As Churchill remarked, "The terrible 'ifs' accumulate." Well, so many ifs went our way at 8:35 in the third quarter of that OU game.

This fall of 2017 we find Brandon Wilson playing for the Cincinnati Bengals, and Cameron Malveaux with the Miami Dolphins. We find ourselves with a new coach and a new set of "ifs," "centimeters" and "milliseconds" – all poised to give us another year of hairsbreadth excitement.

VIEW MORE PHOTOS AT
enginespics.smugmug.com

Photo by John Lienhard

2017 EAA GALA

The 2017 UH Cullen College of Engineering Alumni Awards Gala was held at the Bayou City Event Center on Thursday, June 8, 2017. The annual event, hosted by the Engineering Alumni Association (EAA), celebrates the professional achievements and contributions of college alumni and faculty.

WOMEN IN ENGINEERING BECOME WOMEN IN RED AT SPRING EVENT

The Cullen College hosted its spring Women in Engineering event in March. The free event, funded by alumna Cynthia Oliver Coleman, P.E. (BSChE '71), took place at the UH Hilton and included female engineering students, faculty and alumnae. Those in attendance were inducted into the Women in Red Movement, which serves as a registry of female students and alumnae to serve as mentors for one another. The Cynthia Oliver Coleman Rising Star Award was presented to Tam Nguyen for being named the outstanding senior for the Cullen College of Engineering.

FIRST-YEAR STUDENTS SHINE AT FIRST YEAR EXPERIENCE SUMMIT

First Year Experience students presented their projects at the First Year Experience Summit sponsored by Chevron in May. The event provided a platform for 88 First Year Experience students to present their research posters, meet industry representatives and mingle with fellow students, faculty, staff and Chevron representatives during a private luncheon.

VIEW MORE PHOTOS AT
www.flickr.com/photos/cullencollege/albums

FALL ENGINEERING CAREER FAIR A SUCCESS

Nearly 2,000 UH Cullen College of Engineering students polished up their résumés and put on their business suits to meet with recruiters from over 100 companies at the fall Engineering Career Fair held at the UH Student Center on September 14.

ENGINES OF OUR INGENUITY:

Excerpted from "THE MALDIVES" Episode No. 501

Today, harsh reality moves in on a dream. The University of Houston's College of Engineering presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

We all have secret places we dream about running off to. For some, those places are rooms. For others, they're forests. My secret place is the Maldive Islands. Actually it's not much of a secret. I often express the dream. When I do, people usually say, "The Maldives! Where're they?"

The Maldives are a string of 1,200 coral islands stretching down into the Indian Ocean, well south of India. Only 200 of them are inhabited. Their people are liberal Muslims, and they have a history of hospitality with visitors.

The islands are a well-kept secret – a little-known island paradise. But their people's easy warmth took a beating in 1988. A group from Sri Lanka tried to overthrow the government. The Maldives survived; but they didn't quite make it back to the same easy state. And my daydream begins to unravel.

There's another reason, more dire than the first, that the dream is coming apart. The Maldives lay low in the water. The highest elevation on the capital island of Malé is only 15 feet.

In 1987 Malé suffered a nasty surprise. For no apparent reason, the waves were higher than usual. Suddenly, two-thirds of Malé lay under water. Those flukey waves did $40 million worth of damage. It was a new kind of disaster for the Maldives.

When we ask what the flood meant, we get an unsettling answer. The world is warming up. As we dump more and more carbon dioxide into the air, we form a heat trap. The short wavelength energy of the sun can still get in. But carbon dioxide won't let the energy get back out of the atmosphere.

We now think Earth's average temperature could rise 5 degrees in the next century. That'd melt enough polar ice to raise ocean levels more than 2 feet.

Malé's average elevation is only 6 feet. You can imagine what raising the ocean 2 feet will do. The recent flooding was a grim preview of the probable death of the Maldives.

Maldivians have called on the industrial nations to burn less fossil fuel. That, of course, is like the mouse telling the camel to get his nose out of the tent. They're also trying to build protective sea walls.

So my favorite day dream is collapsing. I have to find a more secure mental escape. But then, the time has come to leave mental escape, and replace it with mental fight. If we don't, all the beauty of this Earth will one day be no more than a lingering dream.

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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