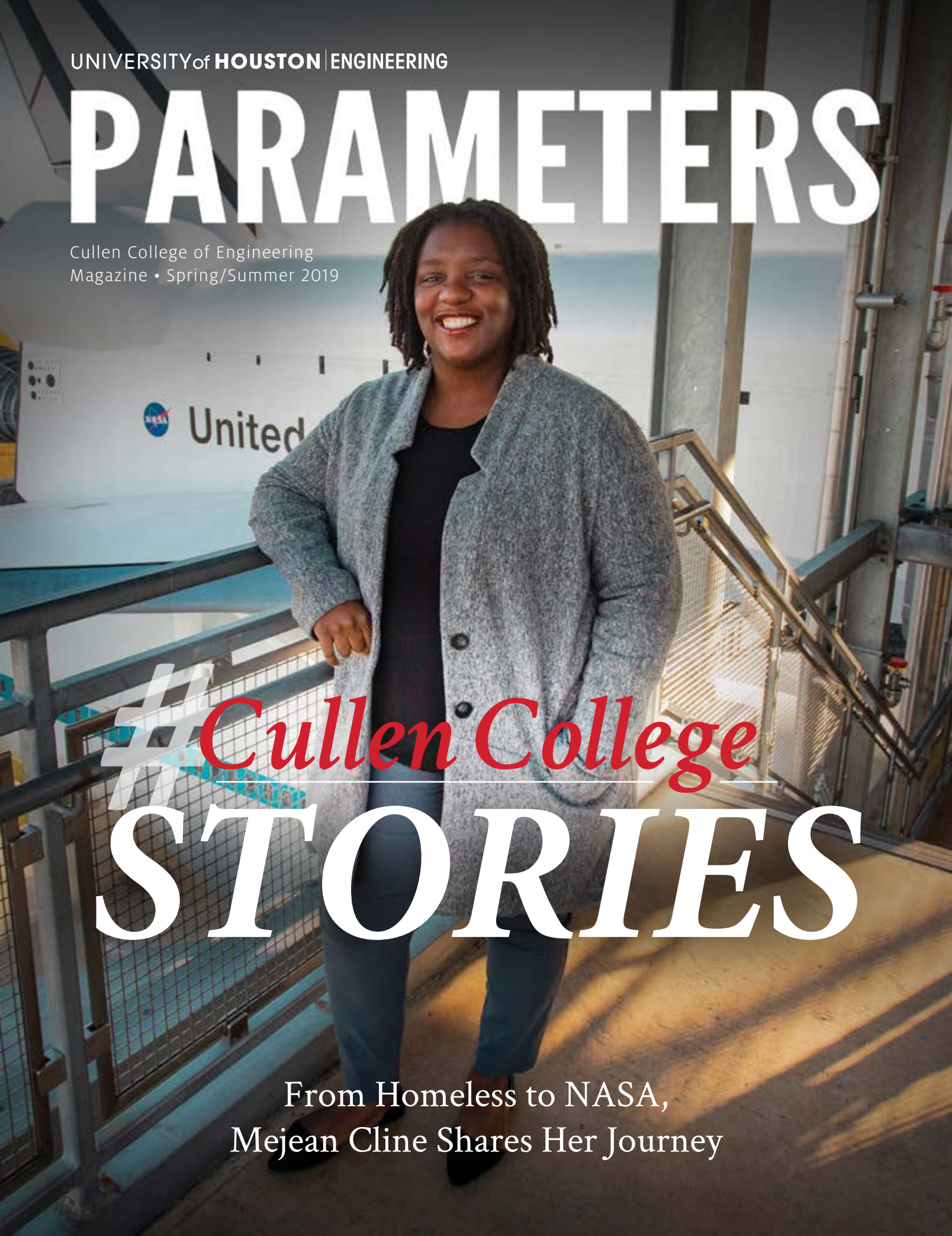

UNIVERSITY of HOUSTON | ENGINEERING

PARAMETERS

Cullen College of Engineering
Magazine • Spring/Summer 2019

#CullenCollege STORIES

From Homeless to NASA,
Mejean Cline Shares Her Journey

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IN EVERY ISSUE

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UNIVERSITY of HOUSTON
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DEAN'S LETTER

If I asked you to describe the people of the Cullen College of Engineering, what would you say? Ask me that question, and my answer will go on a while. I will never be able to describe our cast of characters in a few quick words.

In this issue of *Parameters,* I invite you to get acquainted with some of our students and graduates who aim to change the world, or at least improve a corner of it.

These individuals started life in various parts of this country and around the globe. They grew up in distinct environments, faced uneven opportunities and came of age at different times and in different circumstances.

Here is a glimpse: Ayoola John-Muyiwa (A.J.) has a promising job waiting in the oil and gas industry. He also keeps an eye focused beyond his own good fortune. Early years in Nigeria and later in Houston inspired him to address the disparity of wealth in the U.S., as well as developing countries' need for basics, such as electricity and water.

Mejean Cline felt helpless when her life journey as a young adult diverged ever wider from her career goal. Battered by injury, debt, even homelessness, an engineering degree seemed far beyond her grasp. With some assistance and lots of determination, she powered through the obstacles. Cline not only earned her degree, but also landed her dream job.

Matthew Hogan was a child when he had to endure the pain of his father's illness and death. As an adult he dedicates his professional life to easing others' suffering by combining engineering and medicine. He is now a post-doctoral fellow, researching new ways the central nervous system can heal from stroke and injury.

Fascinating stories.

Each of us arrives at the Cullen College with a story already unfolding. After you read about others' histories, take a moment to honor your own.

Your particular background, life experiences and goals – whatever they may be – are now part of our mix; still driving your own success while helping expand the ways your colleagues fit into the global community. That's valuable insight for someone who aims to change the world.

Here at the Cullen College, we aim to change the world, too – one unique engineer at a time.

Warm regards,

Joseph W. Tedesco

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

IN THE MEDIA SPOTLIGHT

FOX 26

Get acquainted with your financial aid counselor. That was **Yolanda Norman's** first tip when she sat down Aug. 10 with Fox 26 Houston morning news anchor Melissa Wilson with advice on how to find help paying for college.

"Your best friend when you are trying to find financial aid is your financial aid counselor," said Norman, program manager at the UH Cullen College of Engineering Career Center. As soon as you are accepted into school, find out who your designated counselor is and get acquainted by email.

As you search for scholarships and grants, do not underestimate local opportunities; they often draw less competition than national programs. "Make sure loans are your last option," Norman stressed. Try for scholarships, grants and work-study options first and strive to minimize after-college debt.

CEP
ENERGY-EFFICIENT MANUFACTURING

A team led by **Wei-Chuan Shih,** associate professor of electrical and computer engineering, uses a microscope platform in a smartphone (portable and easy to manage in the field) that combines nano-colorimetry with dark-field microscopy. So sensitive is the test, it can detect lead in levels below the Environmental Protection Agency's safety threshold.

The November 2018 issue of *CEP Magazine,* published by the American Institute of Chemical Engineers, highlighted Shih and his new lead-detection technology in the article "Engineers Use Smartphones to Detect Lead in Drinking Water."

What's not to like about U.S.-produced fuel that's affordable, better for the environment and readily available? Producers of BYUradio's "Top of Mind With Julie Rose", a live daily news talk and interview show, liked the idea of a catalyst for natural gas vehicles so much they featured **Michael Harold,** the M.D. Anderson Professor and chair of the chemical and biomolecular engineering department at the University of Houston, on an episode.

Harold, who is an expert in catalytic reaction engineering, is leading a team chosen by the U.S. Department of Energy for a $2 million project to develop and optimize a lower-cost, more efficient catalyst to eliminate unreacted methane.

The show reaches a national audience of Brigham Young University alumni and affiliates, as well as satellite radio subscribers looking for smart, informative and uplifting radio content.

DASER

What goes on inside the brain when an artist goes deep into the creative process?

UH Professor **Jose Luis Contreras-Vidal** introduced the topic as he opened the Art and the Brain forum Sept. 20. Experts from the United States and Mexico described their research during the one-day forum, part of the ongoing DASER series in Washington D.C.

In ongoing "brain on art" studies at UH, Contreras-Vidal and his research team study brain waves of visual artists, chefs, dancers, musicians, even video game players. The team hopes understanding how artists' brains work will someday reveal new ways neurological injuries can be healed.

Contreras-Vidal is the Hugh Roy and Lillie Cranz Cullen Distinguished Professor of electrical and computer engineering, as well as UH site director of The BRAIN (Building Reliable Advancements in Neurotechnology) Center, a collaboration of UH, Arizona State University and industry partners.

Monthly DASER (D.C. Art Science Evening Rendezvous) presentations in Washington D.C. are sponsored for the public by Cultural Programs of the National Academy of Sciences and Leonardo, the International Society for the Arts, Sciences and Technology.

"Whenever I'm in traffic, I wish I had a flying car," Professor **Kaushik Rajashekara** said in the Nov. 30 episode of the "Seeking Delphi" podcast, hosted by futurist Mark Sackler.

Flying cars are not mere wishful thinking for Rajashekara. He believes technologies based on automobile-aircraft hybrids will be a definite possibility not too far in the future. However, he cautioned, the technology will be very expensive at first and used primarily by the military and medical industries for quick transportation.

Rajashekara – distinguished professor of electrical and computer engineering at the Cullen College of Engineering, head of the Cullen College power and energy systems program and director of the Power Electronics, Microgrids and Subsea Electrical Systems (PEMSES) laboratory – is a world-renowned authority and advocate for renewable energy and futuristic vehicles, in particular flying cars.

His discussion, "Future of Driving Part 2, Flying Cars, with Kaushik Rajashekara," is podcast No. 27 in the "Seeking Delphi" series.

informs EDITOR'S CUT | BIG DATA

Imagine a future where drone-delivered medications or medical testing kits appear at your doorstep, just like packages ordered online. **Gino Lim,** chairman of the Department of Industrial Engineering at the Cullen College of Engineering, envisions drones used as two-way envoys between patients and healthcare providers to deliver medication, pick up urine or other samples and, perhaps, even provide basic diagnostics. The option could become especially helpful when access to patients is challenging, such as on the scenes of accidents and natural disasters, as well as scheduled deliveries in rural areas where doctors and clinics are scarce.

During the Nov. 4-7 INFORMS annual meeting, Lim shared his ideas on the organization's monthly podcast series, "Resoundingly Human." The podcast highlights how operational research and analytics can solve many complex problems in the world today.

INFORMS, with more than 12,500 worldwide members, is the leading international association for professionals in operations research and analytics.

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

UH Engineering Building Named for

DURGA D. AND SUSHILA AGRAWAL

BY JEANNIE KEVER

An engineering building at the University of Houston was renamed the Durga D. and Sushila Agrawal Engineering Research Building in recognition of a gift that will provide ongoing support for faculty, students, research and building operations.

The $51 million building, which opened in 2017, already had a floor named for the couple. Durga D. Agrawal (M.S. '69, Ph.D. '74), founder of Piping Technology & Products Inc., is a member of the UH System Board of Regents and a former member of the Texas Higher Education Coordinating Board.

After arriving in Houston from India in 1968 with a bachelor's degree in mechanical engineering from the Delhi College of Engineering, Agrawal earned a master's degree and Ph.D. in industrial engineering from the UH Cullen College of Engineering.

"My message to the students is to always be optimistic; one can achieve any goal with hard work, persistence and determination," Agrawal said. "As alumni, we must keep the torch of knowledge, excellence and innovation growing and glowing."

Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College, said the gift's impact "will be nothing short of transformational."

"It will allow us to expand and enhance our laboratory and classroom facilities, recruit some of the world's greatest engineering minds as students and faculty members and develop new and innovative academic programs," he said. "This gift will boost our capacity to conduct research that directly impacts the quality of life across the greater Houston area and beyond."

Durga D. and Sushila Agrawal with Suresh and Renu Khator, UH President & Chancellor at the building's dedication event

> "This gift will boost our capacity to conduct research that directly impacts the quality of life across the greater Houston area and beyond."
>
> - DEAN JOSEPH W. TEDESCO

The Cullen College has more than 4,200 students, including more than 1,150 graduate students, enrolled in 10 engineering disciplines, as well as several interdisciplinary graduate programs.

The gift contributes to the University's $1 billion "Here, We Go" Campaign, the first major fundraising campaign in more than 25 years, in support of major University priorities.

Eloise Brice, vice president of University Advancement, said the Agrawals' gift will benefit a number of key objectives.

"Recruiting the best and brightest students and faculty is a key goal for the University of Houston, and this generous gift will allow the Cullen College of Engineering to make great strides in that arena," Brice said. "The ability to improve our research and academic facilities made possible by the Agrawals will ultimately benefit the state of Texas and the nation."

Celebrating THE MIND:

BRAIN Meeting Showcases Advances in Neurotechnologies

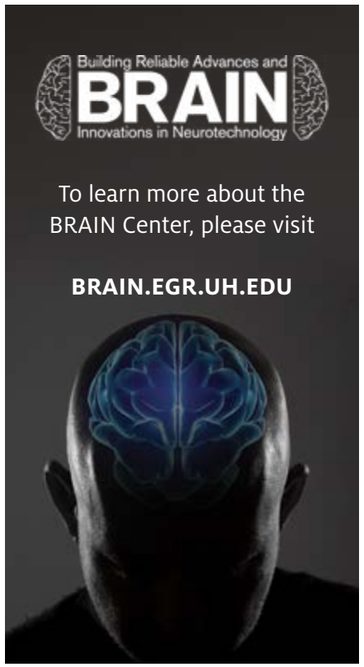
BY RASHDA KHAN

The Building Reliable Advancements in Neurotechnology (BRAIN) Center, an Industry-University Cooperative Research Center (IUCRC) dedicated to bringing new neurotechnologies and treatments to market, held its third annual industry advisory board meeting in December at the University of Houston Hilton hotel.

The agenda was chock-full of future innovations, strategies and goals of the collaborative enterprise.

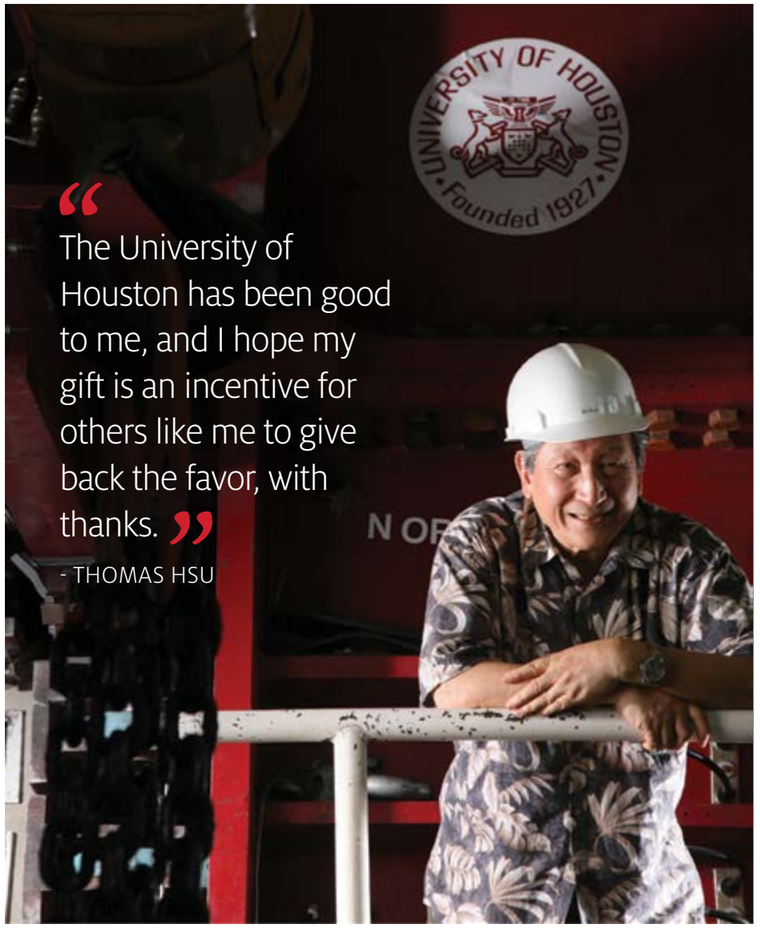
The BRAIN Center, a collaboration among Arizona State University, the University of Houston and industry members, was officially funded in 2017 with a $1.5 million grant from the National Science Foundation. The mission of The BRAIN Center – led by UH Professor **Jose Luis Contreras-Vidal** and Professor Marco Santello of Arizona State – is to develop safe, effective and affordable personalized neurotechnologies.

Since its inception, the center has attracted 10 industry partners including the companies Medtronic, the CORE Institute, Indus Instruments, 3Scan, GOGOA Mobility and Brain Products, as well as medical institutions such as the Phoenix Children's Hospital, the Institute for Rehabilitation and Research Memorial Hermann Hospital, and the Houston Methodist Research Institute.



The BRAIN's Industry Advisory Board, co-chaired by Medtronic and Houston Methodist, have recently approved the Tecnologico de Monterrey – a top ranked private university in Mexico – as the first international BRAIN Center site.

The center's eight research areas include big data, clinical trials, device development, device interoperability, neural activity measurement, neuromodulation, neurorehabilitation and assistive device and regulatory science. Both invasive and noninvasive approaches form part of BRAIN's neurotechnology portfolio.



$1 MILLION GIFT

Will Expand UH Structural Engineering Labs

BY JEANNIE KEVER

When **Thomas Hsu** first stepped onto the University of Houston campus in 1980, UH was an emerging research university in search of top research faculty members to advance the Cullen College of Engineering. To Hsu, who was then chair of the Civil Engineering Department at the University of Miami, heading an adequate but dated structural laboratory, UH offered a most attractive incentive: housing for a new research laboratory where he could design and build the innovative experimental equipment that could do the research that would advance the science and technology of structural engineering.

The Thomas T.C. Hsu Structural Research Laboratory houses the Universal Elements Tester, the world's only large-size equipment to test wall and shell elements subjected to various types of forces, notably earthquake action. The behavior of these elements, predicted from Hsu's theory, can then be integrated by high-speed computer to predict the behavior of today's infrastructure such as large buildings, highways, bridges, offshore rigs, nuclear containment structures and others.

The Universal Element Tester was designed and built at the University's South Park Annex in 1986. This equipment and lab space have been modernized over the past 30 years with more than $3 million in grants from the National Science Foundation and other public and industry sources.

Now 33 years later, after the directorship of Yi-Lung Mo, Moores Professor of civil engineering at UH, and current director Mina Dawood, associate professor of civil engineering, the Structural Research Lab is ready for larger space, updated equipment and resources to meet the growing and increasingly complex needs of a changing infrastructure that serves the society we live in.

A $1 million gift from the Hsu family is intended to pay it forward. The gift, eligible for a 75 percent match from the state's Texas Research Incentive Program (TRIP), would further strengthen UH's Tier One status.

While Hsu's lab was originally focused on structural engineering, the new space will be designed to accommodate researchers and graduate students in a wider range of civil and environmental engineering disciplines. **Joseph Tedesco,** dean of the Cullen College, said the gift will provide the college with needed lab space and facilities to meet the needs of both faculty researchers and graduate students.

"Thomas Hsu has been part of the Cullen College during four decades of transformative change," Tedesco said. "This gift to expand the Thomas T.C. Hsu Structural Research Laboratory ensures his legacy of cutting-edge scholarship, along with his support for generations of graduate students, will live on."

Hsu received his master's and doctoral degrees from Cornell University, where he and his family have a long, multigenerational relationship. He has received a number of honors and awards, including the American Concrete Institute Arthur J. Boise Award, ACI's highest research award for concrete structures. He is an honorary member of ACI and a distinguished member of the American Society of Civil Engineers.

Eloise Brice, vice president for University Advancement, said the gift will make it possible for UH to offer important research opportunities to future graduate students. "This laboratory, and the equipment that it will house, will allow the Cullen College to remain at the forefront of advances in civil and environmental engineering," she said.

Hsu said the gift is a way to express gratitude for his time at UH. "I would say I'm a very lucky fellow," he said. "I tell my colleagues I am always happy to come to work. The University of Houston has been good to me, and I hope my gift is an incentive for others like me to give back the favor, with thanks."

ABOUT THE UNIVERSITY OF HOUSTON

The University of Houston is a Carnegie-designated Tier One public research university recognized with a Phi Beta Kappa chapter for excellence in undergraduate education. UH serves the globally competitive Houston and Gulf Coast Region by providing world-class faculty, experiential learning and strategic industry partnerships. Located in the nation's fourth-largest city and one of the most ethnically and culturally diverse regions in the country, UH is a federally designated Hispanic- and Asian-American-Serving institution with enrollment of more than 46,000 students.

ABOUT THE "HERE, WE GO" CAMPAIGN

The "Here, We Go" Campaign is the University of Houston's first major system-wide fundraising campaign in more than 25 years. Gifts made from 2012 to 2020 will contribute toward the university's key priorities, including scholarships, faculty support and strengthening the university's partnership with Houston.

$1 MILLION GIFT FROM NOV

Boosts UH Engineering Research

BY JEANNIE KEVER

A $1 million donation from National Oilwell Varco (NOV) will fund construction of a state-of-the-art facility in South Houston where UH mechanical engineering Ph.D. students will explore some of the biggest issues in today's energy industry.

"This generous gift will give graduate students at the Cullen College of Engineering the opportunity to work side by side with NOV's world-class engineers to find solutions to real-world challenges," said **Joseph W. Tedesco,** Elizabeth D. Rockwell Dean of the Cullen College. "They will be working on issues that are critical to the future of the industry, impacting both the safety and the efficiency of operations."

Research areas include:

- Study of corrosion and erosion of CO_2 in subsea production applications
- Improvement in lifespan predictions for equipment in the high-pressure and high-flow real world environments
- Development of big data and analytics tools to predict lifespan, condition and performance of critical drilling, production and pumping components

"NOV is very pleased to continue its partnership with the University of Houston on advanced research," said Clay Williams, National Oilwell Varco Chairman and CEO. "The talented and creative minds we get to work with at UH bring the most cutting-edge thinking in academia to solve our customers' challenges. Our partnership accelerates technology solutions in our marketplace while also supporting the education of the next generation of engineers for our industry."

The donation is eligible for $750,000 in matching funds from the Texas Research Incentive Program, created by the Texas Legislature to encourage the private sector to work with public universities.

UH Cullen College Ranked Among

TOP ENGINEERING SCHOOLS FOR VETERANS

BY RASHDA KHAN

The University of Houston Cullen College of Engineering and several of its programs are ranked among the "best of the best" institutions in the country for veterans to earn degrees by College Factual in its 2019 Best for Vets rankings.

Overall, the Cullen College sits in the top 10 percent of institutions for best value and most popular engineering degrees among veterans, as well as in the top 15 percent of colleges with the highest paid graduates.

Mechanical, chemical and electrical engineering at Cullen College ranked in the top 10 percent of best value programs, with civil engineering in the top 15 percent. Mechanical engineering program ranks in the top 5 percent of highest paid graduates, with civil engineering among the top 15 percent.

The mechanical engineering program jumped from the previous year's ranking of 27th to 15th, out of 272 schools for veteran friendliness. The electrical engineering program also showed significant improvement – moving from the 30th to 26th, out of 269 schools for veterans in the nation and 4th out of 18 educational institutions in Texas. The civil engineering program rose from 39th to 31st, out of 207 schools in the nation.

According to the College Factual report, students who graduate from UH with degrees in industrial engineering will make average annual early-career earnings of $64,314 and average annual mid-career earnings of $77,778; alumni with civil engineering degrees will have average early-career earnings of $56,839 and average mid-career earnings of $110,672; those with mechanical engineering degrees will have average early-career earnings of $64,453 and average mid-career earnings of $118,622; and graduates with electrical engineering degrees will have average early-career earnings of $67,228 and average mid-career earnings of $104,707.

All the earnings shared are above the national averages in their respective fields.

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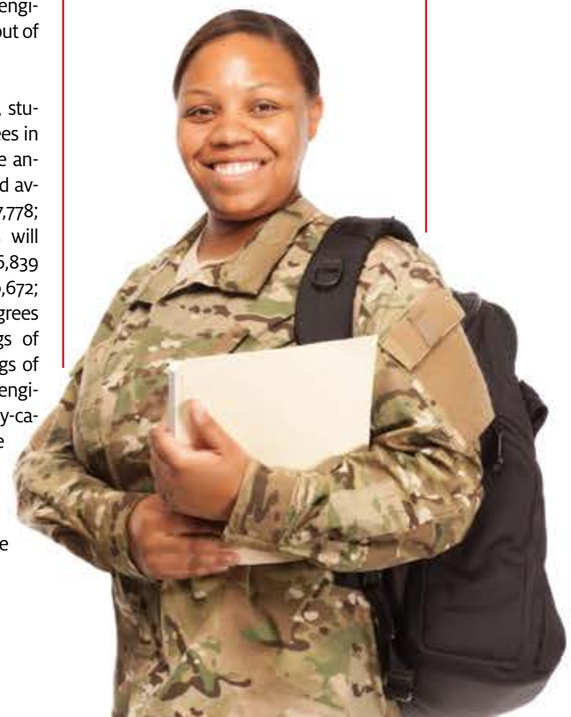
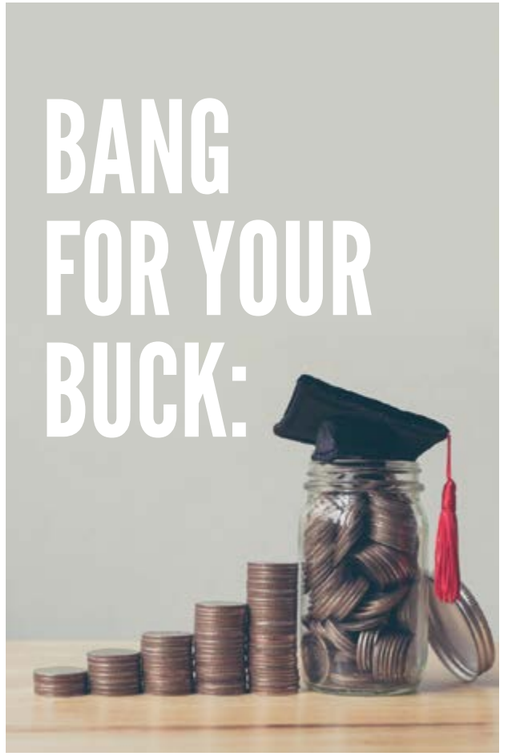
Source: College Factual





Three UH Engineering Online Master's Programs Ranked Among Top in Nation for Return on Investment

BY RASHDA KHAN

Three online master's programs in the University of Houston Cullen College of Engineering were recognized for providing high return on investment and best value in the 2019 Best Online Colleges rankings released by SR Education Group.

The recently released rankings put the online master of science degree in civil engineering at fifth; electrical engineering, 11th; and mechanical engineering, 19th.

SR Education Group, an education research publisher focused on providing authoritative online resources for students, created the Best Online Colleges list. The rankings are based on two factors: salary potential and tuition rates. The SR Group analyzed accredited online schools across the nation – taking into account average mid-career salary data and annual tuition rates – to select the schools that offer the best value to their students.

UH SIGNS MOU

with Indian Institute of Petroleum and Energy

BY RASHDA KHAN

Dean Joseph Tedesco signs the MOU with the Indian Institute of Petroleum and Energy

The University of Houston recently signed a memorandum of understanding (MoU) with the Indian Institute of Petroleum and Energy (IIPE), declared by the Indian Parliament as an "institution of national importance."

IIPE, which was initiated by the Indian Ministry of Petroleum and Natural Gas, was established in 2016 in the state of Andhra Pradesh. At present, it offers undergraduate degrees in petroleum and chemical engineering and is planning to offer various graduate program in energy-related fields.

The aim of this MoU is to build scientific and technical knowledge through joint research, as well as equip students at both institutions with skills and knowledge so they are able to compete in the dynamic energy industry.

The agreement was signed by V.S.R.K. Prasad, founding director of IIPE; Sudarsan Neogi, IIPE administrative liaison; **Joseph W. Tedesco,** Elizabeth D. Rockwell Dean of the Cullen College of Engineering at UH; and **Jaime Ortiz,** UH vice provost for global strategies and studies.

At the signing, Prasad thanked his UH counterparts and urged them to nurture the young institute. "We wish that this institute should develop an international level of globalization of research within the energy industry such that any person with any energy problem should look towards this institute," he said.

The agreement covers four key areas of possible collaboration, including faculty exchanges, student exchanges, joint research projects and joint academic events and activities, including short courses, seminars, workshops and conferences. The two may also explore research and projects involving distance and computer-based learning.

"We continue to build global alliances with academic and research partners around the world," said Tedesco. "IIPE is an excellent university and we're very proud to have this opportunity to work together."

UH Data Science Institute Receives

$10 MILLION BOOST

from Hewlett Packard Enterprise

BY JEANNIE KEVER

The University of Houston announced a new collaboration with Hewlett Packard Enterprise (HPE) in October, including a $10 million gift from HPE to the University. The gift will benefit the University's Data Science Institute and include funding for a scholarship endowment, as well as both funding and equipment to enhance data science research activities.

"At HPE, we have a robust presence in Houston and a long history of partnership with the University of Houston. In fact, a significant portion of our workforce here are alumni, so we are thrilled to have an opportunity to drive innovation in data science and shape the future workforce in that area," said Mark Potter, chief technology officer at HPE and director of Hewlett Packard Labs. "We look forward to continuing to expand the partnership over time and tackling meaningful research that will accelerate discoveries for the industry."

In today's information age, the data being created is only as valuable as the insights that are gleaned from it. The secrets to scientific breakthroughs and industry-changing innovations hide in plain sight behind mountains of data. Data science is the key to unlocking these breakthroughs and is critical as companies undergo digital transformation.

HPE's collaboration with the University is part of a larger movement focused on accelerating the development of Houston's innovation economy, led by organizations like Houston Exponential. Gina Luna, chair of Houston Exponential, which is charged with accelerating development of the regional digital tech ecosystem, said enhancing Houston's position as a leader in data sciences is an important piece of that plan.

"HPE's commitment to this program at UH is exciting for Houston," she said. "As our core industries digitize, leveraging the power of data is critical to that transformation, and collaborations between industry and academia are a key component. This partnership, along with many others, is essential to accelerating our progress as a global leader in this area."

The collaboration between HPE and UH will go beyond funding, with HPE leaders serving as lecturers for UH classes and UH researchers helping to solve complex problems for HPE customers. Students will work on research areas suggested by HPE, part of an effort to ensure students and faculty are focused on real-world problems.

UH offers a number of certificate and degree programs in data analytics, statistics and related fields. Researchers from a variety of disciplines use data science in work ranging from health care diagnostics and imaging to improving the safety of offshore drilling.

The UH Data Science Institute has been renamed the Hewlett Packard Enterprise Data Science Institute (HPE DSI) in recognition of the alliance.

Hurricane Conference Offers Updates on

HURRICANE PREPARATION

BY JEANNIE KEVER

The Hurricanes, Major Disasters, Coastal Protection and Rapid Recovery in Texas and the Gulf Coast Region Conference brought emergency managers, public officials and industry executives to the University of Houston Hilton hotel in August to discuss the latest in disaster preparations, loss mitigation and rapid recovery in the face of hurricanes and other storms.

The conference is sponsored by the Texas Hurricane Center for Innovative Technology, the UH Department of Civil and Environmental Engineering and Department of Industrial Engineering. **Cumaraswamy Vipulanandan (Vipu),** professor of civil and environmental engineering and director of the Texas Hurricane Center for Innovative Technology, produces the annual conference to update emergency managers, suppliers, community members and the academic community with the latest practices and research.

Speakers included Charles Wemple, executive director of the Houston Galveston Area Council; David Casebeer, project manager at the Port of Houston; and Niel Golightly of the city of Houston's recovery office.

UH Engineer Part of $800K DOE Study Targeting

SAFER STORAGE FOR NUCLEAR WASTE

BY RASHDA KHAN

About 20 percent of the electricity produced in the United States is generated at nuclear power plants, according to the U.S. Nuclear Regulatory Commission (NRC). This means residents in one out of every five U.S. homes turn on their lights, use refrigerators and make toast using energy generated by nuclear power.

Nuclear materials and technology are important for other purposes, too, including radioactive isotopes for diagnosing and treating medical conditions, irradiation for making pest-resistant seed varieties, and radioactive isotopes for dating objects and identifying elements in research.

While nuclear power generation emits relatively low amounts of air pollutants like carbon dioxide it does produce nuclear waste, which can remain radioactive "for a few hours or several months or even hundreds of thousands of years," according to the U.S. Environmental Protection Agency.

With 99 nuclear reactors (two more under construction) operated by about 30 different power companies, America is the world's largest producer of nuclear power. As of May 2018, there were 450 operating reactors in 30 countries worldwide, according to NRC reports.

As such, the safe storage and disposal of the radioactive waste is of paramount importance.

"Whenever we deal with nuclear energy, we are always concerned about how we deal properly with the waste that is generated," said **Jeffrey Rimer,** the Abraham E. Dukler Professor of chemical and biomolecular engineering at the UH Cullen College of Engineering. "We want to make sure that the nuclear waste is going to be stored for a sufficient time and not have issues with the release of this material into the environment."

Rimer is the principal investigator on a multi-agency research team studying the corrosion behavior of glass containers often used

> We want to make sure that the nuclear waste is going to be stored for a sufficient time and not have issues with the release of this material into the environment.
>
> - JEFFREY RIMER

to store nuclear waste. Its goal is to find solutions to reduce or avoid the degeneration of the containers.

The U.S. Department of Energy awarded $800,000 to the project, titled "Formation of Zeolites Responsible for Waste Glass Rate Acceleration: An Experimental and Computational Study for Understanding Thermodynamic and Kinetic Processes."

The basic components of the glass – silica and alumina – are also components of crystalline materials known as zeolites, which are present initially in an amorphous state but then eventually form zeolites.

"During the process of glass dissolution and recrystallization to zeolites, cavities are opened within the amorphous glass that can potentially allow the radioactive material to be released," Rimer said. "This is detrimental to the overall goal of trying to keep nuclear waste contained."

Exploring the role of zeolites

Zeolites have been used for many years as adsorbents and catalysts in a variety of chemical processes, spanning applications from gasoline production to additives in laundry detergent, among thousands of other commercial and consumer applications.

Rimer, an expert on crystallization, conducts groundbreaking research in this field. His work has led to the development of drugs for kidney stones (the first advance in kidney stone therapy in 30 years) and malaria. His oil and gas industry-related projects target scaling in pipes and increases in the efficiency of catalysts.

"At first glance, it looks as if I am embarking on a completely new area of research. But on a basic level we are asking the same types of questions in all of our research: What are the fundamental driving forces of new zeolite formation?" said Rimer. "If you understand the mechanisms of crystal nucleation and growth, how to control these processes ... then crystallization becomes a broad platform that can be applied over a wide range of different materials and applications."

The team

Other members of the research team are James Neeway, Radha Motkuri and Jarrod Crum from the Pacific Northwest National Laboratory (PNNL) and Yanni Bourmpakis from the University of Pittsburgh.

The PNNL personnel are experts on storage and glass dissolution and will be handling the assessment calculations, Rimer said. He added that his Pittsburgh collaborator brings expertise in computations and will conduct density-functional theory calculations on the progression of the aluminosilicate dissolution and zeolite nucleation.

"This is a nicely formulated team in that each partner is contributing something unique to the project, but at the same time there is a lot of synergy between each of the three institutions and the roles of each participant in this project," Rimer said. "I think the project will, as a result of our collaborative efforts, make significant headway to improve the efficiency of nuclear waste storage."

Lean Electrolyte Design is a

GAME CHANGER FOR MAGNESIUM BATTERIES

BY JEANNIE KEVER

Researchers from the University of Houston and the Toyota Research Institute of America have discovered a promising new version of high-energy magnesium batteries. Potential applications range from electric vehicles to battery storage for renewable energy systems.

The battery, reported last December in *Joule,* is the first reported to operate with limited electrolytes while using an organic electrode, a change the researchers said allows it to store and discharge far more energy than earlier magnesium batteries. They used a chloride-free electrolyte, another change from the traditional electrolyte used by magnesium batteries, which enabled the discovery.

Yan Yao, associate professor of electrical and computer engineering at the UH Cullen College of Engineering, said the researchers were able to confirm that chloride in the commonly used electrolyte contributes to sluggish performance. "The problem we were trying to address is the impact of chloride," he said. "It's universally used."

Yao, who is also a principal investigator with the Texas Center for Superconductivity at UH, and his team used the chloride-free electrolyte to test organic quinone polymer cathodes with a magnesium metal anode, reporting that they delivered up to 243 watt hours per kilogram, with power measured at up to 3.4 kilowatts per kilogram. The battery remained stable through 2,500 cycles.

Scientists have spent decades searching for a high-energy magnesium battery, hoping to take advantage of the natural qualities magnesium has over lithium, the element used in standard lithium ion batteries. Magnesium is far more common and therefore less expensive, and it is not prone to breaches in its internal structure – known as dendrites – that can cause lithium batteries to explode and catch fire.

But magnesium batteries won't be commercially competitive until they can store and discharge large amounts of energy. Yao said previous cathode and electrolyte materials have been a stumbling block.

The cathode is the electrode from which the current flows in a battery, while the electrolytes are the medium through which the ionic charge flows between cathode and anode.

Other researchers on the project include first authors Hui Dong, a doctoral student at UH; Yanliang Leonard Liang, research assistant professor at UH; Oscar Tutusaus and Rana Mohtadi, with the Toyota Research Institute of North America; and UH doctoral students Ye Zhang and Fang Hao.

Liang noted that until now the best cathode for magnesium batteries has been a Chevrel phase molybdenum sulfide, developed almost 20 years ago. It has neither the power nor the energy storage capacity to compete with lithium batteries, he said.

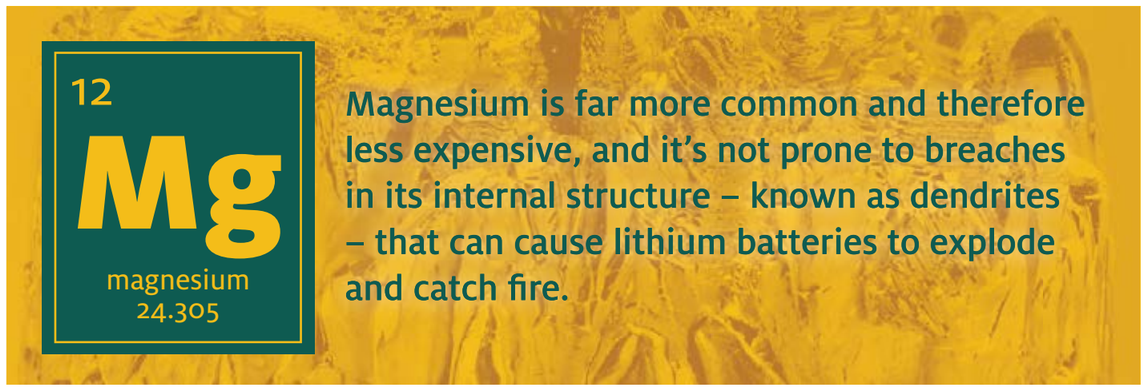
But recent reports suggest organic cathode materials can provide high storage capacity at room temperature. "We were curious why," Liang said.

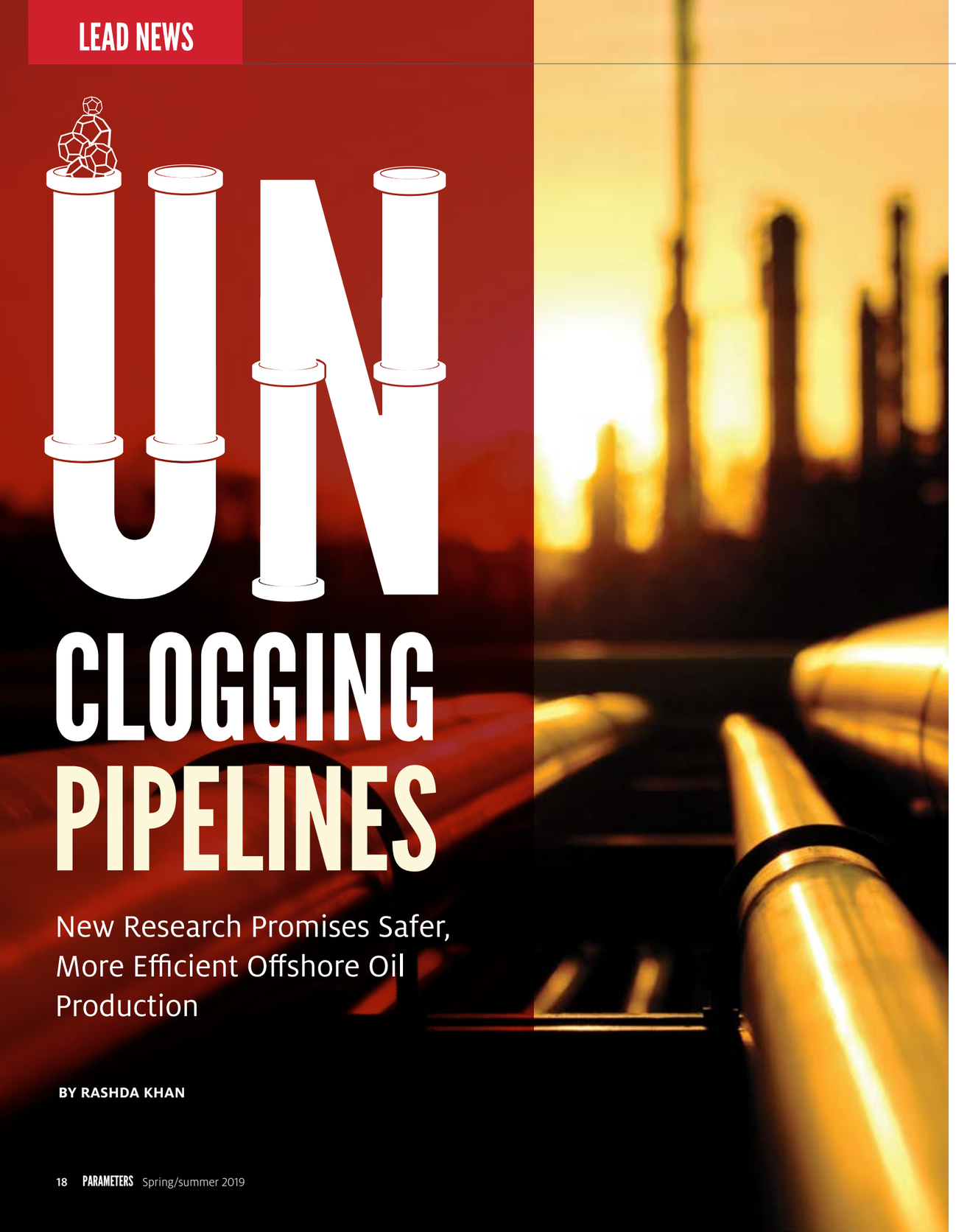
Dong said both organic polymer cathodes tested provided higher voltage than the Chevrel phase cathode.

Yao said future research will focus on further improving the specific capacity and voltage for the batteries in order to compete against lithium batteries.

"Magnesium is much more abundant, and it is safer," he said. "People hope a magnesium battery can solve the risks of lithium batteries."

Yao received the University of Houston Award for Excellence in Research and was named a Highly Cited Researcher selected by Clarivate Analytics based on "exceptional research performance that rank in the top 1 percent by citations in Web of Science" in 2018.





UH CLOGGING PIPELINES

New Research Promises Safer, More Efficient Offshore Oil Production

BY RASHDA KHAN

World-renowned for their anti-icing materials and research, UH engineer **Hadi Ghasemi** and his research group are applying their expertise to a new subject – gas hydrates.

"One of the important aspects of our research that we're working on as a group is surface physics," Ghasemi said. "We're trying to develop innovative and transformational surfaces to address problems in different industries." This led his team to consider issues facing offshore oil and gas production.

Natural gas hydrates are ice-like crystalline solid structures that are formed when water and gas come together at high pressure and low temperature. Gas, most often methane, is trapped inside these compounds making them highly flammable and potentially hazardous.

"When you have high pressure and low temperature in the underwater pipelines used in offshore petroleum extraction, it forms gas hydrates. They accumulate, and after a while they block the pipeline," he said. "Eventually, it may cause the pipeline to shut down or could cause it to blow up. It's a big problem."

In the 2010 Deepwater Horizon situation, gas hydrates were a major issue in the containment of the oil leak following the blowout of the Macondo well in the Gulf of Mexico.

Despite their negative impact in oil and gas pipelines, gas hydrates are a potential asset when present in large natural gas deposits in arctic regions or in oceanic sediments along the continental margins, Ghasemi added. The global estimate of the amount of energy (methane gas) in natural gas hydrate deposits is approximately twice that of all fossil fuel reserves available worldwide. This makes gas hydrates attractive fuel sources.

Ghasemi, Bill D. Cook Assistant Professor of mechanical engineering at the UH Cullen College of Engineering, won a $110,000 grant from the American Chemical Society's Petroleum Research Fund for a two-year research project to better understand the nanoscale physics of gas hydrates.

A better blockage solution

The current strategy in the petroleum industry is to inject huge amounts of ethanol into pipelines at the first sign of hydrates to dissolve the solids and prevent them from forming again. But ethanol is pricey, making this solution economically unfeasible.

Ghasemi's group is aiming to come up with a cost-efficient solution.

The research project has three main objectives: 1) developing new approaches to accurately predict the growth rate of gas hydrates, 2) looking at the nanoscale physics of the gas hydrates to pinpoint ways to inhibit the growth of the hydrates, and 3) creating new surfaces that are hydrate-repellant to avoid any attachment.

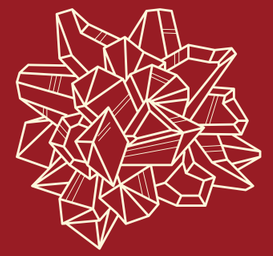
The group has already developed a method to predict the growth rate of the hydrates and has used it in a few case studies.

"The fundamental knowledge that we're going to gain in this project is going to help us avoid any catastrophe in the offshore pipelines and more importantly to use hydrates as an efficient material to address global energy problems," Ghasemi said.

Natural gas hydrate reservoirs occur in the Arctic region, an area which happens to be of high interest to the National Science Foundation.

"There's so much unexplored potential, so much knowledge that exists there and we don't know anything about it," Ghasemi said. "There is great interest in acquiring fundamental knowledge that we're missing from the Arctic region."

He is happy to contemplate the possibility of a future research trip to the Arctic. "There's a lot of ice and gas hydrates there," he said.



NATURAL GAS HYDRATES

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gas hydrates were a major issue in the containment of the oil leak following the blowout of the Macondo well in the Gulf of Mexico.

BEYOND ARCHAEOLOGY

NCALM Pursues New Technology, New Projects

BY JEANNIE KEVER

The National Center for Airborne Laser Mapping (NCALM) is best-known for its headline-grabbing work in archaeology. Among them are the 2016 discovery of previously unknown ruins of a complex Maya settlement in the Guatemalan jungles, undocumented settlements from an ancient civilization in Honduras uncovered in 2012, and detailed mapping of more than a dozen other settlements in Mexico and Central America.

But center researchers also use another measure of success.

"The archaeology work is significant, and it gets a lot of attention," said **Craig Glennie**, associate professor of civil and environmental engineering at the University of Houston, where NCALM is based, and principle investigator on a $3.26 million, five-year operational grant from the National Science Foundation. "But the center has produced important science from our work with earthquakes, landslides, wildfires and other efforts to map terrain and how it evolves over time."

Researchers mapped lava flow from Kilauea in Hawaii this summer, helping assess risk of earthquakes and landslides. Locally, they have flown over Buffalo Bayou to help delineate flood damage caused by Hurricane Harvey.

Although the center uses several techniques, its best-known work involves LiDAR technology. LiDAR gathers detailed information by shooting hundreds of thousands of laser bursts per second at the ground then transforms the data into intricate topographical maps.

LiDAR gathers detailed information by shooting hundreds of thousands of laser bursts per second at the ground then transforms the data into intricate topographical maps.

More than 530 scientific papers have been published in peer-reviewed journals using data gathered by NCALM. The papers have been cited about 8,000 times, according to the Web of Science indexing service.

Most of the data is made publicly available through OpenTopography. Datasets involving California's San Andreas and San Jacinto faults have proved the most popular, downloaded almost 4,000 times.

Now 15 years old, NCALM has been based at UH since 2010 and is operated jointly with the University of California at Berkeley. Researchers use laser mapping, satellite data analysis and other technologies to produce high-quality scientific data in a variety of fields, including archaeology, Homeland Security, environmental studies and natural disaster surveillance.

To date, NCALM has provided research- quality LiDAR data for 169 projects that represent:

- 85 principal investigators at 61 universities
- 24 U.S. states and eight foreign countries

The center also offers seed grants to fund projects submitted by graduate students from around the nation; 121 have been funded in the past 15 years. Glennie said the latest National Science Foundation funding will allow NCALM to continue the grants.

Center director **Ramesh Shrestha**, professor of civil and environmental engineering, said the center has three mandates: provide high-quality research data to scientists, advance the technology for laser mapping and train graduate students to use the technologies. Master's and Ph.D. programs in geosensing systems engineering and sciences were started in 2013 and 2015, respectively.

NCALM also plays a key role in advancing technology, he said, most recently through work with the Army Corps of Engineers Cold Regions Research and Engineering Lab to develop a portable high-resolution helicopter mounted LiDAR system.

"Flying a helicopter that can be rented near the location is less expensive than using the airplane equipped with NCALM's multi-wavelength LiDAR system," Shrestha said. "That will allow researchers to collect data for smaller and more remote projects that previously weren't cost-effective."

Researchers Create Smartphone System That Tests for

BY JEANNIE KEVER

The discovery of lead in the Flint, Mich., water supply drew renewed attention to the health risks posed by the metal. Now researchers at the University of Houston have created an inexpensive system using a smartphone and a lens made with an inkjet printer that can detect lead in tap water at levels commonly accepted as dangerous.

The system builds upon previous developments – including an inexpensive elastomer lens capable of converting a basic smartphone into a microscope – made by **Wei-Chuan Shih**, associate professor of electrical & computer engineering, and members of his lab team.

The latest discovery, described in the journal *Analytical Chemistry,* combines nano-colorimetry with dark-field microscopy, integrated into the smartphone microscope platform to detect levels of lead below the safety threshold set by the Environmental Protection Agency.

"Smartphone nano-colorimetry is rapid, low-cost and has the potential to enable individual citizens to examine (lead) content in drinking water on-demand in virtually any environmental setting," the researchers wrote.

Even small amounts of lead can cause serious health problems, with young children especially vulnerable to neurological damage. EPA standards require lead levels in drinking water to be below 15 parts per billion. Shih said currently available consumer test kits aren't sensitive enough to accurately detect lead at that level.

By using an inexpensive smartphone equipped with an inkjet-printed lens and using the dark-field imaging mode, researchers were able to produce a system that was both portable and easy to operate, as well as able to detect lead concentrations at 5 parts per billion in tap water. The sensitivity reached 1.37 parts per billion in deionized water.

Shih and his students last year published an open-source dataset in *Biomedical Optics Express* (a peer-reviewed journal published by The Optical Society) explaining how to convert a smartphone equipped with the elastomer lens into a microscope capable of fluorescence microscopy. That paper has been the journal's most frequently downloaded paper since its publication.

The latest application incorporates color analysis to detect nanoscale lead particles.

Joining Shih as researchers on the project were first author **Hoang Nguyen**, assistant professor, and **Xiaonan Shan,** assistant professor, and Yulung Sung and Kelly O'Shaughnessy. All are with the UH Electrical and Computer Engineering Department.

Building upon the smartphone microscope platform to create a useful consumer product was key, Shih said. "We wanted to be sure we could do something that would be useful from the standpoint of detecting lead at the EPA standard," he said.

By using an inexpensive smartphone equipped with an inkjet-printed lens and using the dark-field imaging mode, researchers were able to produce a system that was both portable and easy to operate, as well as able to detect lead concentrations at 5 parts per billion in tap water.

Cullen College Professors Earn $765K Welch Awards to Continue

LIFE-ALTERING RESEARCH

BY RASHDA KHAN

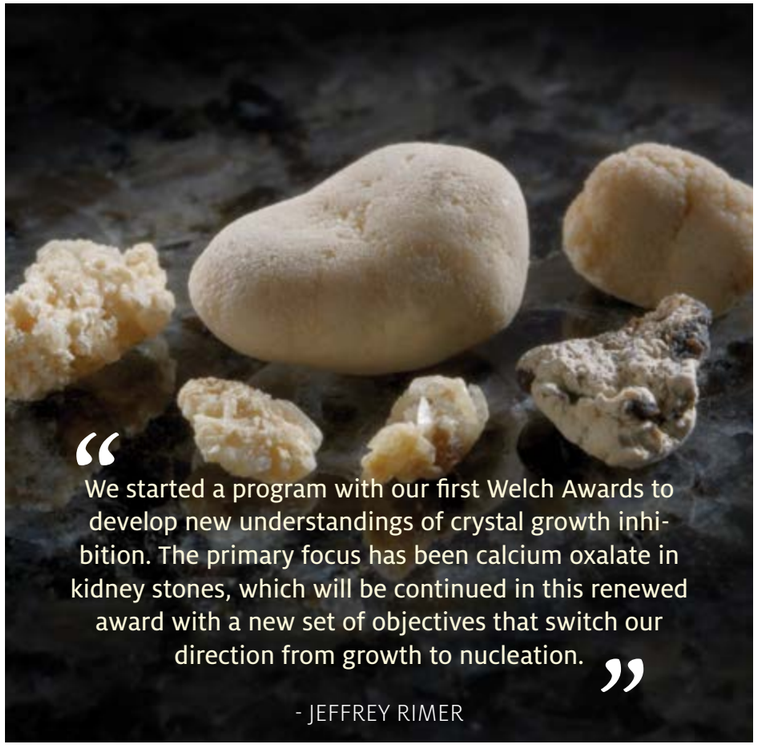
Three UH Cullen College chemical and biomolecular engineering professors received funding from The Welch Foundation for their contributions to basic chemical research that benefits humankind. These three-year grants extend from 2018 to 2021.

Jeffrey Rimer earned a $330,000 award to continue his search for more effective drugs to treat kidney stone disease. Jeremy Palmer was awarded a $240,000 grant to further expand his postdoctoral research on unusual phase behaviors exhibited by water molecules during supercooling. Jacinta Conrad won a $195,000 grant so she can continue exploring the structure and dynamics of attractive nanoparticle glasses.

The three awards add up to $765,000 in research funding.

"New advances can only come from a better understanding of how the world works," said Carin Marcy Barth, chair of The Welch Foundation. "Our mission as a foundation is to support that critical basic research. It has been so rewarding to work with UH faculty as well as scientists across the state who are expanding knowledge at the fundamental level. Ultimately, these insights lead to solving real-world problems and improving lives."

The Houston-based Welch Foundation is one of the largest private funding sources for chemistry research in America. Since its inception in 1954, the foundation has given more than $64.8 million to the University of Houston.



Jeffrey Rimer

Abraham E. Dukler Professor
Title: Physicochemical Factors Governing Molecular Modification of Calcium Oxalate Crystallization
Amount: $330,000

Occasional and chronic kidney stones – which are crystal aggregates made up of mostly calcium salts that form in the kidney – affect approximately 10 percent of the U.S. population. A recent study published in the *Mayo Clinic Proceedings* journal suggests the number of patients suffering from painful kidney stones is on the rise.

Rimer earned his first Welch grant in 2012 to study mechanisms of naturally occurring biological growth inhibitors on kidney stones. The foundation renewed his award in 2015 to explore small, organic molecules as potential drugs to treat the kidney disease. This year's funding focuses on further developing a promising new drug Rimer's research team recently discovered: hydroxycitrate.

"In the past 30 years there have been no advancements in therapies for kidney stone disease," Rimer said. "We started a program with our first Welch Awards to develop new understandings of crystal growth inhibition. The primary focus has been calcium oxalate in kidney stones, which will be continued in this renewed award with a new set of objectives that switch our direction from growth to nucleation."

The current treatment for kidney stones is an organic molecule called citrate, which is an over-the-counter supplement. Citrate acts as a mild inhibitor of the crystals but is incapable of significantly reducing stone incidence rates among patients with chronic disease.

"Understanding the factors governing the specific recognition and interactions between drug molecules and crystal surfaces helps us design more effective crystal growth inhibitors," Rimer said. "Our group is working to develop new drugs that can supplant citrate for calcium oxalate stone disease."

Rimer has filed a patent on the promising new drug for the treatment of kidney stones that serves as the basis for this next phase of research. He is collaborating with a nephrologist at Litholink Corporation to perform human trials and a chemical engineering professor at the University of Pittsburgh to perform computational simulations of drug-crystal interactions.

Rimer intends to leverage Welch funding for future phases of his research. For example, he and his collaborators are recruiting other researchers to conduct animal testing to determine drug efficacy in vivo, for which he is looking to the National Institutes of Health to fund.

The award funds more than three full-time graduate students to help conduct the research.

"Funding from the Welch Foundation has allowed us to expand research efforts to other areas," Rimer said.

With the funding, he has broadened the scope of his kidney stone work to include other types of stones that can occur – brushite and struvite – and to foster collaborations with medical and pharmacy schools to explore fundamental aspects of crystal growth, the design of new therapeutics and methods of translating this knowledge into practice.

"The results of this project have implications for improving human health, but our findings have also uncovered new fundamental insights about crystallization and mechanisms of controlling their growth and nucleation," Rimer said.

Jeremy Palmer

Assistant Professor
Title: Metastable Liquid-Liquid Phase Transitions and Glass Polymorphism in Tetrahedral Fluids
Amount: $240,000

Palmer earned his Welch Award to expand on his postdoctoral research on the phase behavior of liquid water at low temperatures.

"We're trying to fill a knowledge gap about the unusual behavior exhibited by some liquids –tetrahedral liquids such as water, silica and carbon – when they're cooled near or below their normal freezing point," Palmer said.

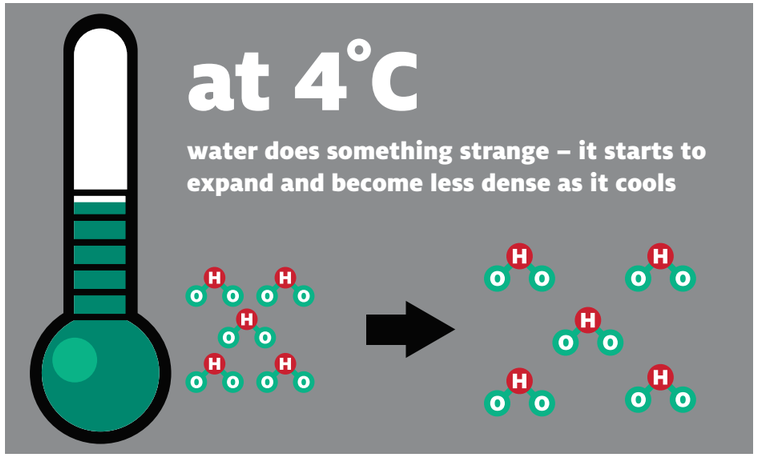
Water's density anomaly is one well-known example of this unusual behavior. As liquid water cools at ambient pressure, its density increases like most simple liquids. However, at 4 degrees Celsius, water does something strange. It starts to expand and to become less dense as it cools. Although liquid water normally freezes into ice at zero C, it can be stabilized in experiments to about 42 C below zero, at which point freezing occurs too rapidly for measurements on liquid water to be performed.

Remarkably, experiments on liquid water performed slightly above this temperature reveal that it continues to defy normal liquid behavior and expand upon cooling. Many other peculiar behaviors, such as its increased compressibility upon cooling, are also observed in water at low temperatures.

Although water is the most studied substance in the world, the physical origin of its unusual behavior upon cooling continues to elude scientists. And it is not the only substance that behaves strangely. Evidence suggests that liquid forms of silicon and possibly carbon exhibit similar trends.

"These are some of the most ubiquitous and important substances on earth," Palmer said. "They shape almost every aspect of our natural world and life as we know it, and yet we still don't understand why they behave the way that they do."

With Welch Foundation support, Palmer and his research team will use state-of-the-art computer simulation techniques to study molecular models of these substances to better understand their odd behaviors. Their investigation will focus on the physical origin and broader thermodynamic implications of the liquid-liquid



phase transition.

"The insights gained from this research will address fundamental knowledge gaps that currently frustrate interpretation of the growing body of experimental work in this field, crystal nucleation and glass transitions in tetrahedral liquids," Palmer said.

Jacinta Conrad

Ernest J. and Barbara M. Henley Associate Professor
Title: Dynamics in Attractive Nanoparticle Supercooled Liquids and Glasses
Amount: $195,000

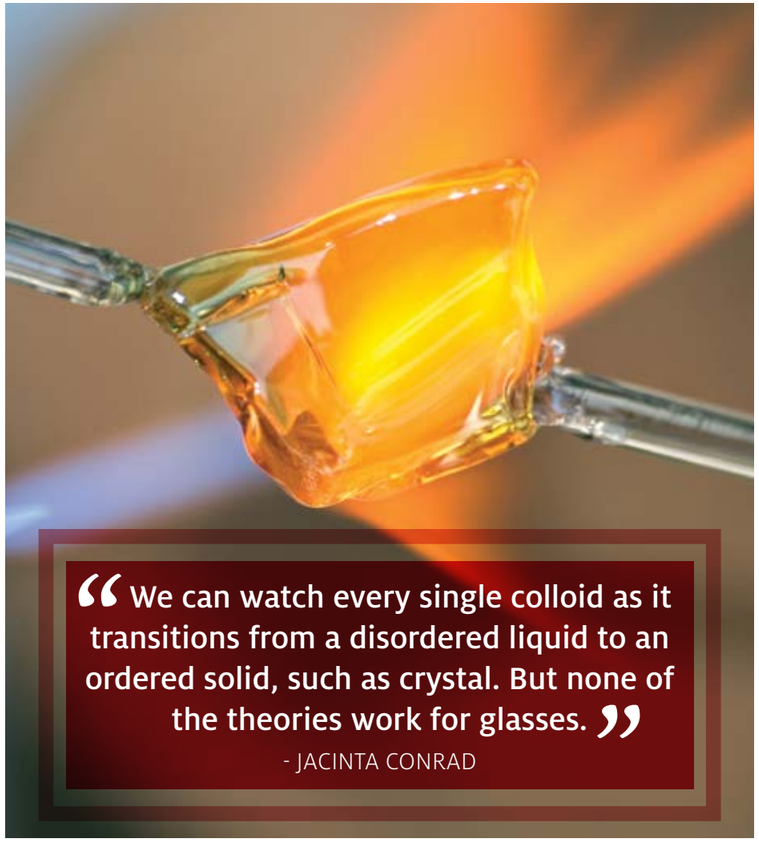
Conrad is using her Welch Award to explore one of the most intriguing basic problems in physical chemistry: the nature of the glass transition.

Glasses lack long-range order and look structurally like liquids but behave mechanically like solids. In contrast, many solids are ordered crystals, in which the molecules or atoms are arranged in a regular lattice. Ordered crystals and disordered glasses can be composed of the same molecules, but their structures and how they form are very different. Despite years of research, the reasons for these differences are poorly understood among scientists.

"While we have a basic understanding of crystal formation, we don't understand what drives the formation of glass," Conrad said. "There is not one unifying theory that explains the phenomenon."

Conrad's research group uses a novel colloidal model system to study the structure and dynamics of colloidal particles across the phase transition from dense liquid to glass. Their objective is to test existing theories for the glass transition, which will increase fundamental understanding and help engineers tailor mechanical properties of glasses for practical applications.

"We can watch every single colloid as it transitions from a disordered liquid to an ordered solid, such as crystal," Conrad said. "But none of the theories work for glasses."



Conrad hypothesizes that differences between the predictions of existing theories and the measurements on experimental glasses are caused by attractive interactions between the colloids, which she and her team will control in this study.

In her model system, she can make the particles attractive, or sticky, by adding small polymers to her solutions. The polymers crowd the colloids, and this crowding pushes the colloids together to create an effective attraction. She plans to study the effects of these attractions in controlled settings to better reconcile the gaps between theories and experiments.

Over the course of this three-year grant, Conrad's research team will test microscopic theories of the glass transition in a model for molecular liquids, confine supercooled liquids in 2-D and 3-D for testing and generate ultrastable nanoparticle glasses through slow sedimentation for additional testing.

"This ambitious research program will open new avenues to develop fundamental insight into the nature of the glass transition," she said.

Conrad hopes to establish the usefulness of her novel colloidal modeling system for testing existing theories and to study the glass transition in thin films and small drops, which is relevant for applications in coatings and 3-D printing.


Jeremy Palmer

UH Professor Discovers Issue at the Root of

SEVEN-YEAR WATER DISPUTE

BY RASHDA KHAN

A scientific quest, started with genuine curiosity and a passion for research, turned into a Hatfield-McCoy style feud that lasted seven years.

This legendary dispute and the man who finally resolved it – **Jeremy Palmer,** assistant professor of chemical and biomolecular engineering at the UH Cullen College of Engineering – are featured in an article titled "The War Over Supercooled Water" published in *Physics Today.*

The beginning

Two teams of researchers – one at Princeton University and the other at the University of California, Berkeley – worked to answer the same fundamental question: What happens when liquid water is cooled far below its freezing point?

Water that's free of dust and other impurities on which ice crystals can form can be supercooled tens of degrees below 0 degrees Celsius. But all water in liquid form, no matter how clean, crystallizes at about -40 degrees Celsius in experiments.

Both teams wanted to know what theoretical models predict water might look like at even colder conditions. Each came up with a different answer.

Initially, the two teams started to work together to resolve the issue. But after a year, no consensus had been reached and the relationship had soured – each side convinced its answer and methods were correct. So started a scientific dispute conducted mostly via journal publications and conference presentations.

The stalemate continued until Palmer, then assistant professor at UH, dove deep into the Berkeley team's computer code and discovered the error in their calculations.

Palmer, who won a National Science Foundation CAREER Award in 2018, said reproducibility is a key part of the research process. He is creating a short course for graduate and undergraduate researchers at the Cullen College focused on whether findings by one research group can be reproduced by another.

"It's a huge issue," Palmer said. "Eighty percent of the work out there is not reproducible to the extent it should be."

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

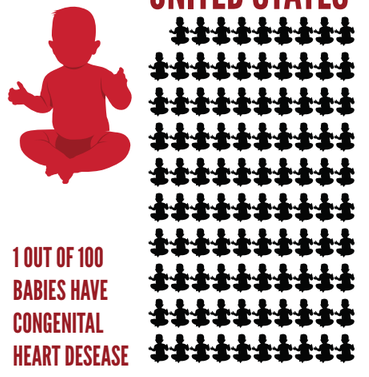
UNDERSTANDING CONGENITAL HEART DEFECTS

to Prevent Them

BY LAURIE FICKMAN

To understand cardiovascular failures, the leading cause of birth defect-related deaths in infants, UH professor of biomedical engineering **Kirill Larin** is teaming up with Baylor College of Medicine professor of cellular and molecular physiology Irina Larina on a chicken and egg hunt.

"When the heart develops, it becomes stiffer as required for ability to contract and pump blood," said Larin. "So the question is: Does it become stiff because it's contracting, or is it stiff to begin with because it is genetically predefined?"



Surprisingly, very little is known about an embryo's developing heart.

"Defining how these mechanical factors integrate with genetic pathways and heart function is critically important for understanding congenital heart defects and heart failure," said Larin. Such information is required to develop new strategies for therapeutic interventions of heart defects.

While multiple studies suggest that cardiac contraction, blood flow and stiffness each influence cardiovascular development of the heart, their individual roles remain unknown. The team's project, defining the roles of cardiac contraction and flow-induced shear stress in regulating mechanical stiffness, is part of a $3 million grant from the National Institutes of Health.

It is well established that biomechanical stimuli are important regulators of proper cardiovascular development. The research team will get a bird's eye view, watching the heart develop in utero using optical coherence tomography (OCT), a noninvasive high-resolution retina imaging technology that uses light waves to take cross-section pictures. Larin is one of the pioneers of using OCT to image portions of the body without touching or making a cut. He describes the method as "frontier technology," and is using it in his other work to assess if heart medicine is working and scar tissue is healing immediately following a heart attack.

Larin is developing the data processing methods and the imaging tools which will deliver 3-D images and will be "super-fast to catch the cardiac cycle and all the activity as the heart forms," he said.

"One out of every 100 babies in the United States has a congenital heart defect leading to death," said Larin. "Understanding biomechanical regulation of heart development is highly important for better management of congenital heart defects."

The project fills a significant gap in the field of early mammalian cardiac development and defines the role of cardiac forces in maintaining mechanical stiffness and cell differentiation.

While multiple studies suggest that cardiac contraction, blood flow and stiffness each influence cardiovascular development of the heart, their individual roles remain unknown.

Can Nanoparticles Be Used to LOWER ANTIBIOTIC RESISTANCE?

BY JEANNIE KEVER

Antibiotic resistance is one of the world's most serious threats to public health, forcing the use of medications that are more toxic, more expensive and not always effective. There are several causes, including over-prescription of antibiotics in both humans and in livestock.

Two engineers with the University of Houston have embarked on a project to determine whether the use of tiny amounts of antibiotics embedded in corn-based nanoparticles could allow the use of lower dosages and avoid wiping out the microbiome – the collection of both healthy and disease-causing bacteria found in the intestines – and the resulting genetic mutations that lead to antibiotic resistance.

Debora Rodrigues, associate professor of civil and environmental engineering, and **Stacey Louie,** assistant professor of civil and environmental engineering, have developed a reactor to simulate pig intestines in order to study how antibiotics react in the pig microbiome.

"Pigs have a lot of similarities to humans," said Rodrigues, principal investigator on a $437,535 grant from the USDA National Institute of Food and Agriculture. "We are working with livestock, but ultimately it could be helpful for humans."

Collaborators Cristina Sabliov and Carlos Astete at Louisiana State University will create corn-based nanoparticles loaded with antibiotics for the project.

Early data supports the researchers' hypothesis that the plant-based nanoparticles will be less toxic than many other forms of nanoparticle. They are designed to dissolve in the simulated pig intestine.

The reactor mimics a pig's lower intestine, with a dialysis bag positioned to capture nutrients as pig slurry is funneled through. Louie said the bag functions much like the gut, allowing water, sugars and other nutrients to pass through.

Antibiotics – both at regular dosages and the minute amounts in the nanoparticles – will be added to the slurry, allowing the researchers to test how the drugs affect the microbiome at different dosages.

The goal is to determine if administering antibiotics in a different way will avoid the widespread damage to the microbiome associated with current practices.

"We'll study how the microbial community is changing and what genes related to antibiotic resistance are emerging," Rodrigues said.

This work is supported by the USDA National Institute of Food and Agriculture.

‘SMART’ ROBOTIC SYSTEM

COULD OFFER HOME-BASED REHABILITATION

BY JEANNIE KEVER

Researchers in Houston and elsewhere have shown that robotic systems controlled by the user’s own brain activity can help patients recovering from stroke and other disabling injuries. But the demonstrations have taken place in highly controlled settings, and none of the systems have been approved for use in clinics or patient’s homes.

An engineer from the University of Houston is leading a team of researchers, healthcare providers and industry to fast-track the commercialization of a groundbreaking robotic rehabilitation system. Backed by a $750,000 grant from the National Science Foundation’s Partnerships for Innovation program (the NSF PFI program), the goal is to build a system that can be approved by the U.S. Food and Drug Administration and is sturdy, simple and inexpensive enough for stroke patients to use at home.

“We want to break that wall between the lab and home,” said **Jose Luis Contreras-Vidal**, professor of electrical and computer engineering at UH and co-director of the Building Reliable Advances and Innovation in Neurotechnology (BRAIN) Center, a NSF-supported Industry/University Collaborative Research Center based at UH and Arizona State University. “We want to build a system that can be used at home with FDA approval.”

The NSF PFI program allows academic innovators to advance prior NSF-funded research by further developing technologies that show promise for commercialization and societal impact. Such technology development efforts benefit from industry-academic collaborations that are needed to accelerate the transition of technology from the academic lab to the marketplace.

The rehabilitation systems work by capturing electrical activity in the brain, which can be translated into movement through the use of algorithms that decode movement intent from patterned brain activity. Early versions of this brain-computer interface relied upon a skull cap embedded with the sensors, but Contreras-Vidal said any system intended for home use will have to be far simpler for patients to use.

He has worked for years with TIRR Memorial Hermann, a nationally ranked rehabilitation hospital, in a quest to design medical systems that can assist in recovery from strokes and other injuries and illnesses.

Other partners in the project are National Instruments Corp. and Harmonic Bionics, both based in Austin. The UH Office of Intellectual Property Management will help with commercialization, and Jeff Feng, associate professor for the UH Gerald D. Hines College of Architecture and Design who has a background in the design of medical devices, will work with Contreras-Vidal on the headset design to optimize usability and form factor.

> “Each year, thousands suffer a stroke which can leave them facing a long road of rehabilitation. By developing this device for use at home, it can be an added and convenient component to their rehabilitation journey.”
>
> - JOSE LUIS CONTRERAS-VIDAL

“It has to be very user friendly,” Contreras-Vidal said. The idea is that use of the device – it will be modeled on a simple rowing machine and at least initially will focus on the upper limbs – will promote plasticity in the brain and the restoration of motor function. Contreras-Vidal said the same concept could apply to the lower limbs to restore a patient’s ability to walk.

While the work also has applications for virtual reality, gaming and consumer electronics, he said the researchers are focused on using it to help people recover from stroke. It will be tested in the clinic at TIRR before being sent home with patients.

“The research team of the physical medicine and rehabilitation department is fortunate to be a part of this project, which will make a difference and improve the quality of life in stroke survivors,” said Dr. Gerard Francisco, chairman and professor of physical medicine and rehabilitation with McGovern Medical School at the University of Texas Health Science Center at Houston and chief medical officer and director of the NeuroRecovery Research Center at TIRR Memorial Hermann.

“Each year, thousands suffer a stroke which can leave them facing a long road of rehabilitation. By developing this device for use at home, it can be an added and convenient component to their rehabilitation journey.”

Harmony Bionics will produce the robotic device, while National Instruments will provide a compact, embedded hardware solution for the brain-computer interface system and provide technical assistance.

“There is a growing need for accelerating the transition to practice of the discoveries and innovations that start at universities,” said Igor Alvarado, business development manager for academic research at National Instruments. “This project allows us to help advance new at-home rehab technologies for stroke patients by providing the data acquisition and control platform to be used in prototyping, testing and deploying the new rehab device.”

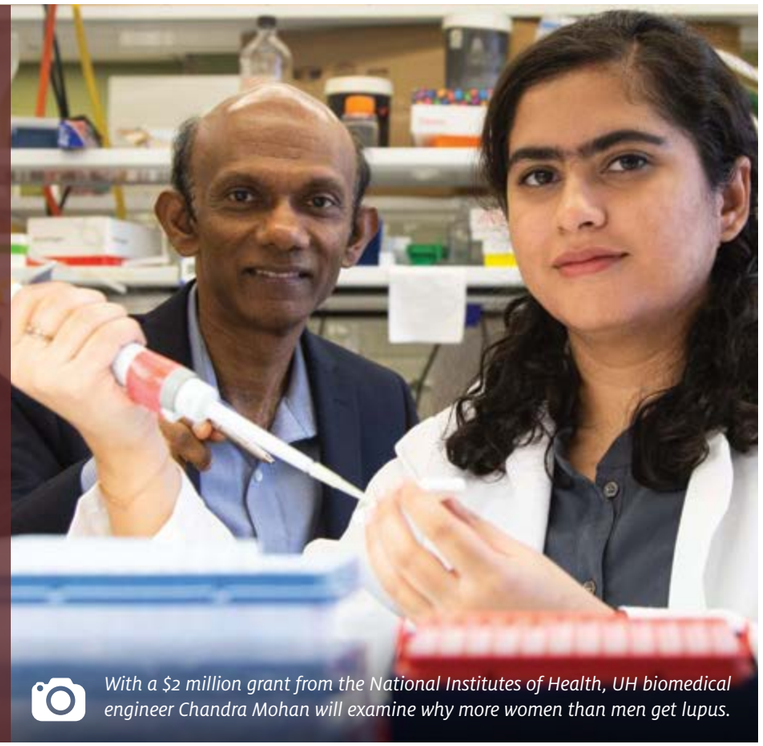
National Instruments also will oversee a national competition, which will release the researchers’ datasets and encourage people elsewhere to suggest improvements in the decoding algorithms.

“That’s STEM outreach,” Contreras-Vidal said. “But it’s also citizen-science and advancing the state of the art.”

WOMEN AND LUPUS

- Tackling the Debilitating Connection

BY LAURIE FICKMAN



With a $2 million grant from the National Institutes of Health, UH biomedical engineer Chandra Mohan will examine why more women than men get lupus.

The chronic inflammatory disease systemic lupus erythematosus (known as SLE or lupus), is about nine times more common in women than men, and a University of Houston researcher now has the money to find out why. The National Institutes of Health has awarded **Chandra Mohan,** Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering, $2 million dollars to examine the connection.

Mohan knows just where he's taking the money – straight to the bank. Bank1, that is, a critical gene in B-Lymphocytes, immune cells which make the antibodies that cause lupus when they misguidedly attack the body's own cells.

"Bank1 exists in men and women, but in women the consequences are more drastic because the Bank1 gene and female hormones work together on the same pathway and make even higher levels of disease-causing auto antibodies," said Mohan.

Genetic studies have led to the identification of several genes involved with lupus, but how they operate is still unclear. One of these genes is the Bank1.

"We will examine how the Bank1 impacts B-cell function and disease, in concert with female sex hormones," said Mohan. "A unique aspect of this grant is its focus on unraveling why females are more prone to lupus, by factoring in the contributions of culprit genes and estrogens."

Merely having a target is a step forward. The complex autoimmune disease is difficult to diagnose and treat because it is a multisystem disorder, typically impacting skin, joints and kidneys. The disease is characterized by high levels of anti-nuclear autoantibodies and B-cell hyperactivity. Only one treatment for lupus has been approved in nearly 60 years.

Mohan will examine the molecular mechanisms through which lupus genes and sex hormones interface to cause autoimmunity. A better understanding of the pathogenic mechanisms underlying the disease will also pave the way toward better therapeutics, he said.

Mohan is one of the leading lupus researchers in the world. For more than three decades he's been exploring the disease on different fronts.

"There are three major areas we need advances in concerning lupus," said Mohan. "We need a better understanding of the disease, we need to know if we can diagnose and monitor the disease better using better biomarkers, and we need to know superior ways to treat the disease."

On this grant Mohan is joined by Chin-Yo Lin of the UH Center for Nuclear Receptors and Cell Signaling and biologist Anne Satterthwaite of UT Southwestern Medical Center in Dallas.

ESTABLISHING IMMUNOTHERAPY

for Pediatric Liver Cancer

BY LAURIE FICKMAN

As part of a $6 million effort to establish new therapies for high-risk pediatric liver cancer, **Navin Varadarajan,** associate professor of chemical and biomolecular engineering at the Cullen College of Engineering, will modify T cells to recognize and kill glypican-3, a molecule found in liver cancer cells.

Inherently that's what the immune systems' white T cells do – they fight invaders or infections. It is also what Varadarajan does. With two previous awards from the Cancer Prevention & Research Institute of Texas (CPRIT), Varadarajan is working to improve effectiveness of T-cell immunotherapy. On this CPRIT multi-investigator research award, he joins Andras Heczey, a physician researcher at Baylor College of Medicine, in examining one of the most common forms of liver cancer in adolescents, hepatocellular (HCC) carcinoma. HCC patient survival rate is under 30 percent.

No effective cure is available for most metastatic hepatocellular tumors. Current treatment includes surgical resection or liver transplantation in combination with dose-intensive chemotherapy regimens (associated with significant morbidity in HCC) which may cause low blood-cell counts, hearing impairment, speech and cognitive delay, and long-term damage to the heart. "It is thus critical to develop new, effective and safer therapies," said Varadarajan.

T cell-based immunotherapy has worked in other types of cancers, like leukemia and lymphoma. The team at Baylor will isolate the T cells, modify them with synthetic receptors and then Varadarajan will get to work.

> "The hope is to get consistent and durable patient responses in pediatric HCC by using the power of immunotherapy."
>
> - NAVIN VARADARAJAN

"We have a platform for documenting how well T cells work and we will use it to determine which T cell properties are essential in fighting the cancer cells," said Varadarajan, whose team built the microscopy-based methods for monitoring cellular function.

Once determined, certain functions can be added or subtracted through genetic editing to make the T cell the best cancer fighter possible. The modified cells will deliver targeted and tailored therapy in clinical trials at Baylor.

"The hope is to get consistent and durable patient responses in pediatric HCC by using the power of immunotherapy," said Varadarajan, who credits CPRIT with the steps forward in immunotherapy.

"Texas taxpayers are amazing for funding CPRIT. Much of this research would not be possible without it," said Varadarajan. CPRIT's goal is to expedite innovation in cancer research and product development, and to enhance access to evidence-based prevention programs throughout the state of Texas.

A New Take on

FIGHTING MULTI-DRUG RESISTANT BACTERIA

BY LAURIE FICKMAN

Two UH researchers have won a five-year, $3.5 million grant from the National Institute of Allergy and Infectious Diseases to develop technology that will quickly suggest the most promising combinations of antibiotics to kill certain resistant bacteria. According to the Centers for Disease Control, "Antibiotic resistance is one of the most urgent threats to the public's health."

"People are dying, there's no question about that. And it's because bacteria, time and again, have come up with ways to fight back against the antibiotics we are throwing at them and survive," said College of Pharmacy professor Vincent Tam who, along with **Michael Nikolaou**, professor of chemical and biomolecular engineering, intends to even the score with bacteria by optimizing clinical use of antibiotic combinations to combat resistance.

"In the war of people versus bacteria, bacteria are winning," said Tam. It's not just because they reproduce every 20 minutes and outnumber all of us (estimates propose 5 million trillion-trillion bacteria), they also have become more sophisticated and resistant. Thirty years ago, the chances of bacteria being resistant to ampicillin, a common antibiotic, was 5 percent. Today it is more than 50 percent.

Combining antibiotics has emerged as a typical practice to treat infections caused by virulent strains of bacteria resistant to a single antibiotic. But quickly choosing the correct combination is tricky. For instance, the antibiotic prescribed for a wound infection is not the same one prescribed for strep throat or a myriad of other infections.

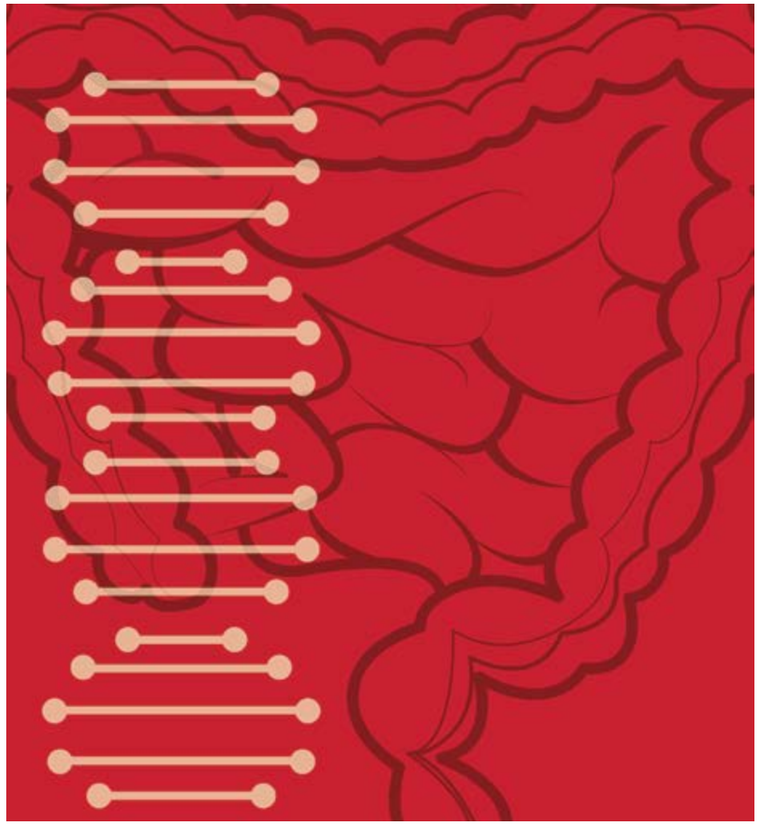
"A robust method to guide rational selection of effective antibiotic combinations is crucial to help prevent returning to the pre-antibiotic era of untreatable infections," said Tam. The team is working with an external company, BacterioScan, to develop a rapid diagnostic device that will test bacterial responses to several drug combinations. Clinicians will place bacteria samples in the device, a box, which will monitor bacterial growth in the presence of different antibiotics and will automatically process collected data to spit out predictions of the best combinations in short order.

"I don't have the time and luxury to take days, if not weeks, to figure this out when a patient is dying. The device we are developing will only take hours," said Tam, who envisions these monitors in every hospital lab. The box will deliver a raw signal, or string of numbers, that Nikolaou's algorithms will interpret to deliver a predicted ranking system of the best combinations.

Initial testing will include bacteria P. aeruginosa, which cause pneumonia; A. baumannii, which cause urinary tract infections and meningitis; and the superbug Klebsiella pneumoniae, which can cause all three illnesses and others. They will test different structural classes of antibiotics to hit the bugs at different sites.

Since bacteria are different from person to person, this approach is a personalized solution to a problem that cannot be solved with a one-size-fits-all prescription.

"It is tailor-made and customized to deliver results for a specific bacterium for a specific patient," said Tam.



Stool Proteins to

PREDICT INFLAMMATORY BOWEL DISEASE

BY LAURIE FICKMAN

University of Houston researcher **Chandra Mohan** is set to make a breakthrough in predicting and monitoring inflammatory bowel disease (IBD). With $347,490 from the Crohn's & Colitis Foundation of America, he and IBD expert Subra Kugathasan, a gastroenterologist at Emory University, are examining stool protein biomarkers that indicate the disease.

An autoimmune disease, IBD occurs when the body's immune system fights its intestinal cells. Two of the most common types are Crohn's disease and ulcerative colitis, both of which cause inflammation in the digestive tract. Mohan is one of the world's leading experts in autoimmune disease, particularly lupus.

"With the right biomarkers, we could be in the position to predict the diseases even before a diagnosis is made using conventional approaches," said Mohan, Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering.

It's a long time coming. For two decades only one stool protein, fecal calprotectin, has been used to predict IBD, but it is suboptimal, according to Mohan, because its specificity and sensitivity are not perfect in predicting the diseases. Until now, no one looked for other stool proteins in a comprehensive fashion.

By examining the levels of 1100 different proteins in IBD stool samples supplied by Kugathasan, Mohan and doctoral student Sanam Soomro have narrowed down to 50 the number of proteins that are consistently elevated in IBD stools. That means they have found new and simple ways to predict who has IBD.

It is significant because Mohan's team studies many bodily fluids from several autoimmune diseases and this one seems to work better than others. "This one is really good because we see really high levels – and they are crystal clear compared to healthy control stools – so we know something is going on there," said Mohan.

As an added bonus, better disease diagnosis, monitoring and therapy in IBD can significantly improve the lives of patients. Diagnosing or monitoring the disease from a stool test is easier, less invasive and less expensive than endoscopy or colonoscopy.

For instance, a patient already diagnosed with IBD might find out early if the disease is flaring or the symptoms are merely transient, indicating a momentary disturbance. The hope is that the biomarker will tell the difference. If the disease is flaring up, the biomarker in the stool will increase, meaning the patient can get treated quicker.

Mohan envisions a self-care or easy-care kit one day where patients can immediately understand what is happening inside, much like the saliva test and home-test kit for lupus his team is creating.

"If we have the right biomarkers, this has the potential to be a major breakthrough," said Mohan.

Watching an

EMBRYO'S NEURAL TUBE CLOSE

BY LAURIE FICKMAN

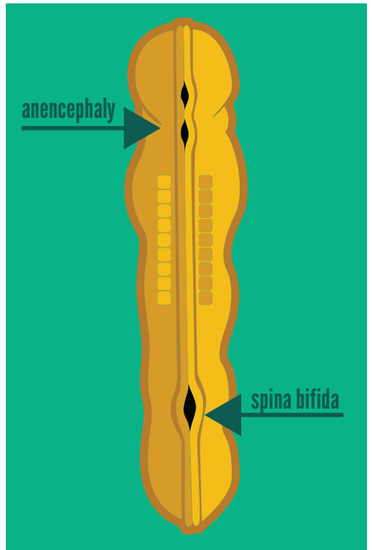
In those precious weeks before a woman even realizes she's pregnant, an embryo will have already developed a neural tube, a hollow structure made of cells that eventually become the brain and spinal cord. Now, with $3.2 million from the National Institutes of Health, UH professor of biomedical engineering **Kirill Larin** will tackle the evolutionary anomaly of why the neural tube closes in most embryos but remains open in others, leading to birth defects such as spina bifida and anencephaly.

Neural Tube Defects (NTD) are the second most common structural birth defect in humans, affecting upward of 500,000 pregnancies worldwide and approximately 2,400 pregnancies each year in the United States.

Together with Baylor College of Medicine professor Richard H. Finnell and Giuliano Scarcelli, assistant professor of bioengineering at University of Maryland, Larin will create new technology combining Brillouin spectroscopy and optical coherence tomography (OCT) to deliver 3-D images of the mechanical factors at play when the neural tube closes and – in so many cases – when it does not.

Most commonly used to examine the retina, high-resolution OCT is an imaging technology that uses light waves to take cross-section pictures. Brillouin spectroscopy is a light scattering technology that will sense the stiffness of the tissue, which is critical to its success in closing. During malfunctions there are areas of low stiffness, so it is not folding together properly, Larin said.

"We will create this hybrid microscope putting these two powerful technologies together. OCT will image the development of the neural tube while at the same time, Brillouin spectroscopy will probe its mechanical properties. We will be imaging and sensing at the same time," said Larin.



Neural Tube Defects (NTD)

are the second most common structural birth defect in humans, affecting upward of 500,000 pregnancies worldwide and approximately 2,400 pregnancies each year in the United States.

Finding out how mechanical properties controlling neural tube closure in developing embryos can be manipulated to ensure proper neural development is the first step to exploring treatment for the defect.

"If we find out what causes the tube to close, what is exactly happening, we can develop new drug treatments for at-risk embryos," said Larin.

The work fills a significant data gap in understanding neural tube closure biomechanics.

"It's still one of the great mysteries of life, no one on earth knows how this happens. That is really exciting to us," said Larin, "because we will be the ones to find out."

New Data Suggests

NICOTINE WHILE PREGNANT ALTERS GENES

BY LAURIE FICKMAN

The Akay Lab biomedical research team at the UH Cullen College of Engineering is reporting in the journal *Nature Scientific Reports* that a possible cure for addiction may be found by following the pathways of significantly altered dopamine neurons in newborns who were chronically exposed to nicotine in utero. The findings of the altered neurons come from recordings of dopamine and non-dopamine neurons in the brain's addiction center, called the ventral tegmental area (VTA), following chronic nicotine exposure during pregnancy.

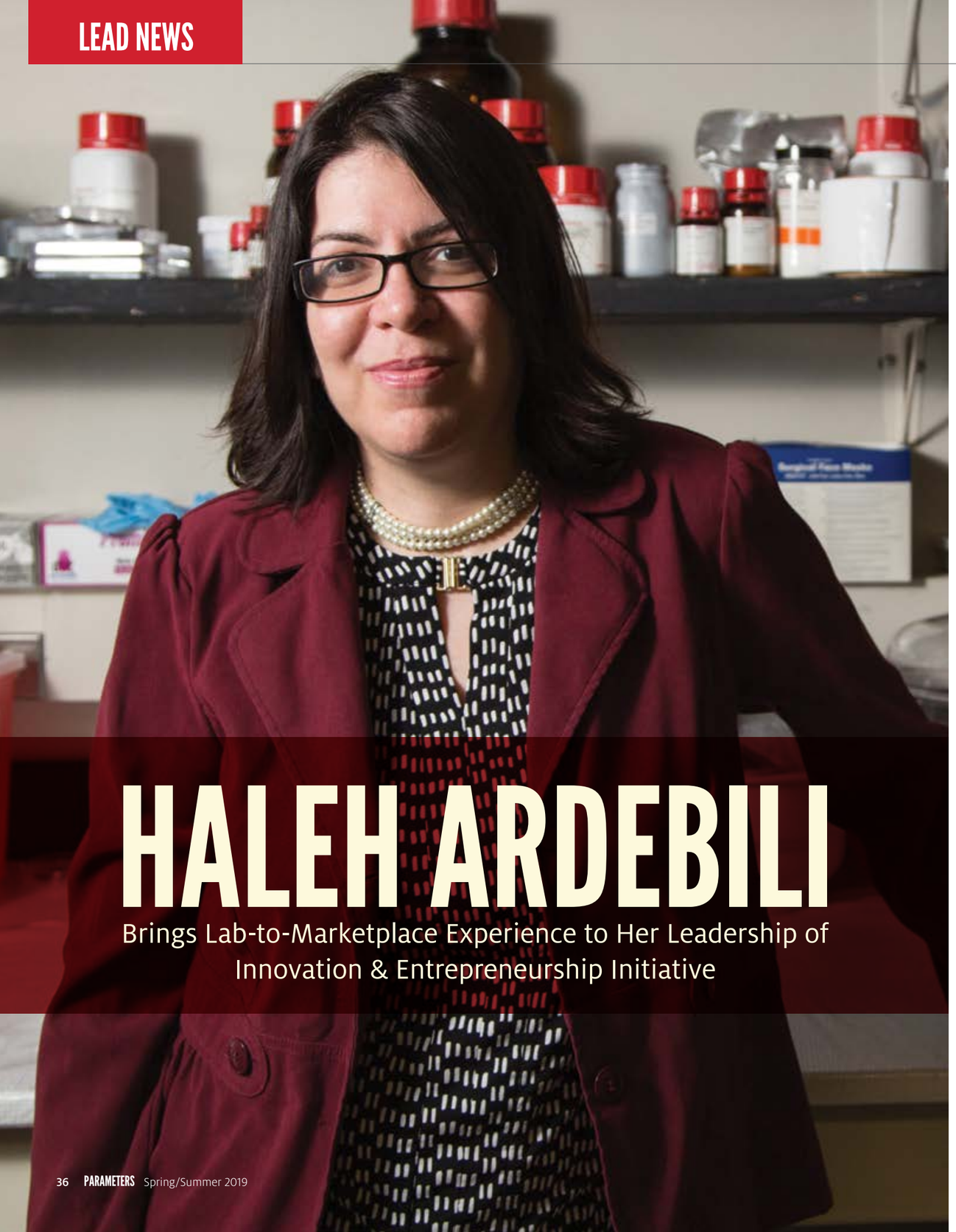
Active dopamine, known as the "feel good" hormone, might seem a good thing at first glance. It's a neurotransmitter that carries information between neurons and regulates emotional responses. It allows us to see rewards and encourages action that will lead to reward, but since it contributes to those feelings of pleasure and reward, it also plays a part in addiction.

"The impacted dopamine can result in babies being born addicted to nicotine, but once we understand which genes are altered, which gene regulator networks are altered and which gene pathways are altered, we can develop targeted medication that could eliminate addiction in the offspring," said **Metin Akay**, John S. Dunn Endowed Chair Professor of biomedical engineering and department chair, heading the research team.

Exposure to nicotine during pregnancy through maternal smoking or nicotine replacement therapy is associated with adverse birth outcomes as well as several cognitive and neurobehavioral deficits.

The Akay lab previously published work indicating that dopamine neurons in the VTA are very likely involved in nicotine addiction. Their current work speaks to the very nature of health itself, exploring how the dopamine of nicotine-exposed offspring alters gene expression, a fundamental building block of health. Many diseases are caused by a change in the DNA of a single gene.

Akay's team includes Renee F. Keller, Tina Kazemi, Andrei Dragomir and Yasemin M. Akay, assistant professor of biomedical engineering.



HALEH ARDEBILI

Brings Lab-to-Marketplace Experience to Her Leadership of Innovation & Entrepreneurship Initiative

Haleh Ardebili, director since June 2018 of the Innovation and Entrepreneurship Initiative, is bringing a spotlight to promising technologies being developed in Cullen College laboratories – especially those discoveries with potential to benefit the world.

Her first goal is to introduce entrepreneurship programs and cultivate a culture of innovation within the UH engineering community.

"Over the next few years, we will establish an engineering technology incubator at the College. Its purpose will be to support students and faculty as they generate intellectual property and form start-up companies that can bring their innovations to the public," said Ardebili, the Bill D. Cook associate professor of mechanical engineering.

Ardebili is familiar with the road an innovator travels to bring a complex product from the research laboratory to the consumer marketplace. With her research team, she developed a new kind of battery – flexible, stretchable and roughly the size of a business card – that is so promising it ranked among top-10 finalists in the NASA iTech Cycle 3 competition.

The NASA iTech program encourages inventors at universities and small companies to develop tools that not only address challenges NASA encounters deep in space but also solve problems here on earth. Ardebili's batteries, for example, may some day soon show up in astronauts' spacesuits, as well as in earthbound things such as smart military uniforms and underwater vehicles. She has two pending patents for her stretchable batteries, and her research in energy storage has received funding from the National Science Foundation, the Air Force Office of Scientific Research, U.S. Army NATICK, NASA and the Subsea Systems Institute.

Ardebili's research in flexible and stretchable batteries earned her the National Science Foundation's CAREER Award (2013-2018), the Texas Space Grant Consortium's New Investigator Award for 2014-2015, and the Texas Center for Superconductivity at UH Award (2010-present).

Ardebili is also devoted to teaching and supporting her students' careers. She serves as director of the NSF-funded Research Experience for Undergraduates, a 10-week summer program that allows undergrads from around the country to work in her lab creating new, sustainable materials for manufacturing and energy.

Last year she received the W.T. Kittinger Teaching Excellence Award, the highest teaching honor awarded by the Cullen College.

Ardebili's batteries, for example, some day soon may show up in astronauts' spacesuits, as well as in earthbound things such as smart military uniforms and underwater vehicles.

UH Engineering Professor Wins NSF Grant to STUDY ICE FORMATION AND FIGHT ICING

BY RASHDA KHAN

When it comes to dangerous natural phenomenon, most people think of events like hurricanes, tornadoes and earthquakes.

Hadi Ghasemi, Bill D. Cook Assistant Professor of mechanical engineering at the University of Houston, thinks of ice.

An average of 1,836 deaths and 136,309 injuries per year were attributed to snowy conditions and icy roads between 2005 and 2014 by the Federal Highway Administration. Between 2008 and 2009, there were 19 ice-related road fatalities in Texas but zero tornado-related fatalities.

Air transportation is also impacted by icy conditions. From 1990 to 2000, 12 percent of all weather-related air disasters were due to icing. As the Air Safety Foundation states: "Ice in flight is bad news."

"I know firsthand the amount of problems icing can cause," said Ghasemi, who completed his Ph.D. and post-doctoral work in Canada and Boston. During this time, he experienced power outages as well as transportation and infrastructure issues.

"It's not only about the financial losses, but it also affects the quality of life for the people," Ghasemi said. "I myself have slipped on ice several times so I know that icing is not a good thing."

Ghasemi channels his animosity for icing into motivation. "My field of study is surface physics, so I launched a program to study ice formation and find solutions."

The National Science Foundation rewarded Ghasemi's focus with a $290,259 grant for his project titled "Nano-Scale Physics of Icephobicity and Path Toward Durable Icephobic Surfaces." (Icephobicity is a material's ability to repel ice or keep ice from forming on its surface.) The multi-disciplinary project involves studies of thermodynamics, heat transfer and mechanics.

A tradition of fighting ice

Ghasemi's biologically-inspired anti-icing material can withstand critically low temperatures. The new material – which is applied to surfaces as a coating – was one of three winners of the NASA iTech competition in 2017.

The anti-icing coating was inspired by the tiny North American Wood Frog, a creature that can freeze up to 65 percent of their total body water without dying. NASA chose Ghasemi's project from entries submitted by over 130 organizations across the U.S. for its potential to broadly impact human life on earth and the future of space travel.

Once Ghasemi had plenty proof of concept for his novel material, he partnered with students in his Nano Therm lab to launch the startup SurfEllent and begin marketing the product to consumers.

Other materials created by Ghasemi and his research team include a new magnetic slippery surface (MAGSS), which can be applied to any surface – ceramic, polymers or metals. While pursuing postdoctoral work at the Massachusetts Institute of Technology, he is credited with creating a low-cost graphite "solar sponge" to convert sunlight into steam for potable water.

A new challenge

Ghasemi, not one to rest on his laurels, is excited about his new NSF-funded challenge.

"This project is basically pure science: to study the underlying principles of ice formation and ice adhesion," he said. "The most important aspect of this project is that we can get the nanoscale physics of ice formation, which has not been studied before. In nanoscale, we can break the limits of ice formation that we already have and we can suppress ice formation up to temperatures around -40 degrees Fahrenheit. That means most of the time you would avoid any ice formation on any surface."

Ghasemi's team is focusing on long-term durability in addition to anti-icing properties. The goal is introducing a new material paradigm offering extreme icephobicity. "Once we learn this new science, the next step is figuring out how we incorporate this new science in the new type of material," he said.

There are currently no durable icephobic surfaces or coatings on the market, Ghasemi said. The ones that do exist quickly lose anti-icing properties due to exposure to environmental conditions and must be re-applied frequently.

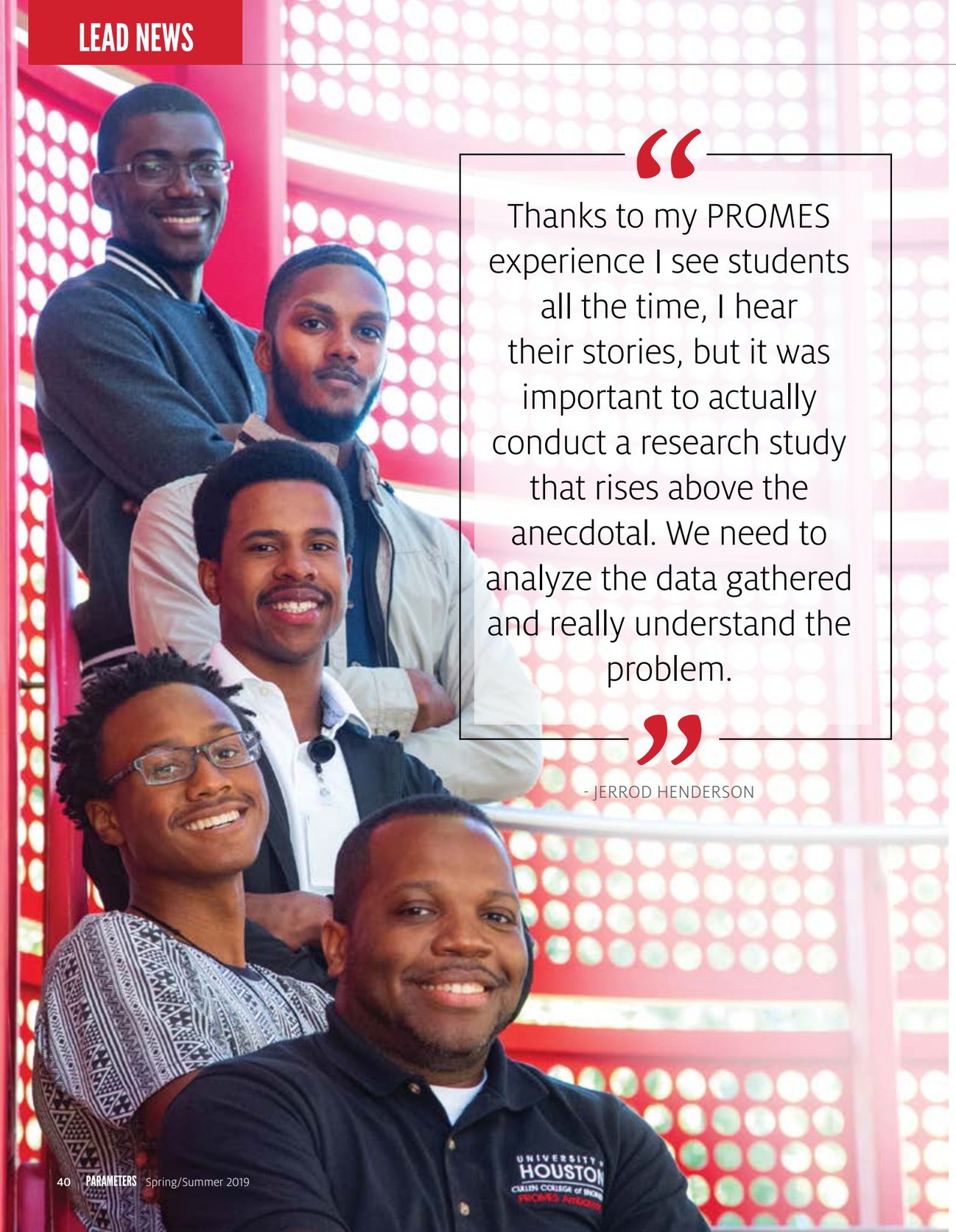
By comparison, Ghasemi said his anti-icing coatings can last up to seven years after a single application.

He hopes to have the new material developed in about three to five years. "We're developing the science that will allow us to create a new class of materials with much better performance than what's available now in the marketplace. It will be revolutionary."

Once that's achieved, the possibilities are endless. Ghasemi and his students are already at work on their first paper about this new project. He is also open to future entrepreneurial partnerships, and anticipates research findings paving the way for improved design of technologies used in a variety of industries, from cryobiology and food engineering to energy infrastructure.

"Ice is a problem that will exist as long as we live on the earth. It's not a problem that'll disappear in a few years, so we need a solution," Ghasemi said. "The end goal is to improve the quality of human life."

Hadi Ghasemi's anti-icing coatings can last up to seven years after a single application.



> Thanks to my PROMES experience I see students all the time, I hear their stories, but it was important to actually conduct a research study that rises above the anecdotal. We need to analyze the data gathered and really understand the problem.
>
> - JERROD HENDERSON

UH Professor Seeks Broader

'WINDOWS OF OPPORTUNITY'

for Black Male Engineers

BY RASHDA KHAN

Producing graduates with STEM – science, technology, engineering and mathematics – capabilities continues to be a vital issue for the future of the United States. Growth in engineering and other STEM occupations is vastly outpacing the supply of skilled workers.

Meanwhile, African-Americans continue to be underrepresented in the STEM workforce and in academia. According to the "2017 Women, Minorities and Persons with Disabilities in Science and Engineering" report by the National Science Foundation, white males constitute about 49 percent of the workers in science and engineering jobs, while African-Americans make up about 3 percent of that workforce.

Just under 8 percent of science and engineering doctorates were earned by underrepresented minorities in 2014. A paltry 2.5 percent of engineering faculty nationwide are African-American males.

Jerrod Henderson, instructional assistant professor at the UH Cullen College of Engineering, has joined forces with Erik Hines, associate professor of counselor education at the University of Connecticut's Neag School of Education, to work on a solution. They're both co-principal investigators of a new project titled "Collaborative Research: Windows of Opportunity – Understanding Black Male Engineers in the Pursuit of Advanced Degrees," which received nearly $400,000 in funding over three years from the NSF.

"I'm really interested in seeing an increase in the number of underrepresented folks in STEM," said Henderson, who was the only African-American faculty in the chemical engineering department at the University of Illinois at one point. "I don't want to always be the only one."

Henderson's research focuses on engineering education and the participation of underrepresented groups in the STEM fields. He is the director of the Cullen College's Program for Mastery in Engineering Studies (PROMES), which has received national recognition for its efforts to increase student success and retention in STEM through mentoring, teaching, research and other programs and initiatives.

"Thanks to my PROMES experience, I see students all the time. I hear their stories. But it was important to actually conduct a research study that rises above the anecdotal," Henderson said. "We need to analyze the data gathered and really understand the problem."

The two researchers will be studying the experience of African-American male students in the context of three different types of institutions: Prairie View A&M University, a historically Black university; University of Connecticut, which is a primarily White institution; and UH, which is a Hispanic-serving institution.

"People throw that word around – diversity – but there are places that are diverse but not inclusive," Henderson said. "UH happens to be a diverse and inclusive place from my experience. But I'm interested in what happens to students of color once they're in engineering in different environments."

The project is focused on three research questions:

1. What factors influenced Black males to pursue graduate degrees in engineering?

2. What assets and strengths are possessed by Black males who persist or plan to continue in engineering beyond undergraduate studies?

3. What role does academic self-concept and engineering identity play in the intent to pursue advanced degrees among Black males?

Henderson hopes their research data will help recruitment and retention efforts of educational institutions and help create real upward movement in getting underrepresented groups involved in STEM opportunities. "We'd like to produce or disseminate best practices for engaging this sub-population of underrepresented people to think about graduate school," he said.

In the last year of the grant, the researchers are planning to bring a conference centered on African-American males and higher education in engineering to the University of Houston campus.

#CullenCollegeStories

Julie Rogers

(BSME '19)
Counselor, G.R.A.D.E. Camp, Summer 2018

"A couple of weeks ago, I met a six-year-old girl. I told her I was going to be an engineer and she told me 'Oh, that's not a woman's job.' I was shocked. I really hope the G.R.A.D.E. camp experience can help change that perception, and that [attendees] go home and tell their friends about this engineering camp, then they help spread the word. I really hope the girls are inspired and they realize this – engineering – is for women."

UH G.R.A.D.E. CAMP CELEBRATES 15 YEARS

of Introducing Engineering To New Generations Of Girls

BY RASHDA KHAN

Spending summer days engineering can be creative, empowering and fun. Imagine taking bits and pieces of circuitry, plastic and metal to build robots, then programming your robots to navigate mazes. Or venturing out into the warm sunshine with friends to collect water from the UH campus pond and testing it for invisible microbes. Or maybe creating Texas-shaped earrings using a 3-D printer.

These are defining moments of doing, creating memories and building friendships.

All of these activities and more are part of G.R.A.D.E. (Girls Reaching and Demonstrating Excellence) Camp, offered by the UH Cullen College of Engineering. The one-week camp, which is offered twice in the summer, introduces girls ages 13-17 to the wonders of engineering. It starts them on a journey of recognizing their own potential and considering careers in science and technology.

"I attended camp in 2012, which feels like a long time ago. Back then I thought engineering sounded kind of interesting, but I didn't think it was something a lot of girls did," said Julie Rogers, a recent graduate of the Cullen College's mechanical engineering department.

"Going to G.R.A.D.E. Camp … meeting like-minded girls and seeing all the counselors really inspired me," she said. "I think it was part of the reason I went into engineering. And it also helped that the camp was at the University of Houston, where I ended up going to school."

Women like Rogers who go from being G.R.A.D.E. campers to UH engineering students to G.R.A.D.E. Camp counselors are the raison d'être for G.R.A.D.E. Camp, according to **Frank "Fritz" Claydon**, who has been directing the camp since its inception, along with **Stuart Long** and **John Glover** – all electrical and computer engineering professors at the Cullen College.

About 75 percent of the campers end up majoring in an engineering field, according to Claydon.

#CullenCollegeStories

D'Nari Mills

9th Grade, Cypress Woods High School
G.R.A.D.E. Camper, Summer 2018

"I want to be a mechanical engineer when I grow up because I want to make new things, and have new ideas about how to help the community, how to help the environment and be successful.

There's a need for camps like G.R.A.D.E. Camp because a lot of people think girls can't be engineers. Engineering is not just a guy thing, it's for girls too. Girls can learn to do it and have fun."

"We have had campers become engineering students here who have then gone on to industry and have actually come back for our industry luncheons," Claydon said. "That's pretty cool."

Filling the gaps

G.R.A.D.E. Camp at the Cullen College came about because of a need and an opportunity.

In 2001, deans of engineering across the state of Texas gathered with leaders in the semiconductor industry and the Texas Legislature to discuss the need to encourage more students to major in electrical engineering.

"We looked at that funding opportunity and thought, naturally, women were an untapped resource. That's what spawned the idea," Claydon said. "Later on we were able to get other funding from the National Science Foundation, corporations and other sources, and were able to expose people to all kinds of disciplines in engineering."

A pilot G.R.A.D.E. Camp launched approximately three years before the start of Texas Science, Technology, Engineering and Math Initiative (T-STEM) – a $71 million public-private partnership formed in 2005 to increase the number of STEM students and professionals by redesigning Texas schools, improving teacher recruitment and training, and aligning long-term educational and economic development objectives.

A 2007 National Academies of Sciences, Engineering and Medicine report found that "scientific and technical building blocks of our economic leadership are eroding at a time when many other nations are gathering strength." The report, "Rising Above the Gathering Storm," recommended urgent comprehensive and coordinated federal effort to maintain the nation's competitiveness.

In 2012 a report from the President's Council of Advisors on Science and Technology supported those findings. To maintain the nation's standing in science and technology during the coming decade, the council predicted a need for approximately 1 million more STEM professionals than the United States would produce at rates existing when the report was written.

Although the UH Cullen College of Engineering was already ahead of the game with its G.R.A.D.E. Camps, UH established a centralized center in 2013 to support and expand those efforts. The UH STEM Center adopted G.R.A.D.E. and Step Forward Camps and launched new outreach efforts including kindergarten through 12th-grade teacher training; additional elementary, middle and high school student training programs, fairs and camps; and supportive programs for current university STEM students.

G.R.A.D.E. Camp today

In 2018, the camp celebrated 15 years of outreach to more than a thousand campers.

Guadalupe "Lupita" Villanueva almost didn't go into engineering. She didn't know what she wanted to do in college and was considering majoring in business because her mother had mentioned it. Fortunately she worked as a babysitter for a petroleum engineer who took the time to have a conversation with Villanueva.

"She told me all about her work and experience, and how it gave her the opportunity to travel across the world," Villanueva said. "That really caught my attention and interested me."

It turned out that Villanueva really liked petroleum engineering. "I had the opportunity to go for an externship with ConocoPhillips last year and we went out to a drilling rig. It was a pretty eye-opening experience for me," she said. "I was able to see what I have been learning in my classes actually being applied in real life and see other people in the field and what they have accomplished in the industry."

Natalie Cramer

8th Grade, St. Helen Catholic School, Pearland
G.R.A.D.E. Camper, Summer 2018

"My favorite part of G.R.A.D.E. Camp has been making a flowchart (putting together step-by-step instructions) for the Peanut Butter and Jelly sandwich. It was pretty funny because some of the instructions weren't very clear so the sandwiches ended up pretty weird. One of the flowcharts never said to separate the two pieces of bread so the girl making the sandwiches had to go between the two slices of bread while they were still stacked up.

I learned that you have to be very precise when you're making a flow chart and you have to double check your work to catch mistakes and missing steps."

Villanueva never attended G.R.A.D.E. Camp as a camper but has served as a counselor since 2015.

"It's good to start at an early age and introduce girls to engineering because their minds are really open to anything at that point, so it's valuable to have camps like G.R.A.D.E. Camp," she said. "I really enjoy being able to motivate these girls and inspire them and show them what engineering is. It isn't just math, science and numbers. There's a lot of things that you can do with engineering, and there's a lot of creativity involved." Villanueva graduated in December 2018.

Despite progress being made, disparities continue. A white paper published by the Society of Women Engineers in 2017 found that women represent over 57 percent of college graduates but only 22 percent of the engineers entering the workforce. Also, within the workforce, only 14 percent of engineers are women and women leave the engineering profession in greater numbers than men do.

This need is not news for G.R.A.D.E. Camp counselors and directors.

"I recently met a 6-year-old girl and told her I was going to be an engineer and she told me 'oh, that's not a woman's job.' I was shocked," Rogers shared. "I really hope the G.R.A.D.E. Camp experience can help change that perception, and that [attendees] go home and tell their friends about this engineering camp, then they help spread the word. I really hope the girls are inspired and they realize this – engineering – is for women."

Claydon is glad UH and the Cullen College created G.R.A.D.E. Camp.

"I believe that the girls-only aspect of the camp is important. They can just focus on being them, being who they are and having fun in camp," he said. "It's their moment."

"G.R.A.D.E. Camp is the backbone of the type of outreach that we do and I really think the long-lasting nature of it has sent a message: If you want to do outreach correctly look at how G.R.A.D.E. camp is done," Claydon said.

#CullenCollegeStories

Guadalupe "Lupita" Villanueva

(BSPETE '18)
Counselor, G.R.A.D.E. Camp

"I started as a mentor back in 2015. I really enjoy being able to motivate these girls and inspire them and show them what engineering is. It isn't just math, science and numbers, there's a lot of things that you can do with engineering, and there's a lot of creativity involved.

I really like being able to show them how to do the robots and help them learn new skills. I hope to show them that, while it's not going to be easy, there is a way to do it and you can reach your dreams."

UH PROMES Receives

INSPIRING PROGRAMS IN STEM AWARD

BY RASHDA KHAN

The Program for the Mastery in Engineering Studies (PROMES) at the University of Houston received a 2018 Inspiring Programs Award in STEM from I*NSIGHT Into Diversity* magazine, the largest and oldest diversity and inclusion publication in higher education.

The award honors colleges and universities that encourage and assist students from underrepresented groups to enter the fields of science, technology, engineering and mathematics (STEM). Award winners were selected by the magazine based on efforts to inspire and encourage a new generation of young people to consider careers in STEM through mentoring, teaching, research and successful programs and initiatives.

"Without PROMES hundreds if not thousands of Cullen College of Engineering graduates may not have earned their degrees. As much as it's about helping prepare students academically, PROMES is also a family and a community, connecting students to campus, the college, employers and each other," said Jerrod Henderson, director of PROMES. "This work, being in the trenches with students, is tremendously important and it's great to be recognized for what you love to do."

PROMES provides Cullen College students with recruitment, academic advising, workshops, scholarships, and professional and personal development opportunities. "It's positioned to help students through challenges and barriers and help them become acclimated to the academic rigors of engineering," said Henderson, who is also an instructional assistant professor of First Year Experience at UH.

The program was established at the University of Houston in 1974 for the recruitment, retention and academic development of underrepresented minorities in the Cullen College of Engineering. Today, PROMES is open to all Cullen College students and strives to provide a positive learning environment that supports the needs of undergraduate students.

"We want to honor the schools and organizations that have created programs that inspire and encourage young people who may currently be in or are interested in a future career in STEM," said Lenore Pearlstein, owner and publisher of INSIGHT Into Diversity magazine. "We are proud to honor these programs as role models to other institutions of higher education and beyond."

PROMES was featured, along with 77 other recipients, in the September 2018 issue of *INSIGHT Into Diversity*.

MISSION: POSSIBLE

MAPPING DANGEROUS TERRAIN

BY JEANNIE KEVER

Keeping our military up to date about hostile regions is critical. But gathering fresh detail gets risky, especially along shorelines where underwater mines may lurk and any place enemy forces may be eager to grab our technology.

Engineers from the University of Houston are addressing the challenges as part of a $1 million project led by **Craig Glennie,** UH associate professor of civil engineering and investigator with the National Center for Airborne Laser Mapping, or NCALM.

The work is part of a larger effort funded by the Office of Naval Research and led by Northeastern University. **Megan Robertson,** UH associate professor of chemical and biomolecular engineering, and **Aaron Becker,** UH assistant professor of electrical and computer engineering, are working with Glennie on the project.

One phase involves the design of self-guided "packages," small containers made of a biodegradable material and filled with sensors to map the coastline and sea bottom. Glennie said the goals are for the devices to be about the size of a water bottle and to dissolve upon reaching shore.

The sensors ultimately could have a number of applications, ranging from military and law enforcement to environmental monitoring.

"It's kind of like 'Mission Impossible,' but slightly more discreet," Becker said of the classic TV spy show with its audiotape player that famously destroyed itself in a puff of smoke and flash of flame. "We want them to quickly and quietly dissolve," Becker said.

Another concept involves developing a system to control a swarm of up to 1 million drones or other aerial reconnaissance vehicles in a way that appears to be unpredictable, thwarting an opponent's ability to track and target them.

Early versions of the project will involve the use of cameras, sonar and sensors to measure temperature and pressure, said Glennie, whose work with NCALM involves mapping with unmanned aerial vehicles and using lasers for mapping through shallow water.

"We'll experiment to see what works best," he said, noting that ultimately the researchers want fully biodegradable versions of both the external support structure and the sensors.

To start with, they are experimenting with different materials. Robertson creates biodegradable plastics and other materials in her lab and will focus on determining the best material for the project, from the shell to the electronic components.

"We will investigate various chemical strategies for creating polymers that can quickly disappear under the right conditions," Robertson said.

Becker, who works in swarm robotics and artificial intelligence, will focus on how to deploy the sensors, as well as lead the related project involving drone swarms.

Much current research is focused on drones flying in formation, or schooling and flocking behavior. There are times when that makes sense, Becker said, but the predictability can leave the drones vulnerable to attack. He is developing a way to make the flight paths appear random – and therefore, less susceptible to attack – while still achieving the flight goals.

"We will exploit the computational and maneuverability resources of each drone to protect the swarm," he said.

Aaron Becker, Megan Robertson and Craig Glennie

Researchers Report Advances In

STRETCHABLE RUBBERY SEMICONDUCTORS

BY JEANNIE KEVER

Researchers from the University of Houston have reported significant advances in stretchable electronics, moving the field closer to commercialization.

In a paper published Friday, Feb. 1, in *Science Advances*, they outlined advances in creating stretchable rubbery semiconductors, including rubbery integrated electronics, logic circuits and arrayed sensory skins fully based on rubber materials.

Cunjiang Yu, Bill D. Cook Assistant Professor of mechanical engineering at the UH Cullen College of Engineering and corresponding author on the paper, said the work could lead to important advances in smart devices such as robotic skins, implantable bioelectronics and human-machine interfaces.

Yu previously reported a breakthrough in semiconductors with instilled mechanical stretchability, much like a rubber band, in 2017.

This work, he said, takes the concept further with improved carrier mobility and integrated electronics.

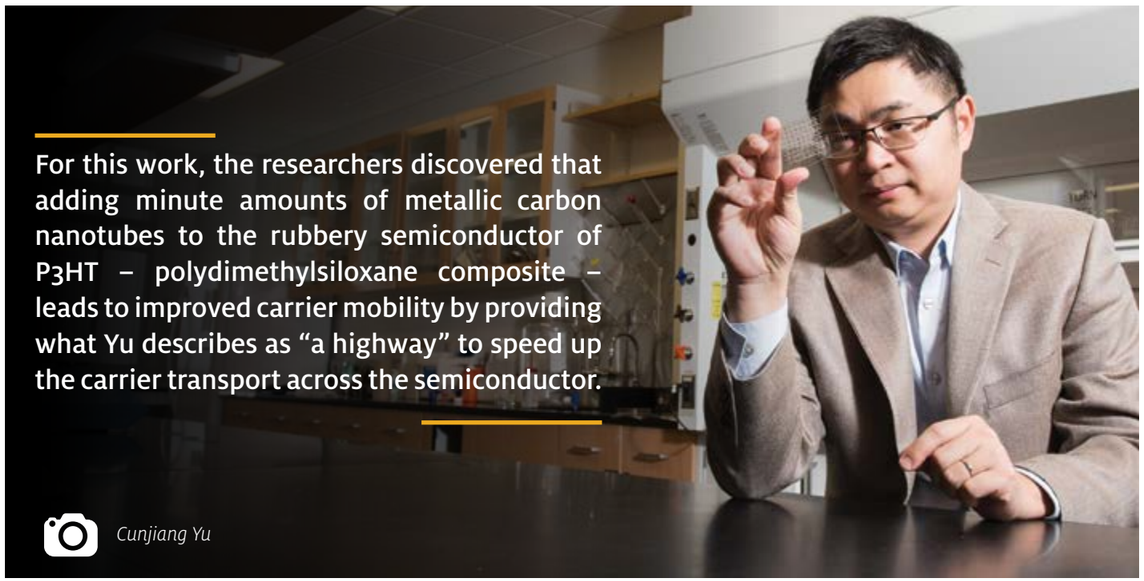
"We report fully rubbery integrated electronics from a rubbery semiconductor with a high effective mobility ... obtained by introducing metallic carbon nanotubes into a rubbery semiconductor with organic semiconductor nanofibrils percolated," the researchers wrote. "This enhancement in carrier mobility is enabled by providing fast paths and, therefore, a shortened carrier transport distance."

Carrier mobility, or the speed at which electrons can move through a material, is critical for an electronic device to work successfully, because it governs the ability of the semiconductor transistors to amplify the current.

Previous stretchable semiconductors have been hampered by low carrier mobility, along with complex fabrication requirements. For this work, the researchers discovered that adding minute amounts of metallic carbon nanotubes to the rubbery semiconductor of P3HT – polydimethylsiloxane composite – leads to improved carrier mobility by providing what Yu described as "a highway" to speed up the carrier transport across the semiconductor.

In addition to Yu, the paper's researchers include first author Kyoseung Sim, and co-authors Zhoulyu Rao, Anish Thukral and Hyunseok Shim, all of UH, and Hae-Jin Kim, a former postdoctoral researcher at UH who is now with Gyeongsang National University in Jinju, Korea.

Future work, Yu said, will involve further raising the carrier mobility and building more complex, hierarchy and high level integrated digital circuits to meet the requirements for integrated circuits, biomedical and other applications.



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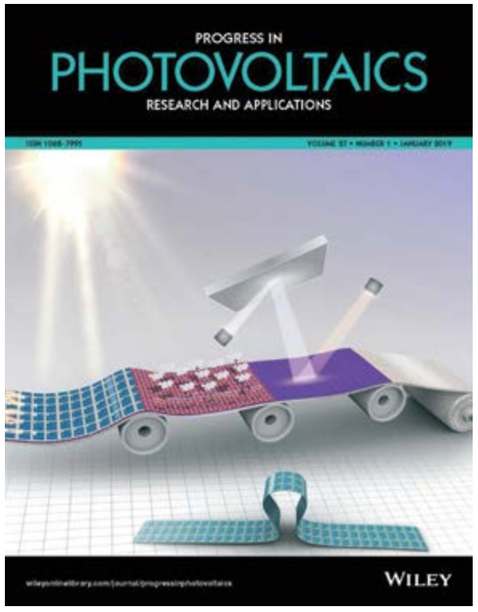
Cunjiang Yu



UH RESEARCH BREAKTHROUGH

Lands Journal Cover

BY RASHDA KHAN

The journal *Progress in Photovoltaics: Research and Applications* featured an article on the collaborative work of two UH Cullen College of Engineering research groups on its cover in January.

The article, titled "High efficiency flexible III/V photovoltaic solar cells based on single crystal-like thin films directly grown on metallic tapes," is about the design and development of highly-efficient, low-cost flexible solar cell devices that can adapt to different environments and uses.

"The overarching goal of the research is to develop flexible and low-cost, yet high-efficiency photovoltaic device – something that generates electricity by exposing material to light – using high-quality solar cell materials on inexpensive metal tape through a continuous deposition process," said **Jae-Hyun Ryou**, associate professor of mechanical engineering.

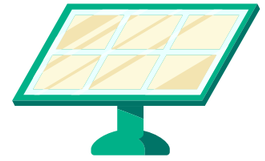
There has been much interest in developing thin-film solar cells because they are lightweight and flexible. Landing on the cover was the result of a breakthrough.

"We demonstrated – for the first time – a working solar cell device based on our research," Ryou said. The new development provides a pathway toward inexpensive high performance gallium arsenide or GaAs thin-film photovoltaics.

The project is funded by the U.S. Department of Energy's SunShot Initiative, which seeks to make solar energy and electricity affordable for American consumers.

The first authors on the paper are Sara Pouladi, a materials science and engineering doctoral student working with Ryou; and Monika Rathi, a research scientist working with the Selva Research Group led by **Venkat Selvamanickam,** M.D. Anderson Chair Professor of mechanical engineering.

The article, titled "High efficiency flexible III/V photovoltaic solar cells based on single crystal-like thin films directly grown on metallic tapes," is about the design and development of highly-efficient, low-cost flexible solar cell devices that can adapt to different environments and uses.



Pouladi designed, modeled and fabricated the flexible thin-film GaAs solar cells based on a new single-crystal-like GaAs material grown on metal tapes by Rathi.

"We demonstrated that we can provide high-efficiency, thin-film GaAs solar cells on low-cost metal foils, bypassing conventional expensive and brittle wafer substrates while offering flexibility and scalability," Pouladi said. "These flexible solar cells can be curved and bent to fit selected placement area wherever electricity is needed – from your rooftop to your backpack in a remote area."

Other contributing authors on the paper are: Davendra Khatiwada, Mojtaba Asadirad, Seung Kyu Oh, Pavel Dutta, Yao Yao, Ying Gao, Sicong Sun, Yongkuan Li, Shahab Shervin, Keon-Hwa Lee, Selvamanickam and Ryou.

Progress in Photovoltaics, published by Wiley, is a prestigious forum for reporting advances in the rapidly developing field of photovoltaic technology.

#Cullen College Stories

#CullenCollegeStories

Celebrating the People of UH Engineering

BY RASHDA KHAN

Creative energy buzzes at the UH Cullen College of Engineering. This is a place where ambitious dreams blossom, nurtured by world-class researchers, dedicated faculty and staff, loyal alumni and bursting-with-potential students.

It's a place that exists because of its people.

Let us introduce you to some of the Cullen College-trained innovators whose creative vision is meeting the challenges of the world today and will help shape the future that is yet is to come.

#CullenCollegeStories

BUILDING SUCCESS

Ayoola John-Muyiwa on Life, Luck and Accomplishments

At the age of 22, UH student Ayoola John-Muyiwa – popularly known as AJ – has an impressive collection of experiences and accomplishments.

John-Muyiwa graduated in May with a bachelor's degree in petroleum engineering from the UH Cullen College of Engineering. He also earned a certificate in corporate entrepreneurship from the Cyvia and Melvyn Wolff Center for Entrepreneurship at UH and attended the Summer Venture in Management Program at Harvard Business School.

His resume is already full of great experiences, such as participating in the BP STEP Leadership Development Track and interning as a Google Developer Scholar. He has also served as a production engineering intern at Exxon Mobil, an energy trading analytics intern and a structured products intern at BP and a drilling and production trainee at Shell among others.

Last year, John-Muyiwa and his partners soft-launched their business, a social enterprise, called "Blademy," which seeks to provide an e-learning platform to help Black millennials "around the world to teach and learn anything."

Not surprisingly, he was a 2018 Forbes 'Under 30 Scholar' and attended the Forbes Under 30 Summit in Boston as an honoree. The event brought together more than 7,000 young entrepreneurs, visionaries and social innovators for an immersive experience featuring more than 200 world-class speakers including investors, celebrities, musicians, sports stars, cultural icons, as well as political and business leaders.

"The Forbes 30 Under 30 list has emerged as the way that the world discovers the next generation of entrepreneurs and game-changers," stated Randall Lane, editor of Forbes magazine and creator of the Forbes 'Under 30' franchise in a news release. "This is the ultimate club: the people that will reinvent every field over the next century."

John-Muyiwa, with a smile that lights up his whole face, credits his accomplishments to God, his mother's support and being "very, very lucky."

> I didn’t really have the best opportunities growing up and the opportunities I did have, I kind of figured things out by luck.

The road to UH

John-Muyiwa was born in Nigeria. He remembers walking miles to fetch water and returning home with a pot balanced on his head. He also recalls the fluctuating and fleeting nature of electricity in their home town.

“Whenever the lights would come on [the kids] would run out onto the street and celebrate, and then the lights would go out again,” he said. “Honestly, back then I was happy. That was just the norm, what I knew.”

Around the age of 13, John-Muyiwa moved to America with his mother. He grew up in southwest Houston. “I didn’t really have the best opportunities growing up and the opportunities I did have, I kind of figured things out by luck,” he said.

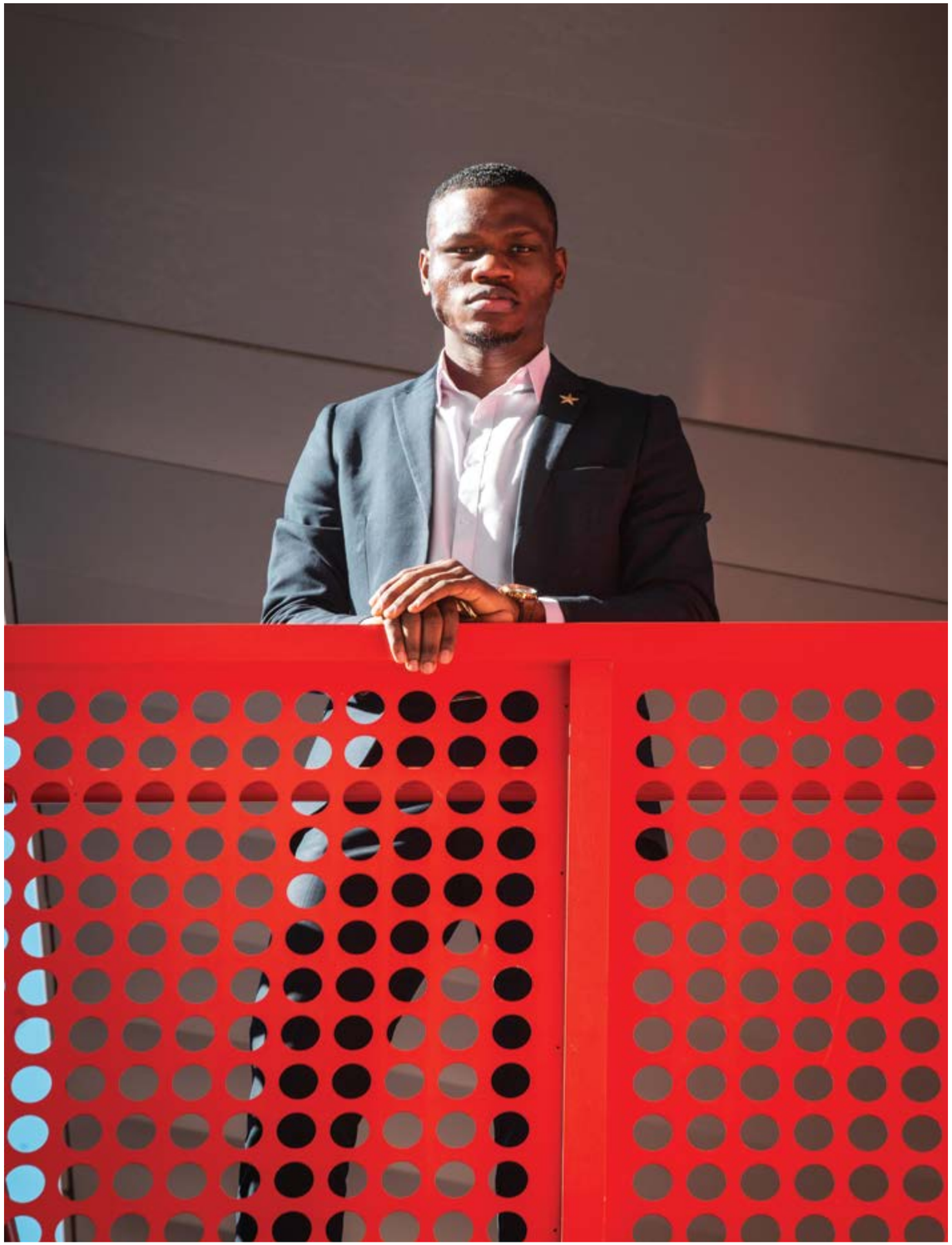
He took the SAT without really understanding what the college entrance exam was all about. Prior to that, his high school counselor had advised him to apply to a two-year college.

Fortunately, he scored high enough to catch the interest of a number of colleges and ended up getting a full scholarship to UH. He participated in the UH Scholar Enrichment Program, and later served as a workshop facilitator and lead mentor. He is also involved in the Cullen College’s Program for Mastery in Engineering Studies (PROMES), which is dedicated to increasing engineering students’ success in their studies, personal lives and careers.

Reflecting on his early-life experiences and his years in Houston, led John-Muyiwa to choose petroleum engineering as a major. “I wanted to work in energy so I could impact people’s lives and help my community,” he said. “Something as basic as having reliable power can influence quality of life and how much can be achieved in a day or days, a lifetime.”

John-Muyiwa’s hard work and drive has led him to win numerous awards and scholarships during his academic career. He also has an active campus life and is involved with several clubs and organizations (often serving in leadership roles), including the Nigerian Student Association and the National Society of Black Engineers.

“UH has been really awesome for me, I definitely made the best decision to come here,” he said. “I have learned so much here and it’s opened up doors to so many other opportunities.”



Building on experiences

John-Muyiwa acknowledged that his life could easily have had a very different trajectory and said he didn't want others to miss out on success due to a lack of knowledge and resources.

"It's really important for me to take the knowledge I have gained and curate knowledge from other people who have found success in different places and bring it all back to help younger people in my community," he said.

Being an engineer, he looks at data, analyzes situations and likes to fix problems. He shared some statistics from "The Road to Zero Wealth" report published by the Institute for Policy Studies and the non-profit Prosperity Now: "The African-American spending power in the U.S. is about $1.2 trillion annually, the median wealth of the African-American family today is $11,000. By 2053 the median wealth of African-American families in this country is projected to be zero."

John-Muyiwa understands finances and economics. In addition to academic knowledge, he worked as a business development intern at Course Hero and as a securities analyst intern at the prestigious investment banking entity Goldman Sachs.

"The wealth gap is actually widening. This is bad," John-Muyiwa said. "For me it's really coming in and solving a social problem that exists and needs to be addressed."

His goal is to one day earn a master's in business administration from Harvard. He has already been offered numerous full-time positions with BP, ExxonMobil and Chevron.

But for right now, John-Muyiwa is busy building Blademy, with the goal of bridging "the increasing wealth and economic opportunity gaps that exist between Black millennials and millennials belonging to other racial and ethnic groups." He is putting all his skills – a unique blend of engineering, networking and business acumen – behind the effort. The official launch is scheduled for fall 2019.

The motto for Blademy is "Collectively we can learn anything."

Earlier this year, Blademy was named an official partner of HBCU@SXSW – a program of the South by Southwest Conference and Festivals, which is the world's largest technology conference and a venue to celebrate music and other arts – alongside companies like Facebook, Microsoft, Viacom, and BET.

HBCU@SXSW was established by Rodney Sampson, the founder of Opportunity Hub (OHUB). The program sponsors minority students from historically Black colleges and universities, Hispanic-serving institutions and predominantly White institutions to attend the conference, according to the program's website. Each year, major corporations, tech companies, startups, and foundations sponsor HBCU@SXSW so the selected students can gain exposure, learning opportunities and direct access to paid internships or permanent jobs in the innovation economy.

Things are looking good and John-Muyiwa is hopeful. If Blademy takes off as he hopes, his life may change directions again. "I'm 22, if I don't take risks now when am I going to take them?" he said, grinning.

For More Information

You can get connected with Blademy and its team on Twitter, Instagram and Facebook, and on LinkedIn at @LearnBlademy. You can also sign up for early access to the online platform at blademy.com

#CullenCollegeStories

Following Her DREAM

From Homeless to NASA, Mejean Cline Shares Her Journey

If you have seen photographs or videos of astronauts working on laptops while floating more than 200 miles above the earth aboard the International Space Station, you have caught a glimpse of the work done by UH Cullen College of Engineering alumna Mejean Cline.

As a Linux developer and configuration management analyst for NASA contractor Leidos Inc., she is part of a team located at the Johnson Space Center that programs and supports all of the computer systems on the Space Station. At 37, Cline is working at her dream job.

"I was a kid who always loved everything about NASA. I loved technology, I loved space," she said. "NASA's vision is: 'We reach for new heights and reveal the unknown for the benefit of humankind.' I have always been fascinated with the unknown and eager to learn everything I could."

Her long journey to success, paved with challenges and hardship, is nothing short of inspiring.

In the beginning

Originally from New Orleans, Cline graduated high school and joined the Orleans Parish Sheriff's Office to help her family with finances. After moving to Houston in 2002, she worked at private security jobs. Through it all, she continued to hold onto her dream of working with computers, becoming an engineer and one day joining NASA.

"Law enforcement was basically how I fed my family. It was always something I could do, but I knew I didn't want to do it forever," she said. "I loved programming and any kind of geeky stuff."

However, life took over and the dream to go to college and pursue her computer engineering degree kept getting postponed. Then she became a mother, giving birth to Elijah in 2004 and Naia in 2007.

"I didn't really decide I could do it in earnest until I was a mom," Cline said. "I always thought I would go to college, but I didn't feel the hurry until I had them. I just had a moment where I was like, 'What *are* you waiting for?'"

First, she earned an associate degree in science from Houston Community College. After that, she took a two-year break to raise her family and work. Finally in 2012, she started her bachelor's program in computer engineering at the Cullen College.

She also joined the Program for Mastery in Engineering Studies (PROMES), a Cullen College program dedicated to increasing engineering students' success in their studies, personal lives and careers. The PROMES staff told her about different scholarship opportunities, special tutorial sessions and more.

At one point Cline found herself overwhelmed by the daily juggle of raising two children, working full-time and going to school. Her grades started to suffer.

> "I just had a moment where I was like, 'What *are* you waiting for?'"

Cline's husband Ray Roberts told her to focus on school and graduating. While the family would have to budget and be careful with money, it was feasible. Cline applied herself to her studies.

Eventually, her grades went up and she eased back into working part-time in the PROMES office. Two of Cline's PROMES mentors told her about the William A. Brookshire Scholarship for students taking a full course load and working at least 20 hours a week.

Dr. William A. Brookshire, a UH chemical engineering alumnus, understood the unique challenges faced by students who work to pay for their educations. Raised without means himself, Brookshire worked full-time at a day job and attended night classes at UH to earn his bachelor's degree in 1957.

In 1967, he and business partner James Slaughter Sr. founded S&B Engineers and Constructors Ltd. in Houston. Initially, the pair made up the entire company. Now it employs more than 4,500 people around the world and serves clients in the refining, petrochemical and chemical, midstream, infrastructure, power generation, pulp and paper industries.

A very generous man and a dedicated Cullen College supporter, Brookshire funded scholarships to help ease the financial burdens of working students. He also donated $1 million to the Cullen College to create the William A. Brookshire Teaching Excellence Award Endowment, whose annual distributed income honors Cullen College faculty "who demonstrate an unwavering commitment to exemplifying the highest levels of teaching excellence inside the classroom."

Cline knew competition for the scholarships would be tough and wasn't sure of her chances. But after much encouragement from her mentors, she applied for and was awarded a Brookshire Scholarship for the fall 2014 semester.

Life interrupted

Life threw a curve ball that October when Cline's husband lost his job. The family no longer could afford a car and had to rely on the bus system to get around. Roberts found a new job, but life continued to be hard.

"I used to ride the bus two hours one-way just to get my kids to school," Cline recalled. "My husband worked [in west Houston] at that point. He would bring the kids home from school, then catch the bus back and spend the night in his office so he could be at work on time the next day."

Then more disaster struck. Two weeks into this new routine, Cline was hit by a car. She had dropped the kids off at school and decided to grab a cup of coffee before heading to her own classes. A woman driving out of a parking lot did not see Cline in the crossing.

"I don't remember much of the details. It felt like I was hit by a wall, then I just remember the ground coming up to my face," she said, her words carefully measured because the experience is still difficult to share. "But the people who saw the accident said that I actually rolled up on her hood like in the movies. The impact knocked my glasses off, my shoes went flying."

Eight hours later she regained consciousness at Ben Taub Hospital.

Cline ended up missing two weeks of class because of her injuries, and her husband left his job to take care of her. "I needed someone there to help me do everything," she said.

During this difficult time, finances spiraled out of control. Cline used her UH Meal Plan to feed her family. They couldn't pay bills or rent. Electricity was cut off, and the family eventually had to move out of the apartment they'd called home for eight years.

"We hadn't had electricity for a month by the time we moved into a homeless shelter," she said. "We were fortunate enough to land in an

> It was time to go back to school, but I was afraid that we would be homeless again. I thought about quitting then. Maybe I was putting my own dreams ahead of my family's needs, maybe I wasn't the sort of person that did awesome things.

awesome place, the Salvation Army Family Residence."

Volunteers kept the young children busy with games, music and other activities.

"The kids remember that time very differently than I do because the [shelter staff and volunteers] kept them distracted," Cline said. "I'm grateful for that."

While still living at the shelter, Cline returned to her classes but continued to struggle, often having to choose between paying for food and bus fare. Her grades suffered and she found herself on academic probation and in debt.

"I was overwhelmed and failing," Cline said. She ended up with an administrative withdrawal for the 2014 fall semester.

Then it was 2015, time to renew her scholarship.

A representative from the scholarship committee reached out to Cline and inquired about her situation. Moved by her story, the committee worked with her. Cline's family was able to move out of the homeless shelter into an apartment again.

She found a job with a private security company at about the same time. "I told the scholarship coordinator that I was taking the rest of 2015 off to get my family situated, and then I would be back," Cline said.

Before she knew it, it was 2016.

"It was time to go back to school, but I was afraid that we would be homeless again," Cline said. She began to doubt herself. "I thought about quitting then. Maybe I was putting my own dreams ahead of my family's needs, maybe I wasn't the sort of person that did awesome things."

She attended the spring 2016 Brookshire Luncheon for scholarship recipients to thank Brookshire in person for his support but also to let him know that she intended to leave school.

Meeting Brookshire is a moment she will always remember. He listened to her words. Then he looked her in the eyes and told Cline that he believed in her.

That steady gaze, that unwavering belief, is what convinced Cline to return to school and pursue her dreams again.

"I wouldn't have come back if it wasn't for Dr. Brookshire," she said. "There was nothing stopping me from then on."

Reaching for the stars

Cline drew inspiration and strength from her own mother's story.

"My mom was a supermom. She went to nursing school when I was a toddler and I remember sitting in class with her. We'd have coloring books while she took notes in class," Cline said. "She didn't have all the struggles I did, but she put herself through nursing school, she did it alone and she got through it."

As a result, Cline brought her kids along with her when needed and the PROMES staff at UH supported her anyway they could. "My kids grew up at UH," she said tossing an affectionate grin at her now 14-year-old son and 11-year-old daughter. "They are Coog kids."

She went on to graduate in summer 2018, with a job waiting for her at NASA.

Her only regret is Brookshire, who died in April 2017, wasn't there to see her achieve her dreams. Cline celebrated with her family, her friends, co-workers, her PROMES family and the entire Cullen College Electrical and Computer Engineering Department. There were cheers, squeals, tears, laughter and lots of hugs.

> "I wouldn't have come back if it wasn't for Dr. Brookshire. There was nothing stopping me from then on."

What's next?

Cline's undergraduate cap and gown are carefully put away in her closet.

"I'm pretty sure I will never use them again," she said. "But I won't ever get rid of them, either. They are in there for whenever I need something that makes me happy, a reminder of what is possible."

Cline loves her job and hopes the "coolness" of working at NASA never wears off. "NASA is like nerd heaven," she said. "I have an entire agency of people to geek out with. Being able to hang out with astronauts is pretty cool, too."

There is a serious aspect to her work, too, and Cline's UH education prepared her for it.

"I used to fret about the complicated processes they taught us in Circuits class, and how many points we could lose for the simplest of oversights. I remember being shocked when Dr. Yuhua Chen [associate professor, Electrical and Computer Engineering] said 'If your code is correct 95 percent of the time, you're failing.' In my mind 95 percent was an A," Cline said with a laugh.

"But in the real world, that attention to detail and those high expectations are crucial to my work," she said. "If I don't make sure my product is 100 percent correct and guarantee it down to the minutest detail, at best my team will be disappointed. At worst, people could be hurt."

Cline is making the most of her present. "The only thing I'm working toward right now is being the very best at what I do," she said. She shared some advice for other moms thinking of pursuing their dreams.

"I want any mom considering going back to school to know that she's not alone, that there are moms who do this," Cline said. "She can do this just as much as the kid who comes right out of high school and gets a degree. Being a mom, having kids, having a family, doesn't make you any less. In a sense, it makes you even more equipped."

#CullenCollegeStories

AIMING HIGH:

Cullen College Grads Share Stories of Passion, Innovation & Success

Pursuing an engineering degree, either undergraduate or graduate, is not for the faint of heart. It involves tough classes, hard work, creativity, perseverance and discipline.

Yet year after year, the Cullen College of Engineering attracts students from all over the greater Houston metropolitan area, from all across the U.S. and from around the globe.

They work with professors who are renowned in their fields and can take advantage of opportunities in Houston's thriving medical, energy, aerospace, data and manufacturing industries. They are involved in cutting-edge research, gaining invaluable experience and exploring the possibilities of entrepreneurship.

Each year the Cullen College of Engineering faculty and staff watch proudly as graduate after graduate walks across the commencement stage and into the real world, ready to impact the future.

Here we feature some of the many talented Cullen College graduates. Armed with the knowledge and experience they gained at UH, they are making a difference on a daily basis.

Nikunj Bhagat

(Ph.D. EE '17)

Electrical engineer at Northwell Health, The Feinstein Institute for Medical Research

> *My interest in medical devices started about 10 years back*

when I was an undergraduate engineering student at the University of Mumbai in India. I was on my way home from college, when I saw a person who was missing all four of his limbs. He was basically lying on the ground and begging.

I started wondering about how we could use technology to benefit people in such situations.

That incident inspired me to do my master's on control systems. Then I worked as a researcher in South Korea where I was looking into robotic surgery and trying to develop technology to assist with such surgeries.

During that time, I got interested in brain-machine interface (BMI) and understanding its potential to help people with paralysis, amputations and spinal cord injuries. I looked up all the researchers in the U.S. and in Europe working in that field. Dr. Jose Luis "Pepe" Contreras-Vidal was one of the most prominent researchers doing extensive work in non-invasive BMI projects using electroencephalogram (EEG) readings of brain activity. I got in touch with Pepe and, fortunately, he had a position for a Ph.D. candidate at that time.

I worked for five years in Pepe's lab at the Cullen College of Engineering while pursuing my Ph.D. in electrical engineering. As part of my studies, I collaborated with physicians from UT Health and TIRR Memorial Hermann and a professor at Rice University to evaluate the efficacy of the brain-machine interfaces for rehabilitation of stroke survivors.

While at UH, I co-invented two neurotechnologies (one patent has been granted and the other is pending) focused on EEG-based BMI and neuromuscular stimulation. I also had the opportunity to demonstrate our BMI controlled exoskeleton technology to a live audience at the 2016 Congressional Robotics Caucus held in Washington DC.

After graduating, I joined Houston Methodist Research Institute in January 2018, where I worked on a novel vagus nerve stimulator designed to treat stroke patients.

Vagus nerve stimulation has been around for decades and helps in treating epilepsy, depression and, recent studies show, it could help with diabetes, rheumatoid arthritis and other diseases. Traditionally, they make an incision in the patient's neck and then implant electrodes around the nerve...that way you can directly stimulate the nerve.

We want to deliver this treatment using a new type of stimulator that is effective, non-invasive and can be deployed rapidly to help with stroke recovery.

As soon as someone has a stroke, there are a lot of procedures done on the patient to help stabilize the situation and time is essential. In the non-invasive approach, we can directly apply the stimulation with minimum assistance and start delivering the treatment. This could be something that is deployed in an ambulance by a paramedic.

Houston Methodist had already patented this idea before I joined them, my role was to actually make this device, test it clinically and show proof of its impact. Eventually, we want to get the new device approved by the Food and Drug Administration (FDA) and bring it to the market.

I started my job in April at The Feinstein Institute for Medical Research, the research arm of Northwell Health, New York's largest healthcare provider. In this position, I will continue to work on brain-machine interfaces and neuromuscular stimulation, which was the focus of my Ph.D., but on a much broader scale.

For instance, in my doctoral work I demonstrated that it is possible to autonomously control the force generated during electrical stimulation of a paralyzed hand. Now, I will be working on expanding this technology to control not only force but also position, which will allow patients with spinal cord injury and stroke to perform dexterous hand movements that weren't possible before.

I will also be working with a team of clinicians, engineers and scientists – in Feinstein's Institute of Bioelectronic Medicine – to develop an implantable, bidirectional brain-machine interface that will allow patients with tetraplegia to control their hands using stimulation, as well as be able to feel the objects that they are trying to manipulate.

I feel a huge sense of pride and purpose, working with my colleagues and other researchers in the field, to push the frontiers of technology and develop solutions that will eventually benefit patients. At the end of the day, the knowledge that my work can have a meaningful impact on people's lives is very rewarding.

Eric Rodriguez
(BSEE '06)

Product manager for the Internet of Things group at Intel

At the age of 11, I moved with my family from Houston to Guayaquil, Ecuador. That was a complete culture shock for me. It was the first time I saw poverty right in front of me. I learned quickly about inequality and the impact education can have in closing the poverty gap in developing countries.

My life completely changed again when I was in the seventh grade at El Colegio Javier in Ecuador. The school got its first computer lab and we were the first students to take a class in it. Within minutes I was able to go online and read about what was going on around the world, especially my hometown of Houston. From that day on, I knew I wanted to do something in technology.

In 1998, the Ecuadorian economy began to collapse. I had two more years before college so my family decided to move back to Houston.

That experience in Ecuador is what drives me today to ensure we continue to use technology for good and help every kid, regardless of where they are from, to be part of the digital 21st century.

My curiosity about how technology works led me to engineering.

The University of Houston Cullen College of Engineering has a great program that brings engineering and computer science together. The professors gave us plenty of opportunities to test and build things, which is a key skill I use today.

I have been working at Intel for eight years now, in a variety of groups from control systems, operations and real estate to education initiatives. At Intel we are always working on how we can make the world more connected and smarter.

In my current role, I am responsible for the product strategy and development of the next generation of control systems for smart manufacturing. I get to learn something new every day.

The BIG question I am trying to answer is: What does the education of the future look like? At Intel, I am in the forefront of building the future our kids will inherit. How are we preparing students for these new technologies or the notions that their jobs have not even been created yet? How do we empower teachers, parents and communities to strive in the middle of constant change?

UH provided me an opportunity to meet and work with students from around the world, to learn about their stories, passions, interests and challenges.

Our University also introduced me to my wife Lorena ('05) and several of our friends. It allowed me to be an example for the next generation, which included my brother Kevin (BSChE '10).

Technology impacts everyone in some form or fashion. Therefore, as a product manager I need to understand how the complex piece of technology we are creating will impact the lives of others. I will be forever grateful to UH for expanding my world view through the experiences I had every day.

What gets me excited is that I am learning about the future of work and how it will impact students that are in school today. I am learning about the disruptions of tomorrow and I want to help people get ahead of them. My job is to plant the seeds of innovation now, so that the next generation will make sure they flourish to their full potential. ■

Peter J. Rayna, P.E.
(MSIE '97)

Supervisory mechanical engineer Headquarters, U.S. Army Corps of Engineers (USACE) Fort Belvoir, Virginia

Currently I am a supervisory mechanical engineer with Headquarters, U.S. Army Corps of Engineers. I have been working in this job since late February 2011.

This is a civilian job, not to be confused with my service in uniform. I retired this past summer as Colonel, Corps of Engineers, United States Army Reserve, having completed 30 years of combined active and reserve service.

In my civilian job I work as a program manager, overseeing efforts to conduct emergency restoration of critical infrastructure if damaged unexpectedly. I also perform all necessary coordination for the program with other agencies within the National Capital Region.

Managing this program is like running my own small business. The program is very small in terms of both annual budget and assigned personnel. I often joke with people that I do everything from taking out the trash to briefing four-star generals, and literally everything in between.

My father was the town engineer where I grew up (Enfield, Connecticut) so it was probably inevitable that I, too, would become an engineer. He was a civil engineer, and he suggested that I look into other engineering disciplines as well.

The opportunity to attend West Point as an undergraduate – I got a bachelor's degree in mechanical engineering – was a significant influence, in terms of both engineering and public service. West Point was founded in 1802 as the nation's first engineering school, and cadets are taught to pursue "a lifetime of service to the nation."

Significant reductions in U.S. military forces with the end of the Cold War led me to Houston. I left active military service after Operation Desert Storm and went to work in private industry.

During that time, I enrolled at UH to get my master's degree in industrial engineering. I had the opportunity to meet and work with students and professors with interests and experiences much different than my own.

Most of the classes I attended were in the evening, with a mix of full-time and part-time students working in industries other than mine. I completed 30 hours in [industrial engineering] and 12 hours in the business school. This, and attending many interesting guest lectures, helped me broaden my horizons.

I completed several courses in Human Factors Engineering, which is really foundational – you're always interacting as part of a larger system. You need to understand your role, or the role of the operator, with respect to the purpose of the system to be successful. I also completed Organizational Power, Politics and Culture with Dr. Abigail Hubbard [UH Bauer College of Business] which has helped me through all these years.

Despite many years and positive experiences in Houston – meeting my wife, passing the professional engineer exam and completing my master's degree at UH – I missed the strong camaraderie and sense of mission of the military. So I took the opportunity to move to the National Capital Region where I have worked for the U.S. Department of Defense as a civil servant for the last 20 years.

Since I recently retired from uniformed service and will become eligible for civil service retirement in a little less than five years, a time of transition is coming for me. I expect to keep working for probably 10 more years. I'm not quite sure yet what the next chapter looks like. ■

Matthew Hogan

(Ph.D. BME ’15)

Postdoctoral fellow at the Center for Neuro-regeneration Houston Methodist Research Institute

When I was 11, my father passed away from lung cancer.

He was a mechanical engineer, and before he passed he instilled in me a love for mathematics and science. I’m a hands-on person and practical minded. I love to build things, to tweak and repair. Engineering seemed like a natural fit, but I didn’t want to build bridges or cell phones.

Because I’ve seen first-hand how a disease can affect a family, I wanted to help people and ease their suffering. Biomedical engineering seemed to be the best of both worlds. While I was working on my Ph.D. at the Cullen College of Engineering, my research applied tissue engineering to manipulate tissues and materials designed to encourage the healing process.

I took a ton of great classes and was exposed to all sorts of different, useful subjects. I studied principles of drug delivery, electrophysiology, in silica modeling and more. My diverse background has helped me bring unique solutions to research questions. In science, a broad knowledge can bridge gaps between different fields of research. I am truly grateful for the knowledge and opportunities I discovered during my time at UH.

Now I am a postdoctoral fellow at the Houston Methodist Research Institute working on methods to improve outcomes after central nervous system injuries, in particular spinal cord injuries and strokes. I joined the Horner lab at Methodist in the fall of 2015 where I began my fellowship focusing on mechanisms of neuroregeneration and how neural activity influences the ways neurons behave and recover after injury.

Life as a researcher is challenging and rewarding. It requires me to wear many hats and so I am always doing something different every day.

In neuroregeneration, I can use principles of engineering, biology and science to seek new clinical opportunities. I have a ton of interesting projects, including using virtual reality to analyze 3-D medical and scientific data, building new spinal stimulators and manipulating neural activity patterns with flashing lights. I am excited to come into work every day to face a new problem and apply unique solutions.

My main focus now is on exploring how neural activity patterns can affect the way nerves behave after injury. Spinal cord injury is especially problematic because nerves in the brain and the spinal cord don’t typically regrow after an injury. We are leveraging next generation tools to manipulate how specific nerves work.

We have already demonstrated that spinal stimulation can improve outcomes after injury, but we don’t know exactly which nerves need to be stimulated and which patterns of stimulation are most important. We are excited to find the answers so that we can better understand how to improve outcomes after injury.

Working in a position where I can use my passion to explore solutions to ease human suffering is a dream job.

Cynthia Oliver Coleman, P.E.

(BSChE '71)

Retired ExxonMobil chemical engineer

I am a first-generation college graduate, and I am proud to say it because it reminds me of the dream my parents had for me.

My story started in the Cuney Homes, located in the historic Third Ward. It's the first development opened by the Housing Authority in 1938. I lived [there] with my wonderful parents who did not have college degrees but were very determined to help me get mine.

They knew a college degree would enable me to get a good job that would be so much better than the low-paying jobs they had. So they encouraged me all through K-12 to study hard and make good grades in school so I could get a scholarship for college.

The turning point occurred during my junior year in high school when my chemistry professor chartered a Junior Engineering Technical Society (JETS) chapter. That was the first time I had heard of engineering. Even though I was told engineering was not for girls, I took a huge leap of faith to pursue it when I got a [college] scholarship. In 1967, I enrolled at UH as a chemical engineering freshman. To my surprise, I was not only the only girl in my class, but also the only Black student.

Both my studies and experiences at UH significantly helped me with my career. The Cullen College of Engineering's chemical engineering department had a high national ranking, and I had the toughest advisor on campus who helped me excel in more ways than I thought possible. In 1971 when I graduated magna cum laude and started my career at ExxonMobil (then Humble Oil), I was prepared to be in a competitive work environment. Also, since I was one of the first two women to receive a chemical engineering degree from UH, I was surprised but prepared to be the first woman engineer in Exxon's large East Texas Division.

> I am very passionate about supporting women and minority engineering students at UH. I remember how it would have been so very helpful to connect with other women in engineering on my journey to graduation.

After I retired from ExxonMobil, ending a 33-year career in 2004, I wanted to increase my volunteerism up a few notches so I could give back in a major way.

I am proud to be a Coog because there are so many important parts of my life that are a result of UH. I am forever grateful for UH being a university where I could achieve more than I ever expected possible.

My UH engineering degree changed the entire trajectory of my life from what it would have been. It enabled me to realize my parents' dream for me. It enabled me to help my younger sister, Patrice O. Yarbough ('80, Ph.D. '85), pursue her dreams at UH. It enabled my husband, Leonard J. Coleman ('70), and me to help our daughter, Kelly Coleman, M.D. ('98), pursue her dreams at UH. It enabled me to be in a position to give back in a big way to help others.

I am very passionate about supporting women and minority engineering students at UH. I remember how it would have been so very helpful to connect with other women in engineering on my journey to graduation.

As a result, I have devoted much of my time, talent and treasure to support UH, UH Engineering and the UH Alumni Association. As a passionate Engineering Volunteer Leader, I will continue to support the UH engineering students ... by giving what I wished was available when I was a UH engineering student. ■

Lorenzo Xavier Cano

(BSIE '04)

Operation Excellence Lead for CareAllies, A subsidiary of Cigna

I have to admit that I did not know what I wanted to major in when I started college.

The Program for Mastery of Engineering Studies (PROMES) exposed me to the different types of engineering disciplines. Industrial engineering is focused on making systems, products and processes more efficient by reducing waste, improving quality, increasing productivity and lowering costs. I have always enjoyed solving puzzles and finding more efficient ways to do things. So naturally, industrial engineering was perfect for me, and I am grateful for the resources I received at the University of Houston's Cullen College of Engineering that allowed me to come to this realization.

The industrial engineering curriculum allowed me to take a lot of great classes that prepared me for my first job. These classes allowed me to get exposure to everyday challenges that many companies face. More importantly, I learned how to come up with creative solutions to overcome challenges and create value for companies.

As an engineering student, I was also involved in many extracurricular activities and served in many leadership roles while in college. The organizations included The Hispanic Student Association, Sigma Lambda Beta National Fraternity, La Comunidad and Omicron Delta Kappa National Leadership Honor Society, among others. This experience allowed me to hone my leadership skills, which proved handy when starting my first job out of college.

My involvement in student organizations also enabled me to meet a lot of amazing individuals and make lifelong friends. We organized a lot of great events on campus and performed community service that changed the lives of many people.

I still remember leading a community event one Thanksgiving season where we worked with local grocery stores to donate over 100 turkeys to lower-income families living near the UH community. This event changed my life and taught me the importance of helping others in need while at the same time showing gratitude for the positive things that I have in my life.

For the last 12 years I have been working predominantly in process improvement, change management and project management roles leveraging Six Sigma and Lean Concepts at Dell, Bank of America and in my current role at Cigna. I have a Black Belt in Six Sigma and am a certified Project Management Professional. In 2010, I earned my MBA from The University of Texas at Austin. In 2014, I published a book called "Resumes That Stand Out" and then began presenting professional development workshops around the country.

I encourage all students to get involved with some type of leadership role. In fact, my wife and I started an annual scholarship for UH Cullen College industrial engineering students who have not only succeeded academically, but have also found time to serve in leadership roles.

Education and service is important to me and my family. I have volunteered for many years with a nonprofit called Prospanica: The Association of Hispanic Professionals to raise scholarships for students and organize professional development workshops for those interested in accomplishing their academic dreams and improving their careers. I was pleased to have won a $25,000 grant last year that has allowed me to give out a greater number of scholarships to students. ■

Jamila C. Johnson, P.E., C.F.M.

(MSCE '00)

Infrastructure policy manager Governmental Relations Office Houston Public Works

I am in the first generation of my family to be able to have my choice of colleges. Segregation and discrimination limited the college and career choices of my parents and grandparents. It is my understanding that UH did not admit its first African-American student until the 1960s. However, because of the achievements of the civil rights movement, my choices were unlimited.

Originally from Detroit, Michigan, I grew up seeing the struggles of that city and it made me want a career focused on solving big city problems.

Detroit's struggles, which continue today, are a result of the decline of the automotive industry and the social problems that led to race riots and White flight to the surrounding suburbs. Declining population and tax base cripple the city's ability to maintain its infrastructure and further deteriorate quality of life for those who remain. Efforts at urban renewal and revitalization have been largely unsuccessful there.

I chose civil engineering because of its focus on people's basic needs – like clean water, shelter and transportation. I wanted to use my problem-solving and planning skills to help people.

After undergraduate school, I chose to move to Houston to pursue my master's in civil engineering because I would have the opportunity to study at UH. I was excited to do my graduate studies in such a diverse environment with so many innovative professors from all of over the world.

The Cullen College of Engineering civil master's program was challenging, but it prepared me to continue to learn in the variety of roles that I have had in my career so far.

I am the infrastructure policy manager for Houston Public Works. I received this assignment in May 2018, after working as the city of Houston's floodplain manager for nine years.

As floodplain manager, I was responsible for leading one of the nation's largest local floodplain management programs. The Floodplain Management Office is responsible for permitting and inspecting all construction activity in the city's floodplain, maintaining records pertaining to the city's floodplain, enforcing the city's floodplain ordinance, providing floodplain information to the citizens of Houston, developing applications for mitigation projects, assisting with flood disaster response and recovery activities and coordinating with FEMA, Texas Water Development Board and the Harris County Flood Control District.

In my new role, I'm responsible for developing policies related to the city's infrastructure, acting as a liaison between Houston Public Works and local, state and national agencies and governmental entities and participating on the city's Harvey Recovery Leadership Team. I have to learn about all the areas of our operations so that I can help develop policy and communicate with the citizens, city leadership and other stakeholders.

Houston has been my home for over 20 years now and I want to help make it a better place for my fellow Houstonians to live and work in. For me this means fighting flooding by developing policy and enhancing regulations in ways that continue to make Houston a vibrant environment for development and redevelopment. This is more important than ever after seeing the devastation that Hurricane Harvey and other recent storms have caused.

While my role covers all infrastructure policy, the big question for me continues to be how best to leverage all of the partnerships and tools available to the city to fight flooding.

I want to help shape a more resilient future for Houston.

#CullenCollegeStories

Cullen College Trailblazers
Brighten the Future of Engineering:

UP CLOSE & Personal

with NAE Faculty

The highest professional distinction an engineer can achieve is obtaining membership in the elite group the National Academy of Engineering (NAE). The nonprofit organization, founded in 1964, brings together many of the world's most accomplished engineers.

The NAE's more than 2,000 renowned member professionals in industry, academia and government from the U.S. and around the globe, provide leadership, expertise and insight to the federal government on matters involving engineering and technology.

The UH Cullen College of Engineering is home to 14 brilliant engineers who have earned their spot on the NAE membership roster with creativity and distinction. In this issue, we invite some of our NAE faculty members to share insights into how they think, dream and innovate.

Benton Baugh

(BSME '76)

Distinguished adjunct professor of mechanical engineering

NAE Election Year: 1999

Election Citation: For implementation of concepts for subsea equipment used in offshore oil production.

What is your philosophy on life?

BB: At all times leave things better than when you found them.

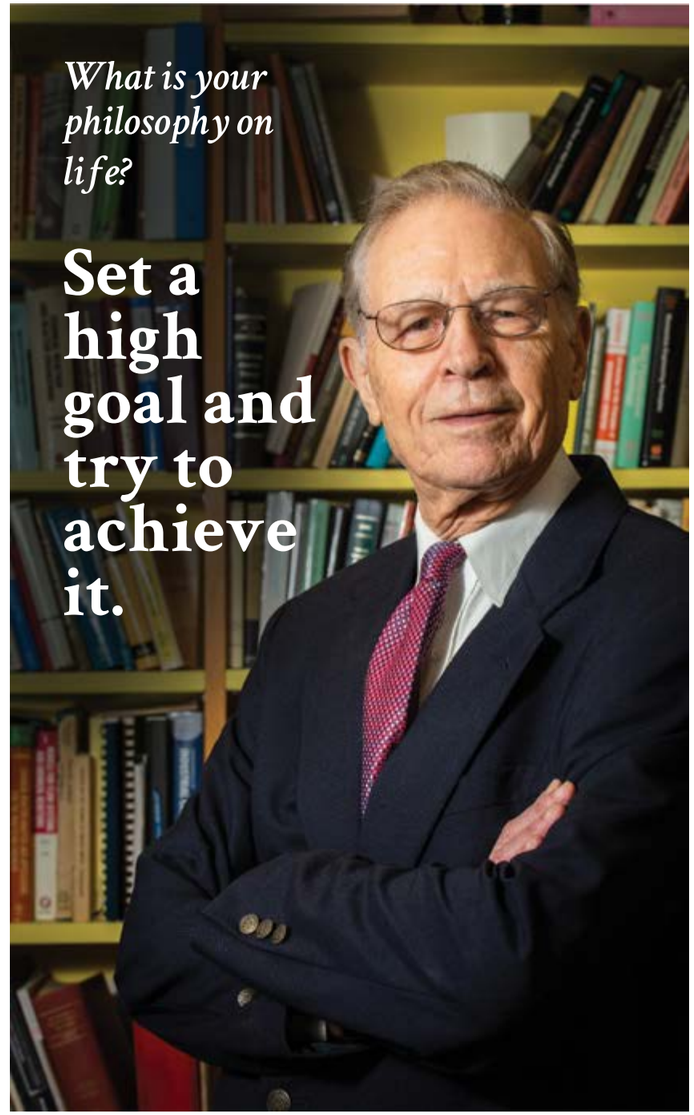
How did you get interested in engineering?

BB: When I was in the eighth grade I was going to be a school teacher, which was the noblest profession I had seen at that point. At that time my brother in college switched to engineering and so I decided to become an engineer also. I had zero career counseling, but it was the right answer.

Engineering has provided a basis not only for success in doing technical design, but also establishing and owning a company and mentoring others.

What keeps you inspired about your work?

BB: As an engineer I get to work on puzzles and problems no one knows the answers to and use the knowledge to produce new products and services.



Dan Luss

Professor of chemical and biomolecular engineering

NAE Election Year: 1984

Election Citation: For his scholarly insight into important industrial problems in chemical reactor engineering and for his ability to support novel, inspired and useful solutions.

Christine Ehlig-Economides

Hugh Roy and Lillie Cranz Cullen Distinguished University Chair and professor of petroleum engineering

NAE Election Year: 2003

Election Citation: For contributions to the testing of wells and characterization of reservoirs, including the management, integration and visualization of data from multiple disciplines.

What is your philosophy on life?

CE-E: Overall, I have enjoyed taking the "road less traveled," and it has made "all the difference." I celebrate diversity. Learning to communicate in unfamiliar technologies or surroundings is stimulating.

What keeps you inspired about your work?

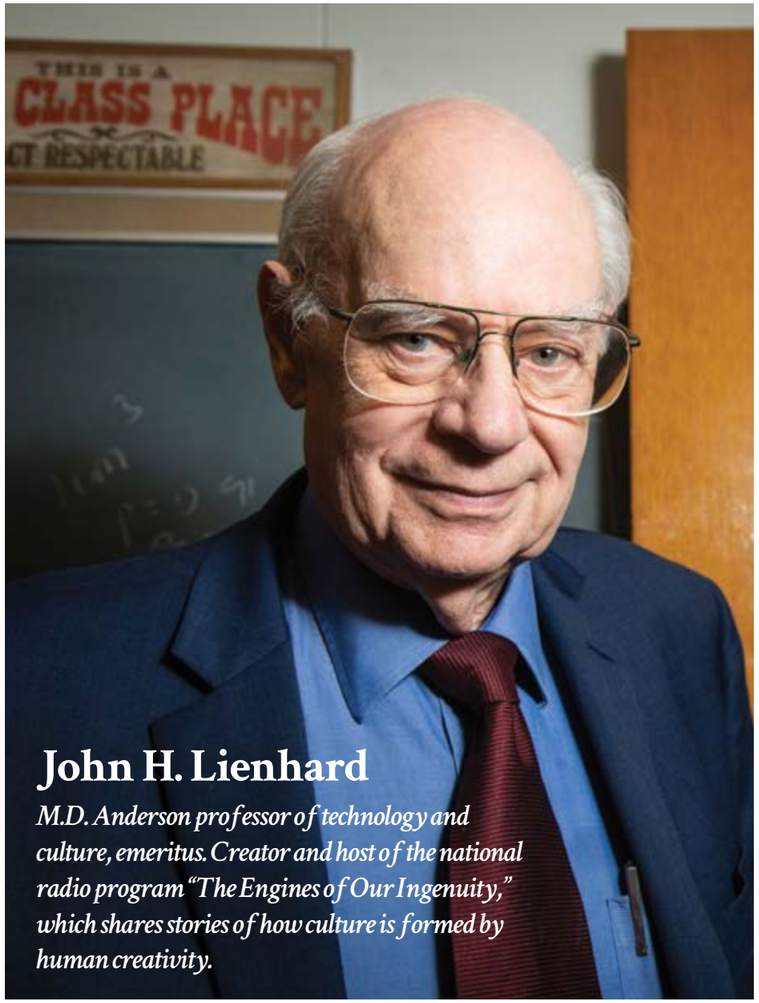
CE-E: It seems like nearly every day I encounter new insights. The university environment is great for this. A Ph.D. student begins to succeed when he or she starts to teach the professor. I will be able to keep this up as long as I can find new ideas to explore.

Who is your favorite engineer? And why?

CE-E: This is a hard question because many well respected and highly known people come to mind. But Dr. Tatiana Streltsova, a civil engineer and hydrologist, was my role model. I referenced her work in my own first published articles. I met her about 20 years later, after she immigrated to the U.S. from Russia, and I knew her after she retired and took up her passion for art. She passed away recently. Streltsova, a child survivor of the Leningrad siege during World War II, overcame many barriers to reach her achievements.

Name one thing that people would be surprised to learn about you.

CE-E: I think the Big Bang theory [origin of the universe] is wrong. One day I may try to investigate and articulate compelling arguments as to why it is wrong.



John H. Lienhard

M.D. Anderson professor of technology and culture, emeritus. Creator and host of the national radio program "The Engines of Our Ingenuity," which shares stories of how culture is formed by human creativity.

NAE Election Year: 2003

Election Citation: For creating awareness of engineering in the development of cultures and civilizations, and for the development of basic burnout theories in boiling and condensation.

What is your philosophy on life?

JL: I must be constantly curious and ready to be surprised by the beauty all around me.

How did you get interested in engineering?

JL: I suffered severe dyslexia as a kid, and had to replace symbolic thinking with spatial visualization. That led me into things like drafting and mechanics. My visual sense suited me far better to geometry and calculus than it did to, say, algebra. It practically funneled me into mechanical engineering.

What keeps you inspired about your work?

JL: A world constantly remade anew.

Who is your favorite scientist? And why?

JL: A triumvirate: Michael Faraday, a British chemist and physicist who contributed significantly to the study of electromagnetism and electrochemistry; John Tyndall, an Irish experimental physicist who is noted for discoveries involving infrared radiation (his invention of the lightpipe led to the development of fiber optics) and atmospheric science among others; and J. Willard Gibbs, an American mathematical physicist who made important theoretical contributions to physics, chemistry and mathematics.

Seek out your ignorance; it is your friend.

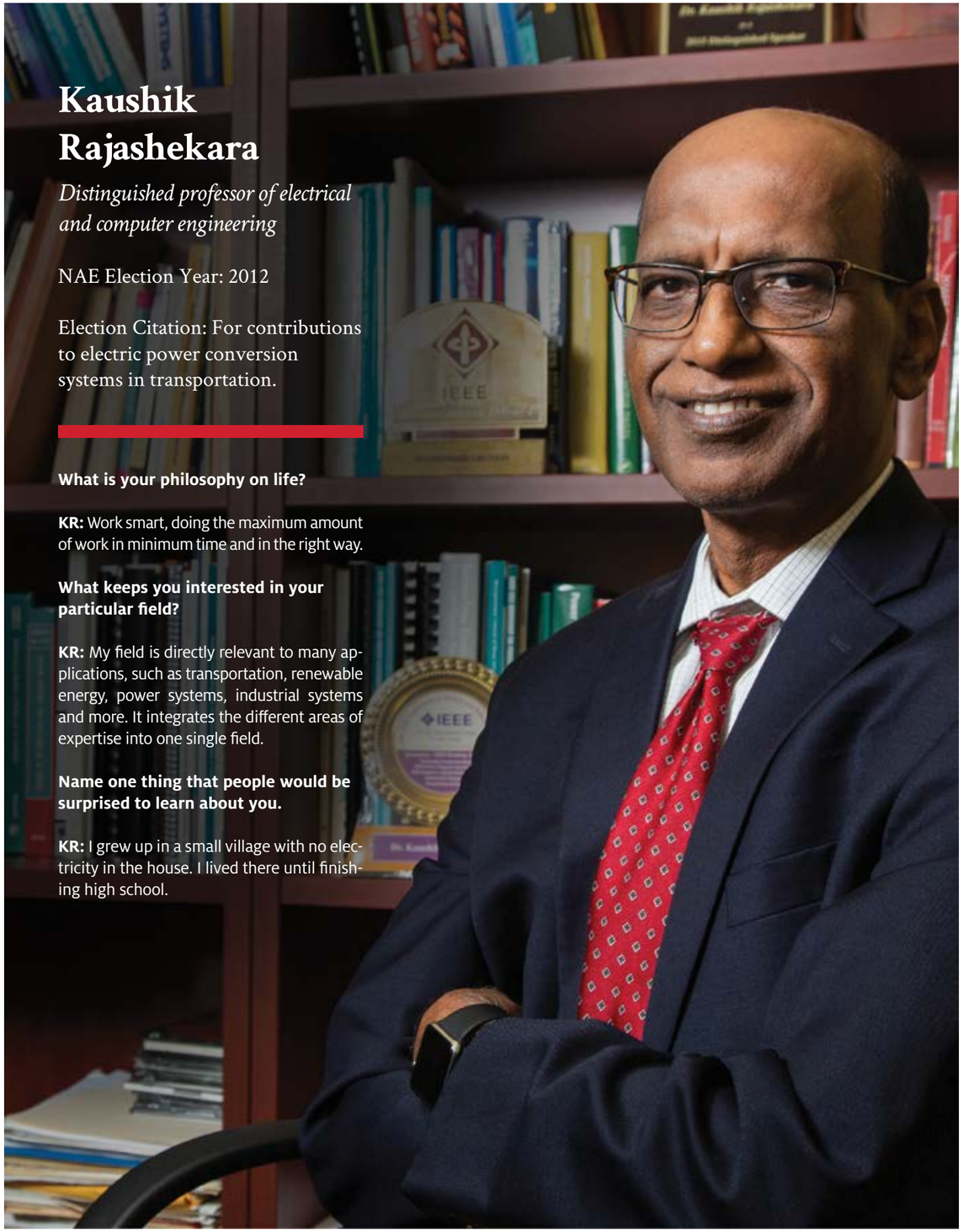
These three scientists profoundly influenced 19th century science and 20th century technology. Each was informed by technology. Each exhibited profound human goodness. Each is less celebrated than others who accomplished much less.

Name one thing that people would be surprised to learn about you.

JL: Maybe the fact that I was deeply involved in vocal music – lead roles in music theater and opera, high level vocal ensembles, even commercial recordings.

If you could tell aspiring engineers and scientists one thing, what would it be?

JL: Seek out your ignorance; it is your friend. Accomplishments and expertise are so yesterday. Knowledge flows into the curious person in the room, to the one who constantly seeks out his or her ignorance.



Kaushik Rajashekara

Distinguished professor of electrical and computer engineering

NAE Election Year: 2012

Election Citation: For contributions to electric power conversion systems in transportation.

What is your philosophy on life?

KR: Work smart, doing the maximum amount of work in minimum time and in the right way.

What keeps you interested in your particular field?

KR: My field is directly relevant to many applications, such as transportation, renewable energy, power systems, industrial systems and more. It integrates the different areas of expertise into one single field.

Name one thing that people would be surprised to learn about you.

KR: I grew up in a small village with no electricity in the house. I lived there until finishing high school.

Ganesh Thakur

Director of Energy Industry Partnerships at UH and distinguished professor of petroleum engineering

NAE Election Year: 2016

Election Citation: For leadership in the implementation of integrated reservoir management techniques.

What is your philosophy on life?

GT:

1. Although difficult to implement, try to create a reasonable work-life balance.
2. Make your work your passion and learn on every step.
3. Never give up, do the very best you can.
4. Pay attention to your own drawbacks before criticizing anyone else.
5. Use encouragement to motivate others.
6. Collect as many facts as you can before making a decision and realize you will make some wrong decisions.

What keeps you inspired about your work?

GT: When I was an undergraduate, oil prices dropped and many people thought oil and gas would run out in 30 to 40 years. They were wrong. Today we still have 40, 50 or more years of oil and gas remaining, especially as we go from conventional oil and gas to unconventional. The sky is the limit, and we may have a whole new era coming up.

The oil and gas industry has been good to me and led to a very rewarding career, not only in financial terms, but also by providing exciting work where you can use advanced technologies, constantly learn new things and work all over the world, meeting diverse people and making friends everywhere.

I also like helping others, especially in teaching my students.

Who is your favorite engineer? And why?

GT: Anthony Lucas (1855–1921), an Austrian-born mechanical and mining engineer who became the leading expert on salt dome formations in America. He discovered Spindletop, the first oilfield found on the U.S. Gulf Coast, kicking off the Texas Oil Boom in 1901. The discovery not only transformed the economy of the area, but also revolutionized the global fuel usage. The Lucas Geyser blew oil over 150 feet in the air at a rate of 100,000 barrels per day.

Lucas returned to Beaumont, Texas, after a job in Mexico and was asked about the Spindletop's rapid decline in production. "The cow was milked too hard," he said, "and moreover she was not milked intelligently." The concept of reservoir management started at that time.

I have been following this philosophy during the last 40 years, and this was the subject of my recognition for the NAE (National Academy of Engineers).

If you could tell aspiring engineers and scientists one thing, what would it be?

GT: Develop a positive attitude and "can do" approach. Be persistent, stay focused, use your time effectively, respect others and embrace diversity.

Our industry has seen many ups and downs and it has affected all of us in some ways. But the outlook for the future of the oil and gas industry is bright and healthy. I see a robust oil and gas industry in the future. We should focus on describing the value of our profession to the society, such as providing energy for light, heating, air conditioning, driving, running machines, airplanes, etc. It's important to continue exploring, drilling, producing, refining and transporting oil, gas and derivative products for a variety of usage. If we stop these activities, the whole world will come to its knees. What we do is an integral part of our society, and today's young engineers and scientists are going to play an even more important role than my generation played.

I would encourage young professionals and college students to continue to stay active, take leadership roles and continue to develop themselves as this is a very important industry and it is going to be here for many more years.

Stuart Long

Stuart Long Honored With

IEEE DISTINGUISHED EDUCATOR AWARD

BY RASHDA KHAN

Stuart Long, Cullen College professor of electrical and computer engineering and associate dean of undergraduate research and the Honors College, received the 2018 Chen-To Tai Distinguished Educator Award on July 11 from the IEEE (Institute of Electrical and Electronics Engineers) Antennas and Propagation Society (AP-S).

The organization recognized Long for "his commitment to electromagnetics education through teaching, research and the development of programs to attract students into electromagnetics and engineering." The award was created in 2000 to recognize outstanding career achievements by an educator in the field of antennas and propagation.

"Based on his mentoring at both the undergraduate and graduate level, [Long] is without a doubt most deserving of the Chen-To Tai Distinguished Educator Award," wrote **Joseph W. Tedesco,** Elizabeth D. Rockwell Dean of the Cullen College of Engineering, in his recommendation letter.

Winning the Chen-To Tai award is a great honor to any educator in the field of applied electromagnetics, but it is personally meaningful to Long and brings him full circle to his early roots.

As a doctoral student at Harvard, Long met Professor Tai, a renowned scientist in electromagnetics and antenna theory. Tai, who was a longtime professor at the University of Michigan at Ann Arbor, at the time was on a teaching sabbatical at Harvard.

"I obviously admired his intellect, and he was always a gentleman ... a really nice person who would just sit and talk to some lowly grad student like me," Long said. Once graduated and working as a professor, Long attended some of the same conferences as Tai. They continued talking, became tennis partners and eventually co-authored a chapter in the classic text "Antenna Engineering Handbook."

In a coincidence, Tai and Long at different times had each been Ph.D. students of Professor Ronold W. P. King, a Harvard professor famous for his contributions to the theory and application of microwave antennas. (In 2001, Professor King would become the first recipient of the Chen-To Tai Award.)

For Long, winning this award was an homage to his academic family. "Anytime you get an award like this, it's really due to all the people who mentored you to this point," he said. "I have had some great mentors."

Long has been teaching and researching at UH since the 1970s and has spent years creating a thriving culture of undergraduate research, mentorship and achievement.

He oversaw the expansion of three mentoring undergraduate research programs on campus — a full-time summer program (Summer Undergraduate Research Fellowship, or SURF), a part-time semester program (Provost's Undergraduate Research Scholarship, or PURS) and the undergraduate senior honor thesis program. Under Long's leadership, the Office of Undergraduate Research recently developed the Houston Early Research Experience (HERE), which is a two-week workshop designed to familiarize rising sophomores and juniors with the fundamentals of conducting research.

He has also done other outreach and helped develop faculty-led lectures, workshops and panels on topics like finding a research position, being a responsible researcher, pursuing graduate school and applying for scholarships.

In 2002, Long was asked to help the Cullen College of Engineering provide opportunities for young women and other underrepresented students to explore STEM careers.

"He answered 'yes' without hesitation to the request and took a huge risk with his professional career, as the time and effort involved ... would divert much of his attention from his technical research," wrote Tedesco. "I am proud to say that his efforts have blossomed into an extensive infrastructure of activities."

Long worked with Cullen College Professor Fritz Claydon, also the director of the division of undergraduate program and Student Success, and others on these activities. Their projects include G.R.A.D.E. Camp, an annual engineering camp for girls in grades 8-12; academic excellence workshops in more than a dozen courses for students; summer research opportunities for engineering undergraduates from across the country; research opportunities for K-12 teachers in engineering laboratories during the summer (which garnered them the White House Award for President's Higher Education Community Service in 2013) and GK-12, a program bringing science and engineering graduate students into area schools to foster greater interest in science and engineering among economically disadvantaged students.

> "Based on his mentoring at both the undergraduate and graduate level, Stuart Long is without a doubt most deserving of the Chen-To Tai Distinguished Educator Award."
>
> - DEAN JOSEPH W. TEDESCO

Long's efforts have garnered the University about $20 million in funding from a total of 89 grants, of which 21 were from the National Science Foundation.

At the University of Houston, Long has won almost every faculty honor there is, including the Esther Farfel Award in 2010 (the highest honor a UH faculty member can receive) and the Fluor Daniel Award (the top career award given by the College). Long also was the first recipient of the UH Career Teaching Excellence Award.

His research interests are in the broad area of applied electromagnetics and wireless communications, and more specifically in microstrip and dielectric resonator antennas.

He became an IEEE Fellow in 1991, won the IEEE Third Millennium Medal in 2000 and received the organization's Life Fellow status in 2010, a designation given to those with "an extraordinary record of accomplishments in any of the IEEE fields of interest." He also received the IEEE AP-S John Kraus Antenna Award in 2014 for creating the dielectric resonator antenna, an antenna that is completely composed of non-conducting materials and is exceedingly efficient at very high frequencies.

Long credits the diversity of his work – teaching, research, administration and more – for keeping him engaged and invested in his 44-year-career. Several of his students and academic hires have already retired, but it's not something that appeals to him.

"I keep doing it because I enjoy it," he said. "As long as I'm in good health and having fun, I plan on continuing. If I had [the opportunity] to do it over, I'd maybe do some things slightly different ... but I'd always end up being a professor. I think that's the best job you can have."

Megan Robertson Honored for Work With

SUSTAINABLE POLYMERS

BY SARA STRONG

Megan Robertson, associate professor of chemical and biomolecular engineering, was honored in May with the 2018 Sparks-Thomas Award from the Rubber Division of the American Chemical Society. During the conference in Indianapolis, Robertson presented her latest findings in the field of sustainable elastomers to fellow polymer researchers.

The Sparks-Thomas Award (sponsored by ExxonMobil) has been given since 1986 by the society's Rubber Division to an early career scientist, technologist or engineer for outstanding contributions in the field of elastomers. It is named for the developers of butyl rubber, William J. Sparks and Robert M. Thomas.

Robertson's 2018 award honors her research into identifying vegetable oil and fatty acid-based materials that could replace petrochemical products as the basic ingredients in the manufacturing of elastomers.

Elastomers are the kind of polymers that can greatly stretch and deform, then quickly revert to their original form. (Think tires and rubber bands, for example.) The goal is to develop new, superior materials that maintain all the benefits of today's products while also being kinder to the environment, as well as to uncover new, advantageous properties.

Traditional elastomers find diverse applications. They are the major components of rubber tires, soft coatings, adhesives, even Silly Putty. They are in the seals that secure the International Space Station and the gaskets that keep our home faucets from dripping. The waterproof sealants that plumbers put around pipe joints are made with elastomers; so are silicone devices used by surgeons in an operating room.


Megan Robertson

As beneficial as these polymers are, their traditional form presents some challenges. For one thing, their raw materials are byproducts of petroleum refining, which means they come from a nonrenewable resource that is subject to the troublesome fluctuations of supply and price on world oil markets. For another, they are not particularly earth-friendly in their creation or in their afterlife.

Biorenewable elastomers

Robertson's research group is using vegetable oils and their fatty acids for the development of new elastomers. These relatively abundant biosources have the potential to replace traditional petrochemical sources for polymers. "If elastomers could be made from biosources instead of petroleum, there is the potential to greatly reduce their environmental footprint," she explained.

Robertson's research has emphasized a specific type of elastomer called a thermoplastic elastomer. Unlike traditional elastomers, thermoplastic elastomers can be reshaped into new forms at elevated temperatures, allowing for their on-the-spot application as well as re-purposing into new products. Thus, the biobased thermoplastic elastomers Robertson is developing not only come from a renewable resource, they potentially could also be recycled after their use.

However, developing new polymers is not an easy task. Starting with a bioresource for polymers often results in materials with very different properties compared to the traditional materials. This presents many challenges for adoption of these materials in applications.

Robertson's group is investigating methods of overcoming such limitations for vegetable oil-based elastomers. As one example, the biobased elastomers show lower strength than traditional elastomers, so Robertson's group is developing methods to strengthen these polymers. Thus, the biobased elastomers of the future may not only be more earth-friendly than the current petroleum-based status quo, they might be stronger, too. For now, the enticing benefits are in the future while today's research is aimed at exploring the potentials. That research is very promising.

More milestones

Robertson had a busy year in 2017, with her calendar filled with major professional and personal milestones.

She was honored at the 2017 American Chemical Society's Young Investigator Symposium, hosted by the Polymeric Materials: Science and Engineering Division. For the symposium, she was invited to join other young scientists in discussing their individual research findings. But that time, she accepted the honors long distance and stayed in Houston to await the birth of her son just weeks later.

Additionally, the UH Undergraduate Research Mentor Award in 2017 honored her talent in guiding young scientists. "We work with many undergraduate investigators in our group, and we are quite proud of their accomplishments," she said.

The pace has not slowed, as Robertson and her group continue to explore game-changing science.

Two UH Cullen College Engineers Among

MOST CITED RESEARCHERS IN THE WORLD

BY JEANNIE KEVER

Two Cullen College of Engineering professors at the University of Houston – **Zhu Han,** John and Rebecca Moores professor of electrical and computer engineering, with expertise in the field of computer science; and **Yan Yao,** associate professor of electrical and computer engineering and a principal investigator at the Texas Center for Superconductivity – are on a list of researchers whose work has been most often cited by colleagues in their respective fields.

Citations – the mechanism by which other researchers refer to previously published papers in their own work – are a measure of the impact of a researcher's work.

Han and Yao, as well as two other UH faculty, made the Clarivate Analytics list of Highly Cited Researchers for 2018. The list identifies scientists and social scientists from around the world who have demonstrated significant influence through publication of highly cited papers during the last decade, defined as ranking in the top 1 percent by citations in a specific field and year.

A total of 22 categories of research are considered in the analysis. New this year is the cross-field category, which identifies researchers who contribute papers in several fields.

The other two UH researchers recognized are:

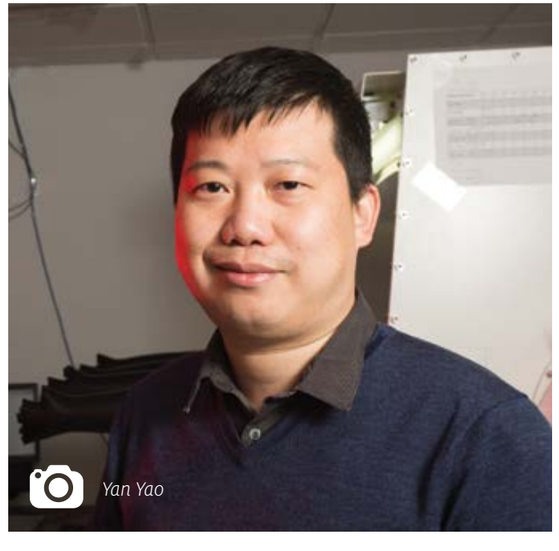
- Olafs Daugulis, Robert A. Welch Chair of Chemistry, in the chemistry category.
- Zhifeng Ren, director of the Texas Center for Superconductivity at UH and professor of physics, in the category of physics.

"We are deliberate in nurturing and investing in research that impacts society and improves the quality of life," said Amr Elnashai, vice president of research and technology transfer at UH. "It is therefore deeply gratifying to note that four of our professors are amongst the highest cited worldwide, an accomplishment that showcases the tremendous quality of the UH research enterprise."

The publisher noted that the list "recognizes world-class researchers selected for their exceptional research performance, demonstrated by production of multiple highly cited papers that rank in the top 1 percent by citations for field and year in Web of Science."


Zhu Han

> "It is deeply gratifying to note that our professors are amongst the highest cited worldwide, an accomplishment that showcases the tremendous quality of the UH research enterprise."
>
> - AMR ELNASHAI, VICE PRESIDENT OF RESEARCH AND TECHNOLOGY TRANSFER


Yan Yao

MEET THE NEW FELLOWS:

Two UH Engineers Named to IEEE Honor

BY RASHDA KHAN

Two UH engineering professors were named 2019 Fellows of the Institute of Electrical and Electronics Engineers (IEEE). The appointment is the Institute's highest grade of membership and is reserved for those with "an outstanding record of accomplishments" in an IEEE field. No more than one-tenth of 1 percent of IEEE's voting members can be named fellows in a given year.

IEEE is the world's leading professional association for advancing technology for humanity. Through its 400,000 plus members in 160 countries, the association is a leading authority on a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics.

Venkat Selvamanickam

Venkat Selvamanickam

Venkat Selvamanickam, M.D. Anderson Chair professor of mechanical engineering at the University of Houston, was named a 2019 Fellow of the Institute of Electrical and Electronics Engineers (IEEE) in recognition for 32 years of research contributions in applied superconductivity, specifically the development and manufacturing of superconductor wires.

Selvamanickam, who earned a master's degree in mechanical engineering and a Ph.D. in materials engineering from the UH Cullen College of Engineering, is one of the world's leading experts on innovative manufacturing technologies related to superconductors.

He is the co-founder and the former officer of SuperPower Inc., which produces superconducting electrical wire, and has continued his research since joining the UH faculty in 2008. He is also the director of the Advanced Manufacturing Institute at UH and the director of the Applied Research Hub at the Texas Center for Superconductivity at UH.

Selvamanickam's groundbreaking research demonstrated a unique technology to fabricate thin film high temperature superconductor (HTS) wire over length scales of more than a kilometer. Using this novel manufacturing process, his team completed the world's first significant delivery of thin film HTS wire for the Department of Energy's flagship program of Albany Cable Project to power 25,000 households in Albany, New York.

The wire is now used by more than 200 institutions around the world for developing applications in various fields, including wind generators, energy storage, power transmission cables, magnetically levitated trains, medical imaging and defense.

He also led a highly successful program funded by the Advanced Research Projects Agency-Energy (ARPA-e) to achieve four-fold improvement in in-field performance of superconductor wires. Currently, Selvamanickam is leading a program funded by the Advanced Manufacturing Office of the DOE to develop advanced manufacturing technologies for superconductor wires for next-generation electric machines.

Selvamanickam's research at the University spans a wide range of advanced processing techniques for high-performance materials for energy and electronics applications, such as high-temperature superconducting thin film wires, photovoltaics and flexible electronics.

"We are working to overcome the obstacles to commercialization of high temperature superconductor wires through a number of projects from nanoscale materials engineering to large-scale manufacturing research," he said.

Selvamanickam earned the Presidential Early Career Achievement Award in 1996, the highest honor the U.S. Government bestows on outstanding scientists and engineers beginning their independent careers. He has also received three R&D 100 awards, the Superconductor Industry's Person of the Year award, Wire and Cable Technology International Award, and the IEEE Dr. James Wong Award for Continuing and Significant Contributions to Applied Superconductivity Materials Technology. Selvamanickam is a Fellow of the U.S. National Academy of Inventors as well.

He has published 240 papers and holds over 80 issued patents. He serves as an associate editor of IEEE Transactions of Applied Superconductivity.

"I would like to thank the support of my colleagues, collaborators, sponsors and the University of Houston over 32 years for this exhilarating experience in the field of applied superconductivity," Selvamanickam said. "I am grateful especially to my peers who spent their valuable time in preparing and supporting my nomination and to the IEEE Council on Applied Superconductivity and the entire IEEE Institution for this honor."

Jose Luis Contreras-Vidal

Jose Luis "Pepe" Contreras-Vidal

Jose Luis "Pepe" Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen distinguished professor of electrical and computer engineering at the UH Cullen College of Engineering, has been named a 2019 Fellow of the Institute of Electrical and Electronics Engineers (IEEE). He is being recognized for his research contributions involving brain-machine interfaces (BMI) and wearable exoskeletons.

"The research for which I am being recognized could not have been accomplished without the work of many talented students, postdocs, university colleagues and clinical partners from the Texas Medical Center, and the volunteers who have participated in our research," Contreras-Vidal said. "I also appreciate the financial support from federal agencies, foundations and industry that made the research possible."

Contreras-Vidal is one of the world's leading researchers in the field of noninvasive brain-machine interfaces. He has been featured in national and international media for his thought-controlled robotic exoskeleton, which can help paralyzed patients regain their mobility. He also leads in the translation of clinical BMI systems to patients with paralysis and limb amputation.

In 2010, Contreras-Vidal was the first to demonstrate EEG-based neural decoding of 3-D center-out hand movement kinematics from the fluctuations in the amplitude of slow cortical potentials in the delta (0.1-4 Hz) band. His breakthrough research has enabled significant advances in the design of noninvasive closed-loop real-time BMIs to robotic prosthetic limbs and powered exoskeletons for people with spinal cord injury, stroke and limb amputations.

Contreras-Vidal's research team is now developing neurotechnology designed to help young children with disabilities.

The team also continues to study brain-computer interfaces in connection to the arts to further understand creativity and innovation, as well as develop BMI-based innovations to improve education, artistic endeavors and art therapy.

Contreras-Vidal is the director of the Building Reliable Advancements in Neurotechnology (BRAIN) Center at UH and the principal investigator for a NSF-funded Research Experiences for Undergraduates (REU) program – titled Neurotechnologies to Help the Body Move, Heal and Feel Again – that trains the next generation of engineers.

He is very involved with the IEEE, serving as an associate editor of the *IEEE Transactions on Human Machine Systems.* He is also a member of the IEEE Systems Council AdCom, the Engineering in Medicine and Biology (EMBS) Society, the Systems, Man and Cybernetics (SMC) Society, the Robotic and Automation Society (RAS) and IEEE Brain.

Contreras-Vidal earned an engineer's degree in electronics and communication from the Monterrey Institute of Technology in Mexico, a master's degree in electrical engineering from the University of Colorado Boulder and a Ph.D. in cognitive and neural systems from Boston University.

BADRI ROYSAM

Elected to AIMBE College of Fellows

BY RASHDA KHAN

Badri Roysam, professor and department chairman of electrical and computer engineering at the UH Cullen College of Engineering, was recently elected to the American Institute for Medical and Biological Engineering's (AIMBE) College of Fellows.

Fellows are nominated each year by their peers and represent the top 2 percent of the medical and biological engineering community.

"This is a great honor," he said. "It puts me in the company of brilliant minds, whom I hope to interact with and work together to inform the larger community about medical and biological engineering innovations and advances."

Renowned in the field of multi-dimensional image informatics, Roysam was awarded the honor for his contributions to automated biological image analysis algorithms that have led to products and discoveries in cell biology, neuroscience and immunology.

His research occurs at the confluence of multi-dimensional signal processing, machine learning, big-data bioinformatics, high-performance computing and biomedicine.

Innovative breakthroughs in his work enabled the first quantitative profiling of the neurovascular stem-cell niche; the first computational stem-cell lineage reconstruction; and computational prediction of retinal stem-cell fate with greater than 98 percent accuracy. They also led to several discoveries, including uncovering a previously unknown hyperfused mitochondrial state; identifying a signaling mechanism driving stem-cell migration; pinpointing proteins underlying thymocyte movements; quantifying immediate early gene expression stimulated by cognitive stimuli; and distinguishing immune cell movement behaviors that predict tumor killing efficacy.

Roysam has pioneered automatic 3-D mapping of the complex arbors of neurons, glia and microvascular networks of the brain, and multi-cellular perivascular structures – especially stem-cell niches. He developed the first method for curved retinal image registration for detecting changes in diabetic retinopathy. His methods have been applied to stem cell biology; gene expression in learning and memory; reproductive biology; transplant pathology; neuroprosthetic devices; cellular alterations due to alcohol and exercise; axonal transport in Huntington's disease; pancreatic, kidney and breast cancer histology; developmental immunology; angiogenesis; cervical cancer; retinal diseases; mitochondrial biology; toxicology assay automation; worm biology; cancer immunotherapy; and concussion.

His current research focuses on two areas: drug discovery for concussions in collaboration with John Redell and Pramod Dash at UT Health and Dragan Maric at National Institute of Neurological Disorders and Strokes, and cell-based immunotherapy for cancer in collaboration with Navin Varadarajan, associate professor of chemical and biomolecular engineering at the Cullen College.

Roysam has published more than 130 papers in prestigious scientific journals, including *Proceedings of the National Academy of Sciences (PNAS), Nature Methods, Nature Protocols, Cell, Journal of Neuroscience, Journal of Immunology, Bioinformatics,* and *IEEE Transactions.*

Even with all his achievements for research, Roysam said working with students is the most rewarding aspect of his career. "They invariably surprise me with great new ideas," he said.

He earned his Ph.D. and master's degree in electrical engineering from Washington University, and earned a bachelor's degree in electronics engineering from the Indian Institute of Technology.

Roysam was inducted in March at the American Institute for Medical and Biological Engineering (AIMBE) annual meeting at the National Academy of Sciences.

AIMBE is a non-profit, honorific society of the most accomplished individuals in the medical and biological engineering fields. Its mission is to advocate for biomedical engineering innovation through public policy initiatives.

JIMING BAO

Elected Fellow of Optical Society of America

BY RASHDA KHAN

Jiming Bao, associate professor of electrical and computer engineering at the UH Cullen College of Engineering, was elected a Fellow of the Optical Society of America (OSA) for his "contributions to semiconductor and metallic nanostructures and their applications in nanophotonics and solar energy harvesting."

OSA members who have served with distinction in the advancement of optics and photonics can be proposed for election to the class of Fellow. The number of Fellows is limited by the society's bylaws to no more than 10 percent of the total membership. According to OSA, at present only about 50 percent of the nominees are elected each year.

"I'm honored by this recognition from my peers," said Bao, referring to his election as an important career milestone. "This makes me feel that I have made valuable contributions to the science of our community."

Bao's research focuses on new and novel materials, semiconductor nanowire optoelectronics, silicon photonics and metallic nanostructures for plasmonics, solar water-splitting and fiber optic sensors.

He was part of a UH research team studying the nonlinear transmission of light through an aqueous suspension of gold nanoparticles when they noticed something unexpected: A pulse laser appeared to have forced the movement of a stream of liquid in a glass laboratory cuvette. This observation led to a new optofluidics principle.

"Whenever I publish new findings or discoveries from my lab, I feel very happy," Bao said. "That's the most rewarding aspect of my career."

In 2012, Bao won a National Science Foundation CAREER Award to study the optical properties of graphene. He recently published a paper in *Advanced Functional Materials* about the ability to control and pattern graphene orientation in all three dimensions using a rotating magnetic field. This finding opens up new possibilities for broad device applications of graphene.

Bao earned both his bachelor's and master's degrees in physics from the Zhejiang University in Hangzhou, China, and his Ph.D. in applied physics from the University of Michigan. He served as a postdoctoral fellow and a research associate on the research team of Federico Capasso at Harvard University from 2003 to 2008.

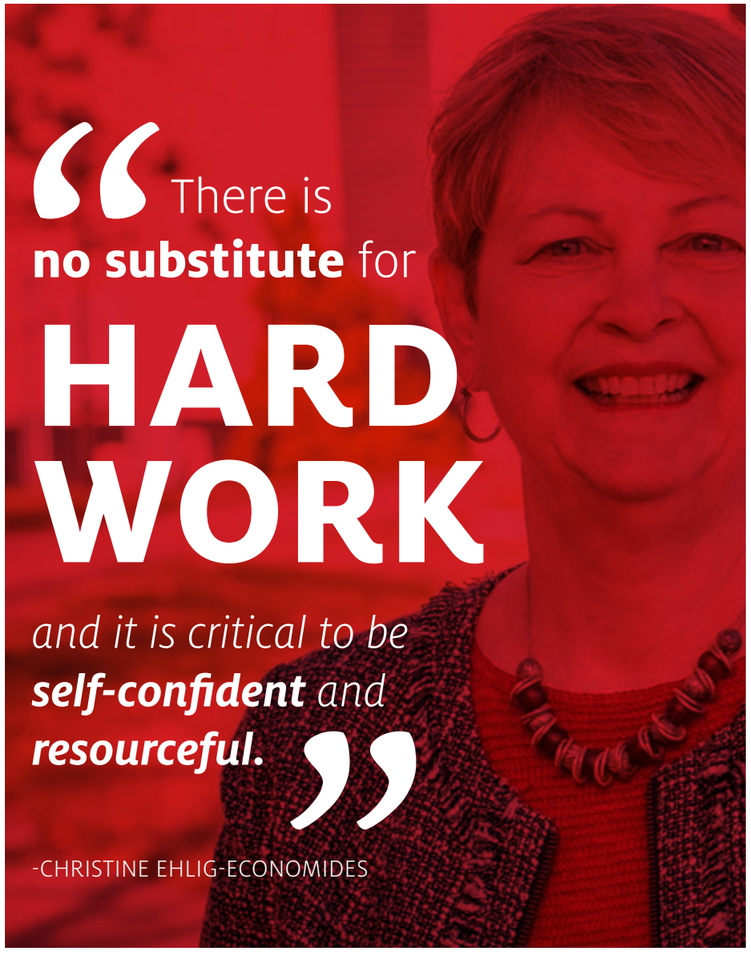
In addition to receiving member benefits and recognition of their Fellow status, OSA Fellow members may also apply for travel grants to visit and lecture in developing countries.

Founded in 1916, OSA is the leading professional organization for scientists, engineers, students and entrepreneurs in the science of light. Its mission is to promote the generation, application and archiving of knowledge in optics and photonics and to disseminate this knowledge worldwide.

Christine Ehlig-Economides Awarded SPE's

HIGHEST HONOR

BY RASHDA KHAN



The Society of Petroleum Engineers (SPE) in September bestowed its highest honor – the SPE/AIME Honorary Membership – on **Christine Ehlig-Economides,** Hugh Roy and Lillie Cranz Cullen Distinguished University Chair at the University of Houston and a member of the prestigious National Academy of Engineering.

Honorary Membership is limited to 0.1 percent of the Society's total membership. The elite group comprises individuals who give outstanding service to SPE or demonstrate distinguished scientific or engineering achievements in the fields within the technical scope of SPE.

"I joined SPE while I was a Ph.D. student at Stanford and have been actively involved with SPE ever since," Ehlig-Economides said. "The Honorary Membership recognition puts me in the company of industry giants. Considering how I started, this is amazing."

Ehlig-Economides earned a bachelor's degree in math-science from Rice University and planned to be a math teacher. "I thought I would marry and spend my life as a parent and a teacher," she said. "Instead, after getting a Master of Arts in Teaching, I learned that math and science teachers had to coach male athletes, and that teaching opportunities were very limited."

Then circumstances changed and a new opportunity appeared. In 1972 the federal civil rights law, Title IX, banned institutions from excluding individuals based on gender. Seeing an opening to enter into historically male-dominated fields, Ehlig-Economides decided to give engineering a try. Her math and science background made the decision easy. She earned a master's degree in chemical engineering from the University of Kansas and a Ph.D. in petroleum engineering from Stanford University.

Prior to joining the Cullen College, Ehlig-Economides taught at Texas A&M University for 10 years and worked 20 years at Schlumberger.

Ehlig-Economides is a co-author of "Petroleum Production Systems," a seminal textbook in the field of petroleum engineering.

She was elected to the National Academy of Engineers in 2003, and was a member of the National Academy of Science Committee on America's Energy Future and the NRC Board on Energy and Environmental Systems. She is one of 16 Quantum Reservoir Impact (QRI) Scholars and now is a member of the QRI Board. She is also a member of the Research Partnership to Secure Energy for America.

Other accolades from SPE include the Anthony F. Lucas Gold Medal and the Distinguished Achievement Award for Petroleum Engineering Faculty, as well as the Lester C. Uren, John Franklin Carll, Innovative Teaching, and Formation Evaluation awards.

Reflecting on her career, Ehlig-Economides said she has no regrets.

"Being a petroleum engineer has given me the opportunity to travel to all but one continent and to work with people from all over the world," she said. "Every day offers new concepts and challenges far beyond my imagination as a young person."

SPE also appreciates Ehlig-Economides' career choice and involvement.

"On behalf of the SPE Board of Directors, I would like to take this opportunity to thank the University of Houston for supporting the active involvement of Christine in the Society of Petroleum Engineers. Member participation and leadership are important factors that enable SPE to achieve its mission of collection, dissemination, and exchange of technical information," said Darcy Spady, 2018 SPE president.

Ehlig-Economides received the award at the SPE Annual Technical Conference and Exhibition, Sept. 24-26 in Dallas.

SPE is a not-for-profit professional association whose 168,000 members in 144 countries engage in development and production of energy resources. SPE is a key resource for technical knowledge for oil and gas professionals through its publications, events, training courses and online resources.

Ehlig-Economides offered some advice to Cullen College students wishing to follow in her footsteps.

"Consider higher education, beyond the bachelor of science degree. I think this has impacted how people related to me professionally," she said. "That being said, too much education tends to limit corporate management opportunities, and now there are women breaking the glass ceiling without so much education. Many might prefer that."

"Either way," she added, "there is no substitute for hard work and it is critical to be self-confident and resourceful."


Jeffrey Rimer


Lars Grabow

I&EC Research Honors
UH Chemical Engineers as 2018

INFLUENTIAL RESEARCHERS

BY RASHDA KHAN

Two Cullen College of Engineering faculty members joined 27 other scientists and researchers from around the world on the 2018 Class of Influential Researchers. The honor recognizing the quality and impact of work by scientists with less than 10 years in their field, was announced Sept. 26 by editors and board members of the *Industrial & Engineering Chemistry Research journal,* published by the American Chemical Society.

Jeffrey Rimer, the Abraham E. Dukler Professor of chemical and biomolecular engineering, is renowned for his groundbreaking research in the broad field of crystallization. His work led to development of drugs for malaria and kidney stones (the first advance in kidney stone therapy in 30 years). His oil and gas-related projects target scaling in pipes and increasing the efficiency of catalysts. He is also principal investigator on a Department of Energy-funded study of corrosion behavior of glass containers that store nuclear waste, with the goal of reducing or avoiding the containers' degeneration.

Rimer won the 2018 Norman Hackerman Award in Chemical Research from the Welch Foundation, 2017 FRI/John G. Kunesh Award from the American Institute of Chemical Engineers, 2016 Owens Corning Early Career Award, and National Science Foundation's CAREER Award in 2012. In addition, Rimer has received multiple teaching and research excellence awards from UH.

Lars Grabow, associate professor of chemical and biomolecular engineering, is world renowned for computational research in the field of catalysis and has won millions of research dollars to find safer, cheaper and more effective catalysts for industrial processes and environmental applications.

He serves as chair of the Catalysis and Reaction Engineering division of the American Institute of Chemical Engineers and vice-chair of the Southwest Catalysis Society. He also serves on the international advisory board of the prestigious journal *ChemCatChem*.

Grabow's work has earned him several honors, including the NSF CAREER Award in 2015, U.S. Department of Energy Early Career Award in 2014, and ICC Young Scientist Award in 2012, along with a UH Excellence in Research, Scholarship or Creative Activity Award in 2017.

Pradeep Sharma Receives Prestigious NATIONAL AWARD

BY RASHDA KHAN

Pradeep Sharma, M.D. Anderson Professor and chair of the mechanical engineering department at the UH Cullen College of Engineering, will receive the 2019 James R. Rice Medal from the Society of Engineering Science (SES).

The award recognizes mid-career researchers who are within 10 to 20 years of having earned their doctorate and have had a substantial impact on the field of engineering sciences. Sharma was awarded the medal for his "creative contributions to understanding the science underpinning flexoelectricity and its applications to engineered and biological systems."

"This recognition by my peers is quite moving and I feel deeply honored and grateful," Sharma said. "The award truly belongs to the amazing students, post-docs and collaborators I have worked with over the years and is a tremendous morale boost for our group."

His research group at the Cullen College uses theoretical and computational methods to understand physical phenomena across multiple disciplines – from materials science to biology. Recent research highlights include the designing of soft multifunctional materials, elucidating why some animals can detect magnetic fields, time-scaling in atomistic simulations and assessing the mechanical behavior of materials used for energy storage.

After earning his Ph.D. in mechanical engineering at the University of Maryland at College Park in 2000, Sharma worked as a research scientist for General Electric Corporate Research and Development. He joined the department of mechanical engineering at the Cullen College in 2004 as a tenure-track assistant professor.

In addition to several UH teaching and research awards, Sharma's past accolades include the 2015 Melville Medal from the American Society of Mechanical Engineers (ASME) and a Fulbright Award in 2013.

Sharma has some words of wisdom for Cullen College students.

"We should never compromise on the quality of work. Considerations such as number of papers, impact factor, etc., should be secondary to the quality of research," he said. "This is epitomized by Professor Jim Rice, in whose honor the medal is named."

Sharma will receive the medal at the annual 2019 SES conference at Washington University in Saint Louis. The award comes with $1,500 and a commemorative plaque.

DEBORAH RODRIGUES Named Journal's Associate Editor

BY RASHDA KHAN

Debora Rodrigues, an associate professor in civil and environmental engineering at the UH Cullen College of Engineering, recently became an associate editor of *npj Clean Water*, a new open-access online journal dedicated to publishing papers about cutting-edge research aimed at ensuring the clean water supplies around the globe. It is published by Nature Research.

"We feel your expertise in environmental biotechnology complements that of our existing editors, and this is a vital discipline to have represented on our editorial team," the invitation stated.

Rodrigues has a master's degree in environmental microbiology from the University of Sao Paulo, a doctorate in microbiology and molecular genetics from Michigan State University and a post-doctoral degree in chemical and environmental engineering from Yale University.

For the past eight years, she has been teaching at the Cullen College and leading several research projects focused on improving water quality and sustainability. Her goal is to understand the aquatic system and its microbial ecology, investigate the effects of nanomaterials on the environment and develop new energy-efficient and affordable technologies to remove harmful contaminants and keep aquatic systems safe.

The journal is part of the *Nature Partner Journal (npj)* series and part of Nature Research, which is a flagship portfolio of journals, products and services, including *Nature*. Nature Research is part of Springer Nature, one of the world's leading global research, educational and professional publishers.

The editor-in-chief of *npj Clean Water* is Eric M.V. Hoek, founder and chief executive officer of Water Planet Inc. and environmental engineering professor at the University of California, Los Angeles.

STANKO BRANKOVIC Serves as Editor of Special Issue

BY RASHDA KHAN

Stanko Brankovic, professor of electric and computer engineering and chemical and biomolecular engineering at the UH Cullen College of Engineering, served as a guest editor for a special issue of *The Electrochemical Society Interface.*

Being invited to be guest editor is a great honor, Brankovic said. "It's basically a society of your peers recognizing you as an expert and trusting you to lead this special issue," he added. "It's not a recognition just for me, but also for the University of Houston in a field that is quite important these days since batteries, and everything else, are based on electrochemistry."

The special issue, titled "Electrodeposition for the Future," explored the topic of electrochemical deposition, a process by which a metal film is deposited onto a conductive surface from a metal ion containing solution. Electrochemical deposition is used to manufacture many products found in everyday life, but researchers have yet to fully understand the process at an atomic level.

Brankovic is director of the Electrochemical Nanofabrication and Nanomaterials Synthesis Group at the Cullen College. His research team focuses on better understanding of the physical and chemical processes that occur at the electrochemical interface and their uses in producing materials and nanostructures with novel functionality and applications.

"I have been watching the field grow in potential for a while on the academic research side. Now it has to transition into application to make it big in the mainstream and I predict that will happen within five years," said Brankovic, who has been studying the phenomenon for over a decade. "The best is yet to come."

For the issue, Brankovic chose articles discussing fundamentals and potential applications of various deposition methods.

Coatings created by electrochemical deposition have many uses, from gold plating on jewelry to creating conductive pathways in circuit boards or protective coating on the wings of airplanes. Researchers are now studying the fundamental underpinnings of electrochemical deposition at the nanoscale to both improve and expand applications of the process.

Brankovic predicts a massive-range of applications – from photovoltaic uses to catalysts to microelectronics.

"These special editions allow us to gather exceptional research and breakthroughs that have the potential to grow the field in a considerable way," said Brankovic. "I hope it gives ideas to practitioners and eventually they'll come up with their own ideas how this could be applied."

Interface is the leading journal for those in the field of solid-state and electrochemical science and technology. Published quarterly, this four-color magazine contains technical articles about the latest developments in the field, and presents news and information about and for members of ECS.

Paper Outlining Fuel Cell Discovery Wins

AIChE BEST FUNDAMENTAL PAPER AWARD

BY RASHDA KHAN

The South Texas Section (STS) of the American Institute of Chemical Engineers (AIChE) chose a paper written by two UH Cullen College of Engineering professors and their Ph.D. students for its Best Fundamental Paper Award.

The award was presented in October at the monthly STS-AIChE meeting in Galveston.

The paper, titled "Finite Size Effects in Submonolayer Catalysts Investigated by CO Electrosorption on PtsML/Pd(100)," was published in the *Journal of The American Chemical Society* in 2017. It was based on research conducted by **Stanko Brankovic,** professor of electrical and computer engineering, and his student Quiyi Yuan, along with **Lars Grabow,** associate professor of chemical and biomolecular engineering, and his student Hieu Doan.

The team's project solved a fundamental research question related to the catalysis that occurs in fuel cells. The best catalytic material for use in chemical fuel cells are based on platinum (Pt), an expensive material. There has been a drive for the last 15 to 20 years to reduce costs by minimizing the amount of platinum used.

However, reducing platinum changes the fundamental catalytic activity.

"The most Pt-efficient geometry is a single layer of atoms, a monolayer, on the surface of a cheaper host material. But when the mismatch between the atom distances is too large then you don't form a perfectly flat continuous monolayer of Pt atoms," Grabow said. "Instead, the atoms form small islands with breaks in between. This change in geometry

Stanko Brankovic and Lars Grabow

gives rise to a new component of strain, which depends on the size of the Pt islands."

Brankovic and Yuan measured carbon monoxide absorption in Pt monolayers on Palladium (Pd) single-crystal surfaces. Grabow and his student Doan ran computer simulations to explain experimental data and identify structures that could obtain favorable catalytic properties due to the finite size effect. Using theoretical calculations to test their hypothesis, Grabow and Doan confirmed that the finite size effect is the origin of the observed Pt catalyst monolayer activity.

"Stanko and I got together and we were able to explain the breakdown of the prevailing theory for monolayer catalysts. The impact of that finding is rather large," said Grabow, adding that the information can help future development in catalyst monolayer synthesis. "That justifies why it was selected as the best fundamental paper."

Brankovic agreed and added more. "The best part of the paper, besides uncovering fundamental science, is the synergy between theory and experiment," he said. "It is an example of a fruitful scientific and collegial collaboration between two groups at UH."

Both Brankovic and Grabow are winners of prestigious National Science Foundation CAREER Awards, which partially funded this research. Additional funding came from the University of Houston GEAR Award, which offers seed funding to young researchers looking to get projects inside their laboratory off the ground.

Yuan and Doan, who were both Ph.D. students at the time of research, have each graduated from UH and are pursuing successful careers as researchers in industry and national labs.

"AIChE is the largest chemical engineering society in the world," Grabow said. "It really feels good that the society recognizes the value of the fundamental contributions that we're making."

This is a second award for the Doan and Grabow team. They both coauthored a paper that won STS best fundamental paper award in 2014.

AIChE has more than 60,000 members from more than 110 countries. Through its varied programs, AIChE provides a focal point for information exchange regarding cutting-edge chemical engineering research in such areas as nanotechnology, sustainability, hydrogen fuels, biological and environmental engineering, and chemical plant safety and security.

CULLEN COLLEGES MOURNS ANDY VELETSOS,

National Academy of Engineering Member and UH Professor

BY RASHDA KHAN

Anestis "Andy" Veletsos, a National Academy of Engineering member and an internationally renowned educator, died on Oct. 25 in Houston. He was a distinguished adjunct professor of civil and environmental engineering at the UH Cullen College of Engineering, which he joined in 2010. He was also the Brown & Root professor of civil engineering emeritus at Rice University. He was 91.

"Our faculty, staff and students are deeply saddened by this news," said **Joseph W. Tedesco,** Elizabeth D. Rockwell Dean of the Cullen College. "We were blessed to have him share his extensive knowledge and expertise with our community. Our hearts go out to his family and loved ones at this very difficult time."

Veletsos previously served as professor of civil engineering at the University of Illinois at Urbana-Champaign, where he also participated in the Center for Advanced Study. He held visiting appointments at the University of California at Berkeley and at universities in Brazil and India.

In his teaching, Veletsos emphasized the importance of mastering the fundamentals of a subject and developing insight into the structures involved.

"Dr. Veletsos was a role model to many of his students and colleagues. He inspired many to continue contributing to the betterment of structural engineering," said **Abdeldjelil "DJ" Belarbi,** professor of civil and environmental engineering at the Cullen College.

> "Dr. Veletsos was a role model to many of his students and colleagues. He inspired many to continue contributing to the betterment of structural engineering."
>
> - ABDELDJELIL "DJ" BELARBI

"He was a good friend to the UH community and his contributions to the University's education mission were remarkable," said Belarbi, who as a UH Ph.D. student took a graduate course with Veletsos at Rice. They eventually became close friends and colleagues. "He will always remain in my heart and I will miss him so much."

Veletsos' leadership in engineering education, teaching and professional activities had a profound influence on structural engineering, Belarbi added.

His NAE membership stemmed from advancements he made in structural dynamics and earthquake engineering, especially inelastic behavior and soil-structure interaction. He was elected in 1979.

Veletsos won the George W. Housner Medal from the Earthquake Engineering Research Institute, the highest honor given by the Institute in recognition of sustained leadership and contributions to earthquake engineering and earthquake risk mitigation.

He was also a two-time winner of the Norman Medal, the highest award given by the American Society of Civil Engineers (ASCE) for papers published in its journals. Veletsos was also elected to honorary membership of ASCE in 1998 and to the Academy of Medicine, Engineering and Science of Texas in 2004.

On the national level, he headed the group that formulated the Applied Technology Council's first design provisions for soil structure and then incorporated those provisions into the federal government's National Earthquake Hazards Reduction Program. He was also involved with the U.S. Department of Energy's Tank Waste Remediation Systems Committee, the U.S. Nuclear Waste Technical Review Board for the Yucca Mountain Repository Project and with the Brookhaven National Laboratory for the Nuclear Regulatory Commission. More recently, he was affiliated with ExxonMobil.

Veletsos' areas of expertise included structural and foundation dynamics, earthquake engineering and the dynamics of offshore platforms. His research helped expand the understanding of response behavior exhibited by structures, foundations and foundation-structure systems, leading to improved designs.

He received his bachelor's degree with high honors from the Robert College in Istanbul, Turkey, and his master's and Ph.D. degrees from the University of Illinois at Urbana-Champaign. He was also awarded an honorary doctorate from the University of Patras in Greece.

His other honors include the Huber Research Prize, the Newmark Medal, the Howard Award, the Reese Research Prize, the Theodore von Karman Medal of ASCE, and the Distinguished Alumnus Award of the Civil Engineering Alumni Association of the University of Illinois.

Draws Undergrads From Across the Country

BY RASHDA KHAN

For 10 weeks last summer, undergraduate students from across the U.S. became bonafide engineering researchers, working alongside some of Cullen College's brightest minds to solve the world's most pressing technical challenges.

The National Science Foundation designated the University of Houston as a Research Experience for Undergraduates site and awarded UH researchers $790,000 for three years to reach students early in their college careers.

Out of hundreds, 26 students were chosen for the 2018 competitive research opportunity. They traveled from far-flung places, including the Midwest, Rhode Island and Puerto Rico, to participate in one of two groups: Materials for Sustainability in Energy and Manufacturing and Neurotechnologies to Help the Body Move, Heal and Feel Again.

The UH engineering professors who lead the program – **Haleh Ardebili**, Bill D. Cook Associate Professor of mechanical engineering; **Jacinta C. Conrad**, Frank M. Tiller Associate Professor of chemical and biomolecular engineering; **Jose Luis Contreras-Vidal**, Hugh Roy and Lillie Cranz Cullen Distinguished Professor of electrical and computer engineering; and **Stuart Long**, professor of electrical and computer engineering and associate dean of the Honors College and Undergraduate Research – share a motivation for leading students into the future.

"Nationwide there is a critical objective to increase the number of students pursuing careers in the STEM fields," said Ardebili, adding that she believes the Research Experience will inspire undergrads to visualize their own futures in science, technology, engineering and mathematics jobs.

"A large body of research shows we lose students at all stages in the pipeline," said Conrad. "Typically, students need role models and research experience early."

Participating students are getting plenty of both in the program, each working under a UH engineering professor and a graduate student mentor as they conduct their daily research.

Inspired, motivated undergraduates

The students chose to spend a good portion of their summer learning hard and working in labs for a myriad of reasons.

Julia White, a materials engineering junior at Purdue University, wanted to spend the summer doing research and traveling.

"A huge benefit is that you're getting paid to learn and get good experience, and you're able to explore a new city," said White, a first-time visitor to Texas. "It's a fantastic opportunity."

She was excited to focus on sustainable materials in her research and particularly the opportunity to work with Ardebili, who is well-known for her research on creating flexible, stretchable and bendable batteries and electronics.

"I'm very passionate about the environment and I think the way I can most make a difference is by getting into battery development because batteries are what's holding us back," White said. "If we can make batteries last longer and find better ways to store energy for future use, then we can really get renewable energy on the map, have it be a viable option."

For **Adriana Echevarria**, an undergraduate student majoring in mechanical engineering at the University of Puerto Rico, inspiration came from Hurricane Maria.

In September 2017, Hurricane Maria ravaged Puerto Rico destroying lives, obliterating homes, businesses and infrastructure. Even after the winds and rain stopped, the devastation continued. People faced food and water shortages, lack of medical resources, power outages and financial issues. An estimated 2,975 people died as a result of the storm.

> "I like to think I'm representing Puerto Rico. That despite everything that happened, we're still here, we're still willing to work, we're still willing to improve the lives of other people as engineers and professionals, as individuals."
>
> - ADRIANA ECHEVARRIA

"But I think the greatest damage that was caused was psychological and emotional," said Echevarria, who considers herself one of the lucky ones. During Maria's onslaught she was with her family and, while water did get into their house, they all survived the experience safe and sound.

Echevarria traveled last summer for the first time out of Puerto Rico to participate in the Neurotechnologies to Help the Body Move, Heal and Feel Again group.

"For me, the brain is the most interesting part of the body, that's where everything happens," she said. "Being here, learning new skills will help me understand what I can take back to Puerto Rico to help my university and my people."

Starting out in a new lab means preparing for the work. White spent most of the first week on background readings and lab training. And it paid off. She soon found herself working in Ardebili's lab every day and making progress.

"I just think it's very cool that I was able to take all these raw materials and put them together to make working batteries. I didn't think I was going to be able to do that so quickly," White said. "Also, I had awesome mentors and learned a lot – even more than I expected."

Her summer research experience at UH reaffirmed her love for problem-solving and research.

"Research is a great way to problem-solve in a way that can really make a difference in society and the world," said White. She hopes to earn a Ph.D. and do research in industry or at a national lab in the future.

Echevarria spent this summer working with **David Mayerich,** assistant professor of electrical and computer engineering. They used tractography, a 3-D modeling technique in neuroscience, to develop algorithms and more detailed visual representation of data collected from the brain.

"The 3-D representation is a tool that'll help scientists and doctors get a clearer understanding of the data," she said.

The mass destruction in Puerto Rico led to canceled classes and extended semesters, which resulted in Echevarria taking some finals while working in Mayerich's lab.

Lasting impacts

At the end of the 10 weeks at UH, Echevarria, White and their cohorts participated in the 2018 Research Experience for Undergrads Poster Session and presented their research to students and faculty.

"If I didn't do this, I would be regretting it so much because it was an amazing experience," Echevarria shared. She said the experience helped her achieve her goals: to get hands-on research experience, gain a better understanding of bioengineering and develop herself as a student and professional.

"I like to think I'm representing Puerto Rico," Echevarria said. "That despite everything that happened, we're still here, we're still willing to work, we're still willing to improve the lives of other people as engineers and professionals, as individuals."

Contreras-Vidal, who also serves as director of the BRAIN (Building Reliable Advancements in Neurotechnology) Center at the University of Houston, said the program offers a unique opportunity for students to witness firsthand how technology impacts society and people.

"At the end [of the experience], students will not only know more about the field, but know how to communicate, how to find information and, most importantly, understand the role of an engineer in society," he said.

Ali Rezaei Is First to Earn

PETROLEUM ENGINEERING PH.D.

BY RASHDA KHAN

Ali Rezaei has the honor of being the first graduate of the Cullen College of Engineering's doctoral program in petroleum engineering. He earned his Ph.D. this year by completing his dissertation on fast multi-pole fully-coupled poroelastic solutions of hydraulic fracturing.

"Rezaei is very dedicated to science and his dissertation is definitely one of the best dissertations I have seen," said **Mohamed Soliman,** William C. Miller Chair of petroleum engineering. "We're proud to have him as our first graduate."

Launched in 2015 in response to the need for qualified engineers across all sectors of the energy industry, the petroleum engineering doctoral program now has 39 students. As a Carnegie-designated tier-one public research university, UH is perfectly situated to provide a rigorous curriculum and cutting-edge research experience for its graduates, Soliman said.

"We expect to graduate between nine and 11 Ph.D. students during the 2018-2019 academic year," Soliman said. "The high quality of Ph.D.s we're producing should reflect well on our ranking."

Rezaei is continuing with UH as a post-doctoral researcher with **Birol Dindoruk,** professor of petroleum engineering and a member of the National Academy of Engineering (NAE).

"Everybody in the petroleum industry is trying to expand on some aspect of working with unconventional reservoirs, such as shale plays," Rezaei said, adding that unconventionals offer great potential in terms of oil and gas extraction in the U.S. and are projected to reach unprecedented levels of output over the next decade.

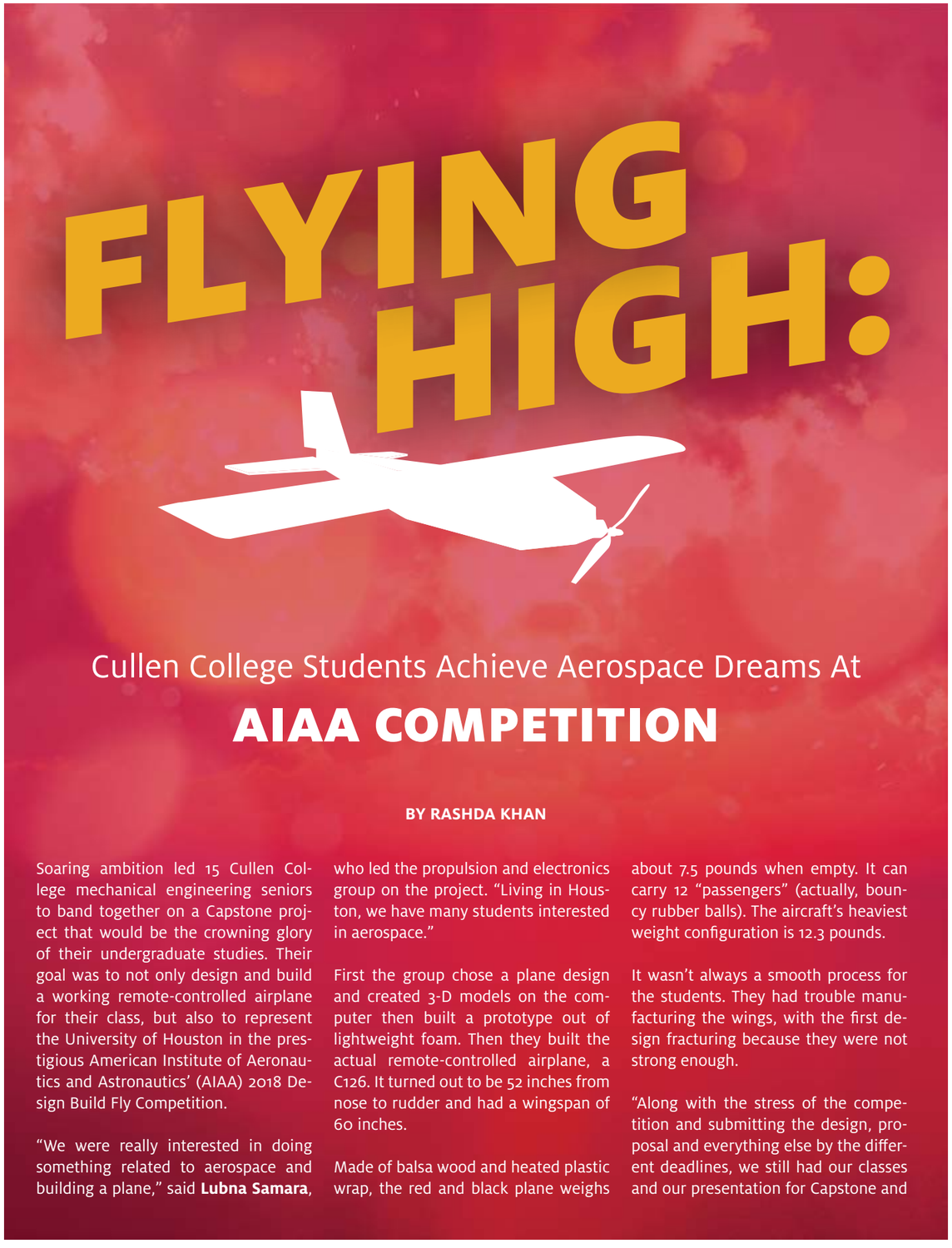
The unique nature of these reservoirs require complex extraction methods, and hydraulic fracturing is key to producing oil in such situations, he said.

He will continue his research started during his doctoral work to understand the behavior and impact of hydraulic fracturing in unconventional reservoirs. And he is proud of his new title.

"I'm honored to be the first one," Rezaei said. "My Ph.D. was a necessary step in preparation for more ambitious research."

> "I'm honored to be the first one. My Ph.D. was a necessary step in preparation for more ambitious research."
>
> - ALI REZAEI

He earned his master's in petroleum engineering from Texas Tech University and his bachelor's in petroleum engineering from Azad University in Iran.



FLYING HIGH:

Cullen College Students Achieve Aerospace Dreams At

AIAA COMPETITION

BY RASHDA KHAN

Soaring ambition led 15 Cullen College mechanical engineering seniors to band together on a Capstone project that would be the crowning glory of their undergraduate studies. Their goal was to not only design and build a working remote-controlled airplane for their class, but also to represent the University of Houston in the prestigious American Institute of Aeronautics and Astronautics' (AIAA) 2018 Design Build Fly Competition.

"We were really interested in doing something related to aerospace and building a plane," said **Lubna Samara**, who led the propulsion and electronics group on the project. "Living in Houston, we have many students interested in aerospace."

First the group chose a plane design and created 3-D models on the computer then built a prototype out of lightweight foam. Then they built the actual remote-controlled airplane, a C126. It turned out to be 52 inches from nose to rudder and had a wingspan of 60 inches.

Made of balsa wood and heated plastic wrap, the red and black plane weighs about 7.5 pounds when empty. It can carry 12 "passengers" (actually, bouncy rubber balls). The aircraft's heaviest weight configuration is 12.3 pounds.

It wasn't always a smooth process for the students. They had trouble manufacturing the wings, with the first design fracturing because they were not strong enough.

"Along with the stress of the competition and submitting the design, proposal and everything else by the different deadlines, we still had our classes and our presentation for Capstone and

grades to worry about," Samara said.

Nevertheless, the students stayed dedicated and kept working on the project, often staying up until 4 a.m. on Saturdays to get things done.

"As engineering students we're always told you should be able to work in a team effectively, and communication is super important," Samara said, adding that working on the project drove home the truth of the message.

Along the way they garnered some supporters from UH and broader community.

The knowledgeable staff of Randy's Hobbies, a Houston-area store specializing in parts and equipment for model and remote-controlled cars, boats, planes and trains, served as technical advisors for the students and helped them do test flights.

The students also presented their project to the greater Houston chapters of the Experimental Aircraft Association (EAA) and received a $200 donation.

Richard Bannerot, professor of mechanical engineering at the Cullen College and the students' Capstone advisor, was so impressed by the project and their hard work that he wrote the team a personal check for $1,000 to help them with the costs of the project and traveling to the AIAA competition.

At the AIAA competition

The students became the first UH team to be accepted into the AIAA Design/Build/Fly competition. The theme of this year's competition was challenging students to design a dual-purpose regional and business aircraft. Samara and four other team members drove the UH airplane to Wichita, Kansas, to compete.

The competition consisted of a written report, one ground mission and three flight missions. The group's written report earned it 19th place in the queue of 91 competing teams, beating teams from Rice University and University of Texas at Austin.

The ground mission required teams to remove and replace two parts, such as a battery or a servos, chosen by a roll of dice. The UH team completed it without any issues. So they set themselves new goals – to complete all three missions of the competition with their plane and finish in the top 50.

The first flight mission was to fly three laps around the 1,000-foot course with no added weight. The second was to fly the same distance with the maximum number of "passengers" – or balls – the plane was designed for. The third had a 10-minute limit to complete as many laps the team wished with the passengers plus an added 227-gram cargo on board. The three mission scores were combined then divided by a rated aircraft cost, which was calculated by multiplying a plane's empty weight by its wingspan.

The AIAA competition brought in 720 students in 77 teams from 16 countries, making it the largest Design Build Fly competition in the event's 22-year history. Kansas greeted them with wind and heavy rain, which resulted in delays and a backed up queue.

"The first time we attempted the first mission, we failed because we had a hard landing due to the wind," Samara said. "We got a second chance and we were able to pass it."

The UH team passed the second mission, but never got the chance to try the third one.

"It was Sunday and they closed the queue at 5 p.m.," Samara said. "It was 4:50 p.m. and we were still in queue. We were really bummed out."

Still, the team achieved 44th place among 91 teams, beating Rice University again.

"Reaching our goal – placing in the top half – was rewarding. But before even reaching our goal, the fact that we were able to do this successfully with no prior experience … It was a success. It was beautiful," Samara said. "Seeing it fly in the air and all the students from around the world cheering us on, it was amazing."

Lubna Samara (on the right end) and four other Cullen College of Engineering students represented UH at the 2018 AIAA Design Build Fly competition.

"It's something I'm going to remember for the rest of my life," she added.

What's next?

Samara, who chose to pursue mechanical engineering because of the broad range of career options in the field, said the idea that someone has to study aerospace engineering to get into the aerospace field is a misconception. Their remote-controlled airplane project involved both mechanical engineering and electrical engineering aspects.

"This is open to all engineering and students of all levels from freshmen to seniors. It's good to get them started early and get some experience in case they want to turn it into a Capstone project," she said. "It does take time, commitment and hard work."

She hopes the next team will also aim high and compete in future AIAA Design Build Fly competitions.

"There's a lot of focus on the Formula-one race and car," Samara said. "We want to bring AIAA into the spotlight."

Andrea Albright Earns Prestigious GRAD STUDENT FELLOWSHIP

BY RASHDA KHAN

Andrea Albright, a graduate student in the Cullen College of Engineering's geosensing systems engineering and sciences program, won a 2018 National Defense Science and Engineering Graduate (NDSEG) Fellowship. She is among 69 fellows chosen from more than 3,600 applicants.

The fellowship, which is the highest honor awarded to graduate students by the Department of Defense, covers full tuition, research expenses and mandatory fees for three years. The Fellows also receive a monthly stipend of $3,200 plus up to $1,200 annually for health insurance and up to two trips per year for training and/or conferences that support their educational initiatives.

Albright's Ph.D. work focuses on studying geosensing systems for application to earth science, specializing in using LiDAR – the leading technology of light detection and ranging – to study morphology and wave processes in the nearshore environment.

"What's really cool about LiDAR data is that you can look at it from many different perspectives. You can literally walk through the information," she said. "I get to come up with the code to actually process the data instead of relying on commercial software packages designed by someone else. I get to do something no one else has done before."

Albright will be using the Department of Defense fellowship for her studies and research involving satellite data collected by two separate NASA satellites.

"I really wanted to work with satellite data, especially looking at satellite imagery," Albright said. "The idea that you could be really far away and still infer important information – in this case, gather information on near shore depths – is pretty amazing."

She is excited about the September launch of NASA's ICESat-2, a continuation of a previous satellite mission called ICESat, which will measure the height of Earth's ice-covered region, as well as the height of other features including trees, shrubs, lakes and more.

"We're hoping to use the LiDAR satellite to make depth profiles and then put a satellite image on top of that to look at the optical properties of the water and be able to extend that using the satellite imagery," Albright said. "In theory at least, we should be able to develop algorithms to measure bathymetry – the depths of water in oceans, seas and lakes – all over the world with very few in situ measurements."

The research project which will measure changes to coastlines, including erosion, build-up of land masses and water depth, could potentially help predict flooding, sinking of land, vulnerability of coastal communities and future development.

"Keep in mind most metropolitan cities are within 50 miles of a coast," Albright said. "We don't have a lot of awareness about how the earth functions, so we make our decisions based off of what we think works for us and end up paying a lot of money when our infrastructure crumbles or natural disasters happen."

"But if you know approximately what the lay of the land is and what processes are underlying that, you should be able to predict infrastructure wear and tear and ultimately lead to better land use practices," she added.

The geosensing systems engineering and sciences graduate program at the UH Cullen College is the only program of its kind in the world. Administered through the National Center for Airborne Laser Mapping (NCALM) at UH, the program trains the next generation of scientists in the rapidly changing field of geospatial engineering, providing students with hands-on experience using state-of-the-art sensors and remote sensing technologies for a wide variety of earth-science applications.

Since 1989, NDSEG has awarded nearly 3,600 fellowships to U.S. citizens and nationals who pursue a doctoral degree in one of 15 supported disciplines at a U.S. institution. The NDSEG Fellowship is sponsored by the Air Force Office of Scientific Research, the Army Research Office, and the Office of Naval Research under the Office of the Assistant Secretary of Defense for Research and Engineering.

Kyoseung Sim Honored With BEST DISSERTATION AWARD

BY RASHDA KHAN

Kyoseung Sim, who finished his Ph.D. in materials science and engineering last summer under the guidance of mechanical engineering professor **Cunjiang Yu,** won the Cullen College of Engineering's Best Dissertation Award for his doctoral dissertation, titled "Materials and Manufacture of Soft and Curvilinear Electronics."

The award committee considered seven highly-competitive dissertations submitted from the Cullen College engineering departments in summer and fall 2018. As the overall winner, Sim was recognized at the Cullen College's commencement on Dec. 13 at NRG Arena. The award comes with $1,000 and a plaque.

Sim's dissertation included a comprehensive set of results in materials, manufacturing technologies, mechanical studies and devices to illustrate the associated novel aspects in soft and curvilinear electronics.

It introduced a new manufacturing approach, called Conformal Additive Stamp (CAS) printing, which utilizes a deformable balloon stamp to pick up and print components of interest in order to fabricate 3-D curvilinear electronics. Furthermore, he provided a detailed example of 3-D curvilinear electronics – a multifunctional smart contact lens – created by utilizing CAS printing.

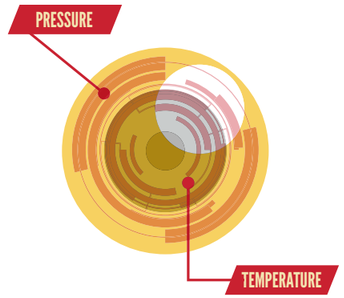
The smart contact lens allows continuous health monitoring including eye intraocular pressure, ocular surface temperature and tear glucose levels. There were several design advantages from the innovation of the devices being based on solution processed indium zinc oxide as well, including multifunctionality, simple manufacturing, imperceptible wearing and robust interfacing.

Last but not least, Sim's thesis shared high-performance rubbery or flexible electronics based on an intrinsically stretchable semiconductor with enhanced carrier mobility. The rubbery electronics retain electrical performance without significant loss under mechanical stretching of 50 percent. He recently had a paper on this topic accepted for publication in the journal *Science Advances*.

"I would like to definitely thank my advisor, Professor Cunjiang Yu, and our research group members for great help during my doctoral study," Sim said. "And I would like to thank my wife, Hanah Na, for her sacrifice and great support during it all."

Sim has published a dozen papers – as first author on half of those – based on his Cullen College research. Three additional papers are under review.

Originally from South Korea, Sim earned his master's degree in physical chemistry and worked on organic electronics at Konkuk University. He was a post-graduate researcher in the Daegu Gyeongbuk Institute of Science and Technology for three years and worked on dye sensitized solar cells. He published 19 papers based on research completed prior to UH.



The smart contact lens allows continuous health monitoring including eye intraocular pressure, ocular surface temperature and tear glucose levels.

Sim is continuing to work with Yu and his research team at UH to further develop materials and manufacturing processes for soft and curvilinear electronics that can be used for wearable, skin-mountable electronics and even direct organ mountable electronics.

"I really like doing research because it's amazing to me to keep trying to find new things and solve existing problems for everyone," Sim said.

He also offered some advice for Cullen College students still in the midst of their doctoral studies.

"Most Ph.D. students feel that this way is not easy – it's tough and stressful. Some people consider giving up. But my advice is just enjoy your research," Sim said. "If they can enjoy every small bit of research progress and achievement, they can have fun in moving forward to the next step and the next. Eventually, they will make huge progress and achieve significant results with great happiness."

The Cullen College's Best Dissertation Award is given twice a year for students who successfully defend their dissertation.

Image courtesy of University of California, Lawrence Berkeley National Laboratory. - Roy Kaltschmidt

Danny Guevara Interns at BERKELEY NATIONAL LABS

BY RASHDA KHAN

Danny Guevara, a first-generation college student, was selected for the prestigious Science Undergraduate Laboratory Internships (SULI) program. He spent the fall semester conducting research at the Lawrence Berkeley National Laboratory in California.

"As a mechanical engineer intern, I conducted field walks and reliability assessments of mechanical equipment rooms, marking up piping drawings to show actual field conditions, and assisting engineering construction managers to conduct mechanical related work at the construction site," said Guevara, who is pursuing a bachelor's in mechanical engineering at the Cullen College of Engineering.

Guevara's academic journey stems from a childhood propensity to disassemble toys and other objects around his home. "I was always curious about how things were produced and assembled," he said. "This mentality allowed me to look at objects and my environment in a different perspective."

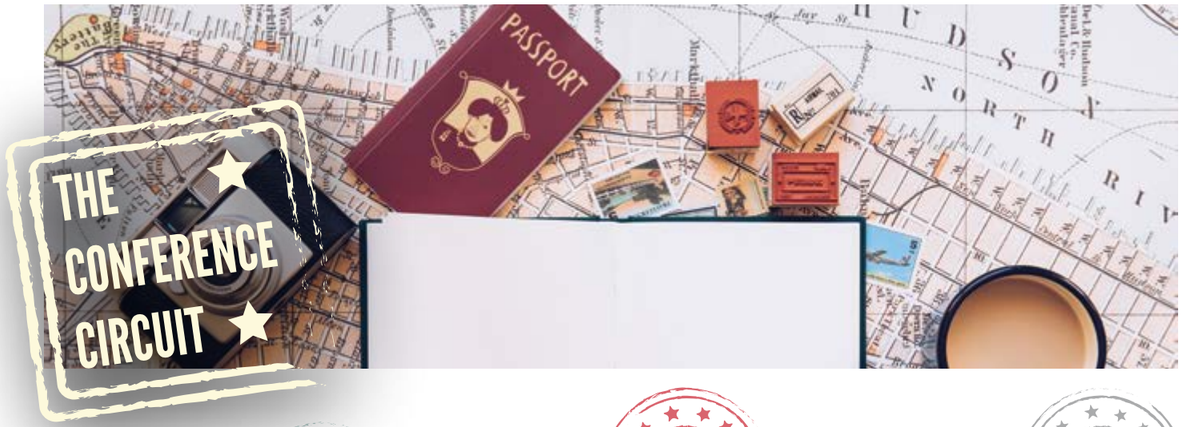
He gained a better understanding of thermodynamics, hydraulic systems and heat transfer applications while contributing to ongoing research at the laboratory during his internship.

"This experience helped me further understand what it is to be a mechanical engineer in a professional setting," he said.

Guevara, who is interested in the dynamics of human motion, works in the UH research lab of Christopher J. Arellano, assistant professor in the department of health and human performance. There, he assists with research projects and helps build and design custom structures for future biomechanics experiments.

He is a member of the Society of Hispanic Professional Engineers (SHPE) and the American Society of Mechanical Engineers (ASME). He credits both organizations for giving him opportunities to grow, from attending leadership conferences to using 3-D software to help design, construct and test a prosthetic arm for children. He has also served as a physics tutor with the Scholar Enrichment Program.

Guevara plans to earn a master's degree with a concentration in biomechanics.



HOUSTON, TEXAS
(Rice University)

Kyoseung Sim, a postdoctoral researcher working on soft functional electronic human machine interfacing (HMI) devices, won the Best Poster Award at the 2018 "Materials Today: The Future of Materials Science in the Next Two Decades" conference. He was a doctoral candidate in materials science and engineering at the time of the competition.

Sim's poster showcased his multi-functional, ultra-thin, mechanically imperceptible and stretchable electronics devices based on solutions processed indium zinc oxide.

HOUSTON, TEXAS

Amareswararao Kavuri, a biomedical engineering doctoral student, won an award for his oral presentation and the affiliated paper was selected as the best paper in the "Image Perception, Observer Performance and Technology Assessment" sub conference within the 2018 SPIE Medical Imaging Conference in Houston. The paper was titled "Interaction of anatomic and quantum noise in digital breast tomosynthesis (DBT)."

HOUSTON, TEXAS

Chemical and biomolecular engineering Ph.D. student Ali Slim presented a poster at the Society of Rheology annual meeting. He won first place out of 133 entries in the student poster competition.

His poster addressed the topic of nanocomposite transport in complex polymer media, a project undertaken in collaboration with Professor Ramanan Krishnamoorti (ChBE) and a former graduate student Ryan Poling-Skutvik (PhD 2017).

SPOKANE, WASHINGTON

Mohammad Sarraf Joshaghani, who is pursuing a Ph.D. in computational mechanics, won a SIAM Student Travel Award from the Society for Industrial and Applied Mathematics (SIAM) to attend the 2019 SIAM Conference on Computational Science and Engineering.

SIAM, incorporated in 1952, is an international nonprofit with more than 14,000 members.

BOSTON, MASSACHUSETTS

Ayoola "AJ" John-Muyiwa, a petroleum engineering senior, was named a 2018 Forbes 'Under 30 Scholar' and attended the Forbes Under 30 Summit in Boston as a honoree.

The summit brought together more than 7,000 young entrepreneurs, visionaries and social innovators for an immersive experience featuring more than 200 world-class speakers including investors, celebrities, musicians, sports stars, cultural icons, as well as political and business leaders.

DARMSTADT, GERMANY

Ujwal Patil, a doctoral student in the Department of Chemical and Biomolecular Engineering, was a finalist in the bioseparations research section of Merck's 2018 Life Science Awards. Patil presented his paper, titled "Real-time monitoring of antibody in column breakthrough" to an audience of Merck scientists at the company's global headquarters in Germany in October 2018.

Patil was one of 12 finalists selected from around the world.

CULLEN COLLEGE JUNIOR WINS STUDENT LEADERSHIP AWARD

For The 2019 BEYA STEM Conference

BY RASHDA KHAN

Joshua Frenchwood, an electrical engineering junior at the UH Cullen College of Engineering, won a Student Leadership Award from the Career Communications Group Inc. and the Black Engineer of the Year Awards (BEYA) Conference.

He will be recognized at the Student Leadership Awards Dinner at the 2019 BEYA STEM Conference in Washington, D.C. in February.

"I chose to study electrical engineering because I am very interested in how electricity and software is used to make new technology," Frenchwood said. He is currently exploring different ways of using software to help small business owners.

"The only way a small business can compete in today's market is with software," he said, citing software products like Facebook, Instagram, Amazon, Shopify and others. "I am very interested in using my coding skills to provide more services and products to the business owners that need it the most."

Giving back is important to Frenchwood. He has worked for more than two years as a program assistant for the St. Elmo Brady STEM Academy, an innovative after school program at the University of Houston Charter School designed to engage underrepresented minority boys – fourth and fifth grade students – in STEM activities, education and issues. In his role there, Frenchwood has designed and facilitated experiments, led classroom management and provided mentorship.

He is actively involved in the UH student chapter of the National Society of Black Engineers (NSBE). As the Career Fair Assistant Chair, he helped organize the 2017 UH Engineering Career Fair, which included more than 100 participating companies.

Frenchwood, who maintains a 3.6 GPA, has earned a number of scholarships. He was the only freshman among 20 high performing students to earn the very selective National Action Council for Minorities in Engineering (NACME) scholarship and was recently named the UH NACME Scholar Ambassador. In his new role, Frenchwood will plan events for local NACME Scholars and serve as a liaison between UH and NACME national headquarters.

He also received a Shell Incentive Fund Scholarship and was recruited by Exxon Mobil for their Future Leaders Academy.

In addition to all this, Frenchwood has also gained work experience through internships. In 2018, he participated in an Exxon Mobil Field Electrical Engineering Internship and – in 2017 – served as a research intern in an electroscience lab at Ohio State University.

Frenchwood's goal is to one day own or work for a company that uses technology to impact the world in positive ways. "I know I can use the skills I'm learning at UH to contribute back to society," he said.

> *"The only way a small business can compete in today's market is with software. I am very interested in using my coding skills to provide more services and products to the business owners that need it the most."*
>
> - JOSHUA FRENCHWOOD

#CullenCollegeStories

Army Veteran Makes *OUT-OF-THIS-WORLD* Dream Come True

2018-2019
Cullen College Outstanding Senior

Dwight Theriot

Graduation Year: 2018
Major: Mechanical Engineering
GPA: 3.84

Dwight Theriot, a decorated U.S. Army veteran, discovered his passion for engineering by accident while serving as an intelligence and security officer in Iraq in 2009.

His unit needed a classified communication system involving a communications satellite receiver and network automation, but couldn't afford to buy a new one. After checking around the Army supply chain, they found one that hadn't been used for a while. It came with no guarantees that it worked. But it was free.

Theriot and his unit picked up the equipment and got to work. After installing its many different pieces, they plugged it in and flipped the switch – only to have the power blow.

"We needed this system up and running quickly, and it was expensive equipment," Theriot said. "We could send it for repairs and wait several months for it to be sent back to us. Or we could just pry it open and try to fix it."

His team opted for the latter option and discovered the main power capacitors had exploded. The replacement parts were relatively inexpensive, so they decided to work with the guidance of a contractor who happened to be an engineer.

Fixing the communications system turned out to be a great learning experience.

"I didn't know anything about all this. It was the first time I had ever cracked open a piece of electronic equipment to try and fix it, the first time I'd soldered anything outside of a classroom," Theriot said. "The entire process, from setting the equipment up to troubleshooting, got me interested in radio and satellite communications. This project sparked my imagination and started me on the path to becoming a mechanical engineer."

He peppered the engineer with questions about his professional background and took online courses to learn more about engineering and communications technology. This exposure deepened Theriot's commitment to pursue an engineering career after his military obligations ended.

"I told myself at that time, if I was fortunate enough to get into an engineering program that I would give my studies everything I had so I could someday work at NASA," he said.

His next posting was at Fort Sam Houston in San Antonio as the executive officer of the Warrior Transition Battalion. Theriot was responsible for the health, welfare and morale of 200 wounded soldiers transitioning from the battlefield to everyday life. In this role, he managed a staff of 60, identified gaps of healthcare coverage and served as liaison between the hospital, the Veteran's Administration and non-profit organizations.

Then he was deployed again, this time to Afghanistan. He spent his free time experimenting with microcontrollers and researching engineering programs. During this time, he also became fascinated with space. Days in Afghanistan were rough and dusty, but nights were clear and had very

little light pollution. They presented an astounding view of the stars.

"You see tons and tons of stars on clear nights," Theriot said. "I found myself looking up a lot."

He cultivated a new hobby: spotting the International Space Station as it flew over Bagram Airfield, where he was stationed. He took more online courses, and he researched and contacted engineering schools.

"I started getting more and more fascinated with outer space and thinking about our place in the universe," Theriot said. "Ultimately I realized I have to go back to school for engineering. I did well for myself in the military, but it wasn't what I wanted to do forever."

By the time he left Afghanistan and the military, Theriot had seen two wars and been awarded a Bronze Star in recognition of his efforts over the course of his deployment, three Army Commendation medals and three Army Achievement medals.

Following a new path

Theriot, who had previously earned a bachelor's degree at the United States Military Academy at West Point focused on Russian and Computer Science, would have to earn another bachelor's degree to pursue engineering.

He returned to Texas ready to begin school with the help of the GI Bill and the Hazelwood Act, a Texas benefit that provides qualified veterans, spouses and dependent children up to 150 hours of tuition exemption.

He applied to the Cullen College of Engineering program and got denied.

"I was like, okay I should just go get a job," Theriot said. "Honestly, there were more than a handful of times – this was one, and then there were other times I was stressed out about exams or homework – where I said to myself, 'With my experience and my resume, I could go out and get a very good-paying job today and I don't have to go through any of this.'"

But his wife Simone knew how much the dream mattered to him, and she didn't let him give up.

Instead, he checked out other UH programs and then applied to the Department of Physics. Once he'd established a good academic record, Theriot transferred to the mechanical engineering program.

"I wanted to pursue a mechanical engineering degree because of how versatile it is and how many things fall under the roof of mechanical," he said.

While a student at UH, Theriot pursued his space interests by seeking out opportunities offered in Houston, often called Space City for being home to the world-renowned NASA Johnson Space Center.

He volunteered with The Mission Continues, NASA on Campus, Pi Tau Sigma (Mechanical Engineering Honor Society), SystemsGo! Rocketry (a high school program) and FIRST Robotics Competition.

He also participated in the NASA Pathways Intern program (formerly known as the Co-Op program) between 2016 and 2018. NASA Pathways allows participants to gain valuable experience by alternating semesters between school and work at NASA in engineering, science or business.

"First they put you where they need you and then you have a choice as to which part of NASA you want to experience … basically, you rotate through different groups," Theriot said.

In spring 2016, he worked with the Advanced Thermal Development Group where he helped design a liquid nitrogen-cooled thermal vacuum chamber, enabling the group to economically test new technologies in space-like conditions. He also taught an introductory Russian language and culture class to NASA employees and was selected as one of two (out of 50 candidates) Outstanding Co-ops for the term.

> "I started getting more and more fascinated with outer space and thinking about our place in the universe, ultimately I realized I have to go back to school for engineering. I did well for myself in the military, but it wasn't what I wanted to do forever."

In spring 2017, Theriot worked with the Extravehicular Activity (EVA) Operations and became certified to teach two astronaut training classes. He participated in mission simulations as an astronaut performing an EVA (doing a task outside the Space Station) and as a flight controller who talked the astronauts through the EVA steps. A lot of engineering know-how is needed for the position.

"It has a lot to do with understanding the nature of things and figuring out the optimal working conditions for an activity or event," he said. "You have to understand how equipment might behave under certain conditions and you have to be able to troubleshoot if things go wrong."

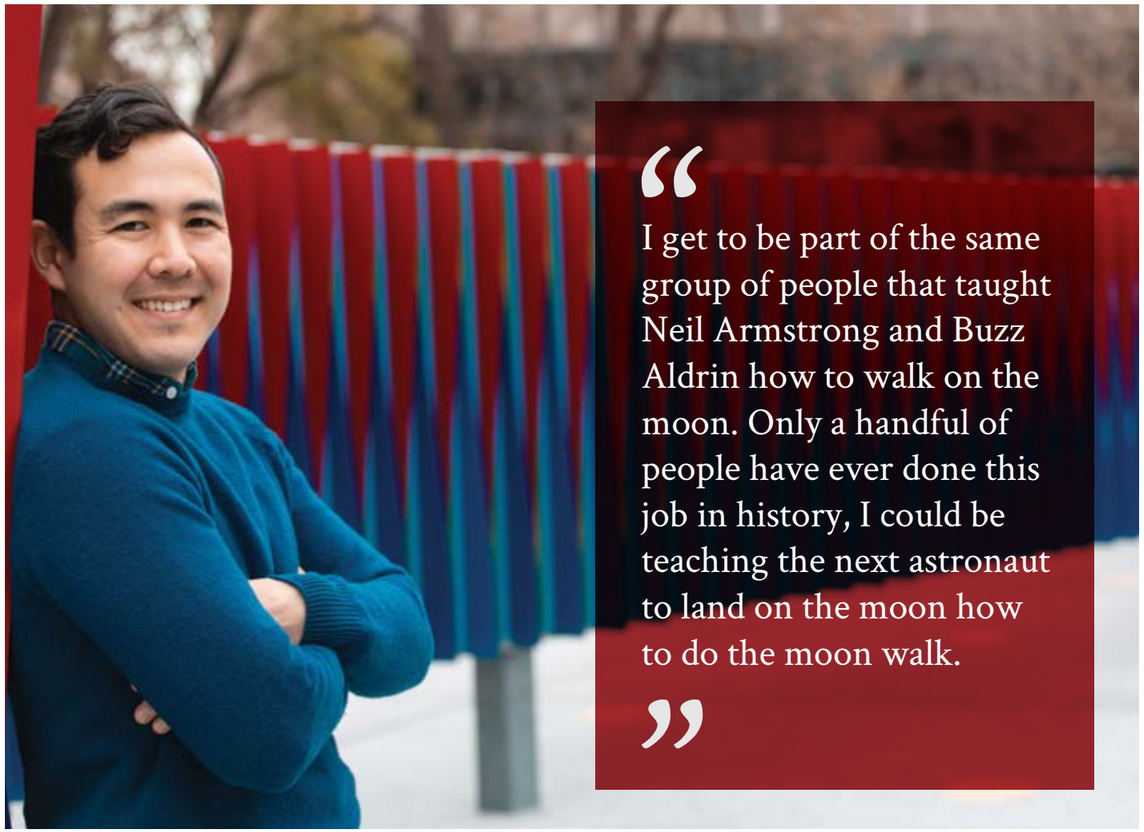
That summer, he worked at NASA's Neutral Buoyancy Laboratory, where astronauts train for space missions. There he designed and implemented the software and sensors needed to integrate new equipment for the training facility.

His last rotation – in summer 2018 – was spent working in the Design and Analysis Branch where he designed and executed a thermal vacuum experiment to evaluate infrared heating solutions for Chamber A, one of the largest thermal vacuum chambers in the world. He also designed and built a thermal fluid loop test stand for emerging heat rejection technologies for the Space Station.

At the end of his internship, Theriot was offered full-time employment and ended up choosing to be a NASA flight controller. The position involves being an expert on EVA in space and teaching astronauts to do spacewalks and maintenance activities outside the Space Station.

He graduated December 2018 and started the job in 2019.

"I get to be part of the same group of people that taught Neil Armstrong and Buzz Aldrin how to walk on the moon. Only a handful of people have ever done this job in history," Theriot said. "I could be teaching the next astronaut to land on the moon how to do the moon walk."



#CullenCollegeStories

PARENTS' IMMIGRATION STORY

Inspires Daughter to Excel

2018-2019
Cullen College Outstanding Junior

Laura Malcotti-Sanchez

Graduation Year: 2020
Major: Mechanical Engineering
GPA: 3.976

"My parents are my biggest examples for never giving up," she said. The family left Venezuela in 2005, after a volatile period of political turmoil that left her father unemployed. "I saw how my parents just kept working hard and looking for the best in all situations. They inspire me."

As a high school student, Malcotti-Sanchez earned a Gold Award from the Girl Scouts of America in 2016 for her project addressing needs at the Casa Juan Diego Immigrant Shelter. She worked with more than 20 volunteers to renovate four residents' rooms and paint a children's mural. She also coordinated three workshops that taught volunteers how to sew curtains, handle repairs and paint.

That same year, she won a Tier One Scholarship to the University of Houston. She chose mechanical engineering because it combined her love of physics, calculus and troubleshooting. "I love mechanical engineering and I can't see myself doing anything else," she said.

She shares her love of engineering by seeking out opportunities to mentor other students. The summer after her freshman year, Malcotti-Sanchez served as a counselor at G.R.A.D.E. (Girls Reaching and Demonstrating Excellence) Camp, a one-week program at Cullen College that introduces girls ages 13-17 to the wonders of engineering, science and technology.

The following fall semester, she worked as an undergraduate teaching assistant for the Introduction to Engineering course and the following semester she became an Honors teaching assistant for the Computing for Engineers course.

"My favorite part of being a TA is answering questions and giving students tips and hints that took me hours to figure out when I was in their shoes," she said. "It's gratifying to see students overcome their challenges and become better thinkers."

"Even though engineering is difficult at times, I always try to show my students that it is fun and, most importantly, worth it," she added.

Malcotti-Sanchez's exposure to teaching inspired her to join the Society of Women Engineers (SWE) Pros Mentorship program, where she mentored a foreign exchange graduate student. She now serves as a mentor for SWE and the American Society of Mechanical Engineers, working with three underclassmen on resumes and applying for internships.

In addition, she has bolstered her academic learning with real-world experience in engineering. In 2018, Malcotti-Sanchez served as a mechanical engineering intern at Hewlett Packard Enterprise. There, she won second place in the Best in Class Contest for presenting project findings involving evaluation of thermal potting materials to a panel of Hewlett Packard employees. The same project earned her the People's Choice Award during the Intern Fair.

This summer she'll explore the oil and gas industry as a drilling and completions engineering intern for BHP Billiton. She is looking forward to conducting well design and construction.

> "I saw how my parents just kept working hard and looking for the best in all situations. They inspire me."

Meanwhile, she's landed a research position with **Haleh Ardebili,** Bill D. Cook associate professor of mechanical engineering, who is well-known for her research on creating flexible, stretchable and bendable batteries and electronics.

"I'm still exploring what I really want to do," Malcotti-Sanchez said. "I want to see if I like research so it will help me determine whether I want to go pursue a Ph.D. or go into industry."

UH Alumnus Appointed

CHAIR OF ENGINEERING DEPARTMENT OF TURKISH UNIVERSITY

BY RASHDA KHAN

Cullen College of Engineering alumnus **Hasan Onur Keles** (BME 2015) was recently appointed chair of the electrical and electronic engineering department at Istinye University in Istanbul. He also serves as an assistant professor in the department.

"My department was established not just out of a need to educate and train the next generation of engineers for Turkey, but also a commitment to create a first-class institution of education and research in engineering in the world," Keles said. "We believe that the collaborative efforts between engineers and medical doctors will promote biomedical research and industry to grow in Istanbul and Turkey."

He aims to continue building the department through collaborative efforts, responding to the needs of the healthcare sector, building a healthcare-focused curriculum and continuing to hire exceptional faculty from around the world.

Keles earned his doctorate in biomedical engineering from the UH Cullen College in 2015, focusing on multi-modality imaging, clinical applications for neuroscience and nano/microscale technologies for global healthcare.

"The biggest advantage offered by the Cullen College is it really cares about hands-on experience and the engineering faculty is very responsive. They encouraged me to use my knowledge to develop engineering tools to meet market needs and demands," Keles said. "In addition, I learned how to collaborate with researchers from different fields — including medical doctors at the nearby Texas Medical Center — during my Ph.D."

Afterwards, he did two years of post-doctoral training at the Massachusetts General Hospital through the Harvard Medical School.

Keles has published and contributed to more than 30 scientific journals and conference papers. In addition, he serves as a visiting researcher at the Dankook University in South Korea, Xi'an Jiatong University in China and Lubeck University in Germany.

Istinye University, founded in 2015, brings together three different hospital brands — Liv Hospital, Medical Park and VM Medical Park. It is part of the largest healthcare group in Turkey with over 30 hospitals located in 17 Turkish cities. Istinye engineering focuses on research and teaching related to robotics, biomedical imaging, control systems and cyber-physical systems.

"Hasan is our first BME graduate to hold a faculty position and become the chair of a major department," said **Metin Akay,** founding chair of the biomedical engineering department and the John S. Dunn Professor of biomedical engineering at the UH Cullen College offering congratulations. "We're very proud of him."

Keles credited the experience as a UH biomedical engineering student for his career in academia. "The guidance and encouragement during my Ph.D. was invaluable. I'm always proud of being a UH BME graduate!"

Keles added he hopes to collaborate with the Cullen College in his new role.

"My department will be happy to provide opportunities for UH Engineering faculty and students," he said.

Istinye engineering focuses on research and teaching related to robotics, biomedical imaging, control systems and cyber-physical systems.

UH Alumna's Paper Lands in

PRESTIGIOUS PNAS JOURNAL

BY RASHDA KHAN


Ilknur Telkes

Ilknur Telkes, who earned a Ph.D. in biomedical engineering from the University of Houston last year and was a 2017 North American Neuromodulation Society (NANS) Junior Scientist Award winner, had an article published in the prestigious *Proceedings of the National Academy of Sciences (PNAS)* journal.

The article, titled "Local field potentials of subthalamic nucleus contain electrophysiological footprints of motor subtypes of Parkinson's disease," reports the location inside the brain that correlates with two major Parkinson's disease types – one form is characterized by tremors, while instable posture and difficulty walking characterize the other.

Parkinson's is a complex progressive neurodegenerative disorder with a broad range of symptoms. The new findings could lead to improved patient-specific therapy.

While a doctorate student at the UH Cullen College of Engineering, Telkes spent a lot of her research time in the operating room at Baylor College of Medicine working with clinicians – Ashwin Viswanathan from BCM Neurosurgery and Joohi Jimenez-Shahed from BCM Neurology – to pinpoint areas in the brains of patients suffering from Parkinson's disease using a novel intraoperative neural data acquisition and signal processing system developed by **Nuri Ince,** assistant professor of biomedical engineering at UH.

Local field potential recordings collected during deep brain stimulation surgery (using multiple microelectrodes) helped the research team capture oscillatory neural patterns in the territories of the subthalamic nucleus of the brain that are specific to these motor subtypes. This information helped the team understand how the brains of patients suffering from Parkinson's disease worked.

"Our results indicate that the spatiospectral dynamics of the brain can be used as an objective method to distinguish these two motor subtypes of Parkinson's disease. To our best knowledge this is the first time such a link has been reported," said Ince, who was Telkes' advisor at UH and a corresponding author on the *PNAS* paper.

"These observations might lead to the development of sensing and stimulation strategies targeting the sub-territories of the subthalamic nucleus for the personalization of deep-brain stimulation (DBS)," he added. "This could make the DBS therapy for patients more efficient."

Parkinson's is a complex progressive neurodegenerative disorder with a broad range of symptoms. The new findings could lead to improved patient-specific therapy.

Other contributing authors on the paper are: Ashwin Viswanathan and Joohi Jimenez-Shahed, both with BCM; Aviva Abosch from the University of Colorado School of Medicine; Musa Ozturk, a UH biomedical engineering Ph.D. student; Akshay Gupta with the University of Minnesota Medical School; and Joseph Jankovic with BCM.

The research project was the result of a collaboration with UH as the lead institution, Baylor College of Medicine, the University of Minnesota and the University of Colorado.

Telkes is now pursuing postdoctoral work in the department of neuroscience and experimental therapeutics at Albany Med, the academic health science center in northeastern New York. Her current research interests include intraoperative and postoperative investigation of spinal cord stimulation in chronic pain as well as deep brain stimulation in Parkinson's disease and Essential tremor.

Established in 1914, *PNAS* is one of the world's most-cited and comprehensive multidisciplinary scientific journals. Publishing more than 3,200 research papers annually, the journal's content spans the biological, physical, and social sciences and is global in scope.

Support & Giving Spotlight:

THANK YOU CHEVRON!

UH Petroleum Engineering Department Receives **Specialty Equipment Donation**

BY RASHDA KHAN

Scientific research takes time and involves a lot of specialized equipment that come with hefty price tags. **Konstantinos Kostarelos,** an associate professor of petroleum engineering at the UH Cullen College of Engineering known for innovative research in the oil and gas field, can attest to this fact.

A recent gift from Chevron ETC to Kostarelos' research lab, which is dedicated to subsurface research including enhanced oil recovery (EOR), made a huge difference to him. The donation of fluid accumulators, high pressure pumps and more will aid the professor's research – related to EOR for conventional and unconventional oil reservoirs – and help teach students for years to come. EOR methods are needed to recover residual oil from an oil reservoir that has been producing oil for some time and the remaining oil cannot be extracted by other means.

"Since many of these pieces of equipment need to be rated for high pressure and high temperature in order to simulate reservoir conditions, they can be rather expensive due to the special material used in manufacturing them," Kostarelos said. Looking around at the many boxes of equipment, he said "purchasing these items outright would have required substantial funding. As a result, this donation is greatly appreciated."

The donation was made after Kostarelos discussed his needs with several employees of Chevron, who helped identify equipment the company was no longer using and arranged for it to be donated to UH.

> "As a corporation we're always looking for opportunities to help the local University... in particular, in petroleum engineering, which is near and dear to our heart ."
>
> - GREG WINSLOW
> *Laboratory R&D Manager, Chevron*

"As a corporation we're always looking for opportunities to help the local University, especially in the areas of science and technology," said Greg Winslow, unit manager of Chevron's Rock and Fluids Characterization Unit. "In particular, in petroleum engineering, which is near and dear to our heart."

Winslow added that a strong relationship with the University is important because of the students and the future promise they hold.

"We need to hire the best and the brightest. If we can do something to help train them – through gifts of equipment and tools, offering internships – so that when they come out of college they are realistically able to function quickly within our organization that is a benefit to everyone," he said. "They can hit the ground running and the projects get done quicker."

The donation also holds personal significance for Winslow, who earned a bachelor's degree in chemistry in 1980 and a master's degree in biochemistry in 1983 from UH.

"We appreciate everything that the local University is doing," he said. "Also being an alumnus, it has great meaning to me to be able to come back and help, give back to the University and to help these programs grow."

UH Engineering hosts Fourth Annual **Girls Engineering the Future Day: A STEM Event," sponsored by Chevron**

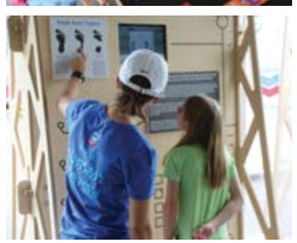
BY INEZ HUTCHINSON

On Saturday, March 30, the hallways and classrooms in the UH Cullen College of Engineering buzzed with excitement as a thousand Houston-area girls attended the fourth annual "Girls Engineering the Future Day: A STEM Event," sponsored by Chevron.

The event introduces girls in grades four through eight to the wide world of STEM and engineering activities organized by faculty and student organizations from UH Engineering.

Girls played with prosthetic hands, built electrical circuits with students from the UH Institute of Electrical and Electronics Engineers (IEEE) and made paper airplanes/launch rockets with American Institute of Aeronautics and Astronautics (AIAA).

Chevron volunteers also provided an interactive activity station called the "STEM Zone" aimed at sparking interest in science, technology, engineering and mathematics.



LIENHARD'S LENS

BY JOHN LIENHARD

I offer two pictures: One is Howard Hughes' famed Spruce Goose –until recently, the largest airplane ever built. The other is a small stand of birch trees in Iceland. What could they possibly have in common? The answer is *wood*. Few people realize that the Spruce Goose is not made of spruce at all. It's made of birch.

Birch has had a remarkable hold on the psyche of northern people around the world. It is the Celtic symbol of rebirth and purification. It's one of the sacred trees of Norway and Sweden. It supplied Nordic settlers of Greenland and Iceland with lumber and fuel. It's the only tree native to Iceland. Settlers used it so heavily that they almost exterminated it. Iceland is trying to regrow its last stands of birch (like the one in the photo.) But a huge portion of its trees are now other imported species.

I spoke long ago at a cold-war think-tank in central Siberia. My hosts walked me through a mile of trees to get to their laboratories. (They made sure that I was as lost as Hansel in the woods.) But they told me with some gravity, as we walked, that those trees – white with black streaks – were beryoska, or silver birch.

The Russians drink birch juice. They make it into wine or beer. They once used birch bark to make writing paper, shoes – even casts for broken bones. Their word for birch is kin to their word for taking care of. The Birch tree was a gift from God. They even have a famous national dance group, The Birch Ensemble. It performs eerie gliding dances in honor of birch trees.

Birch forests lie across Russia, Finland, Norway, and Sweden - across the north-eastern United States and up through Canada. They surrounded me when I grew up in Minnesota. Native Americans used their bark to make wigwams, canoes, and every kind of decorative item. The sap makes birch syrup.

Birch is a hard wood, good for furniture and plywood. But it warps if it isn't well-cured. Hughes' Spruce Goose was made from a special plywood - layers of birch veneer. Hughes put teams of women to work ironing the veneer to stabilize it before it was made into plywood.

Gaze up at that great gun-metal gray airplane, and it's hard to connect it with birch trees. But it really is a true cousin of the Indian canoe. It has the same strength and buoyancy. It manifests the same wedding of strength and grace that has long captivated Nordic peoples around our entire globe.

Left: Howard Hughes' H-4 Hercules, better known as the Spruce Goose. It now resides in the Evergreen Aviation and Space Museum, McMinnville, Oregon.

Right: A small stand of surviving birch trees in southern Iceland

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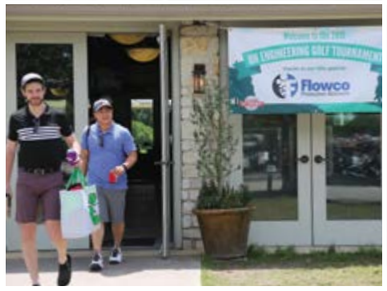
2019 WOMEN IN ENGINEERING SPRING EVENT

The Cullen College played host to the fourth Women in Engineering spring event on March 21. The free event was funded by alumna Cynthia Oliver Coleman, P.E. (BSChE '71). The event took place at the UH Hilton and included female engineering students, faculty and alumnae. Attendees were inducted into the Women in Red Movement, which will serve 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 Audrey Wang.

CULLEN COLLEGE HOSTS ANNUAL GOLF TOURNAMENT

The 30th annual Cullen College of Engineering Golf Tournament teed off at the BlackHorse Golf Club on Monday, April 22nd in Cypress, Texas.

This year's tournament attracted golfers from across the Houston region, including alumni, donors, current faculty and students, industry representatives and other friends of the college.



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ENGINES OF OUR INGENUITY - Episode No. 2409

Today, we struggle to remember what we once knew. 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.

Albert North Whitehead, writing of the need to free ourselves from the past, once said, "A science that hesitates to forget its founders is lost". Well, we do face the twin dangers of re-inventing wheels and using the same old wheels over and over. And the Internet raises new questions about reinventing old wheels.

Long ago, when we graduate students had to find our own thesis topics, one wag suggested that we just go back to 19th-century issues of the journal, *Verein Deutscher Ingeneiur.* We could rewrite their fine articles in English and no one would be the wiser. Long before we had an Internet, it was clear that the sands of time constantly closed over other people's work.

And our joke turned sour in the years that followed. Since then, we've all seen more and more older work replicated -- not by plagiarism, but by ignorance of the past. The cost of that goes beyond people being cheated out of credit -- though many are. The greater cost is the waste of time spent replicating the work of others.

So how has the Internet affected all this? Already, in a 1994 episode of this program, we mentioned how our computers were taking us precisely to the information we sought -- without digressions. We wondered what we were losing without the context of digressions.

Now James Evans at the University of Chicago analyzes paper citations, statistically. He does indeed find them straying far less from the subject at hand and penetrating less into the past. Evans sighs and says that the value of print library research is its relatively clumsy indexing. By forcing greater digressions upon us, it has the unintended result of integrating knowledge.

Of course there's more to it. The Internet can lead us on its own digressions. They may be briefer, but they're equally useful if we have the wits to heed them. And the Internet is now making many older sources more, not less, accessible -- if we know how to find them. But other red flags arise.

One study raises Whitehead's warning when it shows older scholars citing older sources. Is the past, at some point, no longer a fading heritage, but merely a comfortable old shoe?

So the effects of our new means for accessing history remain unclear. We seem to agree on only one point: The Internet is now where we first turn for information. Most of us go to paper libraries only when the Internet runs out.

That's why I get so many e-mails asking where to learn more about a topic when I've already posted my print sources on the web. Like me, my listeners want answers on their screens -- right now.

But at some point, we still need to haul our bodies off to read printed information. How clumsy it seems to turn pages, skim-reading to find what we need to know, blundering up side alleys. Yet I never cease to wonder at the new and fresh ideas that are exposed just at the point that I feel lost in that sea of paper.

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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