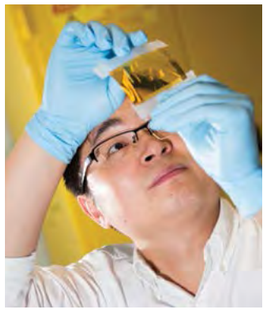
MOMENTUM

Cullen College Department of Mechanical Engineering Magazine | Issue No. 4

ACCELERATING THE DISCOVERY OF NEW MATERIALS



CONTENTS

MOMENTUM

Momentum is published by the University of Houston Cullen College of Engineering, Office of Communications.

Communications Director	Audrey Grayson
Art Direction & Design	Rachel Ward
Photography	Carlos Landa
Writers/Editors	Elena Watts Natalie Thayer Audrey Grayson
Contributing Writer	Jeannie Kever

Office of Communications
Cullen College of Engineering
University of Houston
E301 Engineering Bldg. 2
Houston, Texas 77204-4009
Phone: 713-743-4220 Fax: 713-743-8240

Those wishing to reprint articles or photographs should contact the director. Use the credit line: Reprinted with permission of the University of Houston Cullen College of Engineering. Clippings are appreciated.

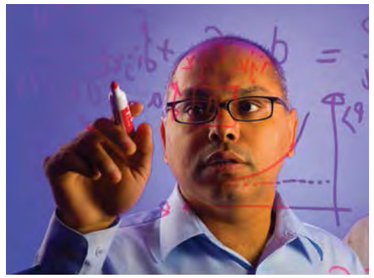
The University of Houston is an Equal Opportunity/Affirmative Action institution. Minorities, women, veterans and persons with disabilities are encouraged to apply.

Contact ME:
Phone 713.743.4500
Website www.me.uh.edu

cullen college news
@uhengineering
uhengineering
UHCullenCollege
University of Houston Cullen College of Engineering

UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

CHAIR'S MESSAGE



In the Mechanical Engineering (ME) Department at the University of Houston Cullen College of Engineering, our central mission is to educate the next generation of globally competitive engineers and to perform cutting-edge research in the broad area of mechanical sciences. In this issue of *Momentum*, we invite you to explore the ways in which we continue to succeed in this mission and to take a closer look at our plans to continue driving the field of mechanical engineering forward for generations to come.

A modern mechanical engineer is very versatile. In our department alone, our students and faculty are currently involved in research related to cell biology, drug delivery, missile design, radiation-hardened materials, quantum dots, hypersonic flights, shale gas exploration, nanostructured Li-ion batteries for energy storage, environmentally-friendly engines, high temperature superconductive materials, subsea engineering, sensors, control of complex systems, thermal management, mechanics of complex fluids, artificial muscles and ultra-strong materials. This abbreviated list of active research within our department should give you at least a glimpse of the amazing array of career and research choices a mechanical engineer has in our current economy.

The University of Houston's highly-ranked ME department boasts very close ties with Houston's energy and engineering industrial complex as well as the medical center. Our graduates can be found in key positions in some of the leading companies both locally and internationally.

The ME program has seen record growth in recent years, with an undergraduate enrollment of over 900 students. Mechanical engineering is currently one of the most sought-after degrees within the Cullen College of Engineering. With our high standards of admission and passion for teaching, we prepare our graduates with a strong foundation in mathematics, physical sciences and engineering principles for applications in industry, research and academia.

I invite you to explore our website at www.me.uh.edu to see what we have to offer. If you need more information about our programs or department, please email me at psharma@uh.edu.

Pradeep Sharma
M.D. Anderson Professor and Chair
Mechanical Engineering
Cullen College of Engineering
University of Houston

BRAGGING POINTS

1

UH Engineering students ranked 15th in the U.S. for salary earning potential (Source: PayScale.com)

2

Named one of the **Best Engineering Schools in the Nation** by *U.S. News and World Report* (2017)

3

Located in **"America's coolest city"** and **"one of the best places to live in your 20s"** (Source: *Forbes* and *Business Insider*, 2015)

4

Listed as one of the world's top universities **for grads who go on to become CEOs** (Source: *The Times Higher Education of London*)

5

Ranked #4 in the nation for **"top colleges where students get the best bang for their buck"** (Source: *PolicyMic*, 2013)

6

Ranked among the top 75 in the nation and **#1 in Houston for engineering research** and development expenditures (Source: National Science Foundation, 2011)

UH ENGINEERING BY THE NUMBERS

10 NATIONAL ACADEMY OF ENGINEERING FACULTY MEMBERS

20% OF MECHANICAL ENGINEERING FACULTY MEMBERS ARE WOMEN

22:1 22:1 UNIVERSITY-WIDE STUDENT TO FACULTY RATIO

TOP 100 ENGINEERING SCHOOLS IN THE U.S.

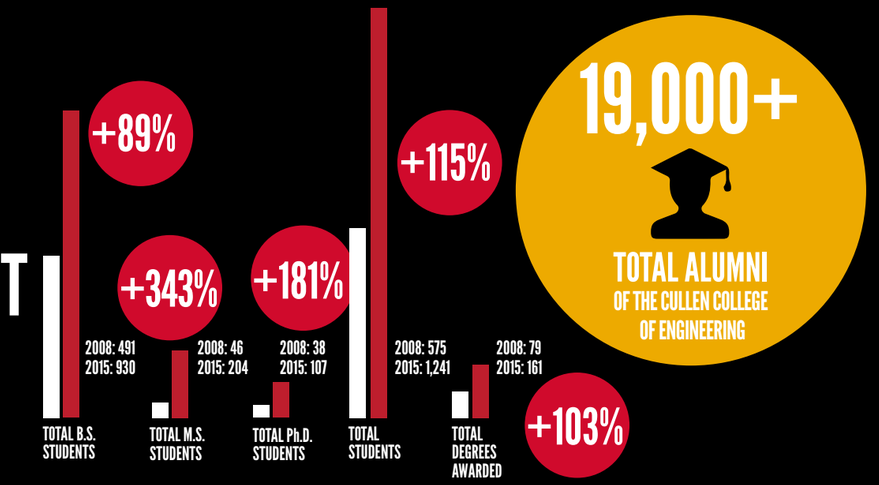
$25.8M IN RESEARCH EXPENDITURES

80% OF UH ENGINEERING UNDERGRADS ARE EMPLOYED IN TEXAS WITHIN ONE YEAR OF GRADUATION

$63,501 AVERAGE STARTING SALARY WITH B.S. IN MECHANICAL ENGINEERING (NATIONAL ASSOCIATION OF COLLEGES AND EMPLOYERS 2015 SALARY SURVEY)

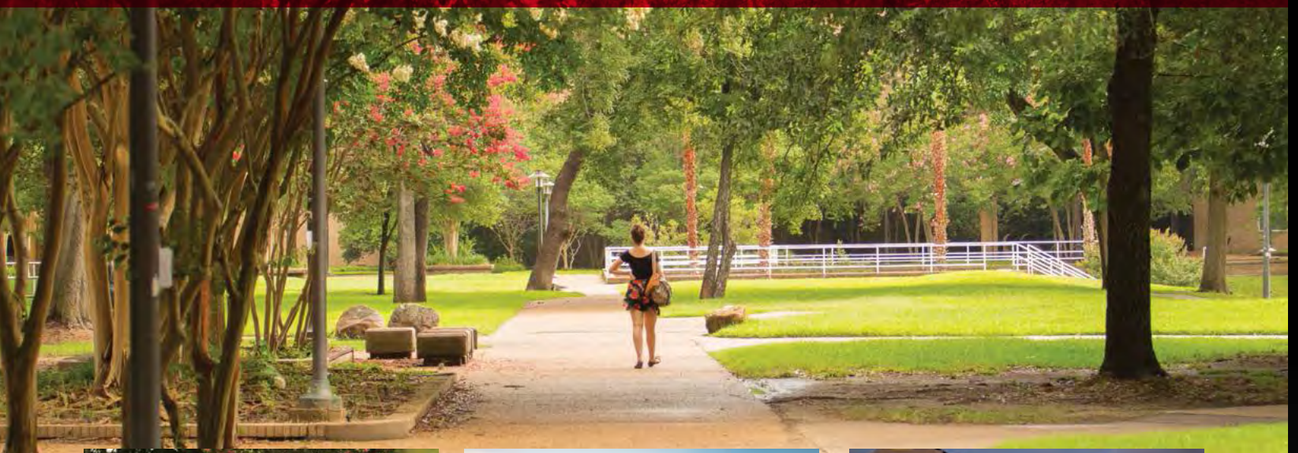
28 ENGINEERING STUDENT ORGANIZATIONS

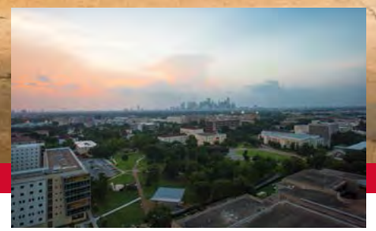
115% INCREASE IN ME STUDENT ENROLLMENT SINCE 2008

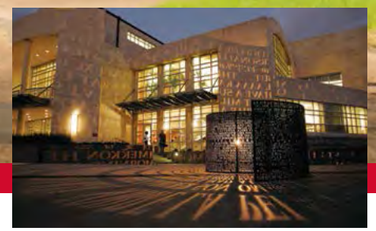


19,000+ TOTAL ALUMNI OF THE CULLEN COLLEGE OF ENGINEERING

UH RANKED AMONG GREAT VALUE COLLEGES WITH BEAUTIFUL CAMPUSES







by Mike Emery

With its lush green spaces and robust public art collection, the University of Houston offers students a cozy, colorful campus. Cougars aren't the only ones in the know about UH's many attributes. The University recently was ranked among the most beautiful campuses in the country by online guide Great Value Colleges.

UH ranks 19th in this list of 35 Great Value Colleges with Beautiful Campuses. In its profile of UH, Great Value Colleges cited UH's Public Art Collection, architecture and landscape as campus highlights.

"One would be surprised to know that within one of the largest cities in Texas sits the University of Houston, which is comprised of 667 acres of lush greenery with eye-pleasing art and structures," wrote Gabrielle Gibeily, Great Value Colleges writer. "Nearby Brays Bayou offers students a scenic hike and bike trail, and the campus has a community garden, multiple fountains, well-groomed lawns and parks that are abundant with trees."

Great Values Colleges cited UH's status as the first Texas state university to establish a Percent for Art program, committing one percent of each facility's budget to public art. Among the most recent additions to its Public Art Collection is "The Snake Is Out" by renowned minimalist Tony Smith. Great Value Colleges also lauds the University's historic Ezekiel W. Cullen Building and the neighboring Cullen Family Plaza.

Great Value Colleges selected institutions for its beautiful campuses list based on affordability, awards, notable features, location and student enjoyment. UH's inclusion on this Great Value Colleges' list complements previous recognition for its scenic campus. In 2014, UH ranked second in Profascinate's Top 10 Most Beautiful College Campuses.

Great Value Colleges is an online college guide that assists students in selecting value-added educational institutions. The site features rankings on topics that include top colleges for an online degree, colleges that promote healthy living, most affordable college towns, best colleges for veterans and LGTBQ-friendly colleges.

For more details, visit
www.greatvaluecolleges.net

UH EXPANDS IN SUGAR LAND AND KATY, PLANS FOR BIG PARTNERSHIPS

State leaders have paved the way for a $54 million new construction at UH Sugar Land (UHSL), a campus of the University of Houston, and an entirely new campus in Katy worth $46.8 million. UHSL received the allocations in HB100, which the governor signed last June.

The 150,000-sq.-ft. Sugar Land facility, planned to be completed in 2019, will primarily house programs offered by the UH College of Technology. A portion of the college will relocate to Sugar Land, and additional programs in business, education and health-related fields are also expected in the next two to five years.

The addition of a fourth building to the 250-acre campus allows for expanded programs that complement the workforce needs of the area, which is home to a number of technology and engineering companies, such as Fluor, Schlumberger and Texas Instruments. Greater Fort Bend Economic Development Council CEO Jeff Wiley says the county is one of the largest in the state, boasts one of the most highly educated populations and consistently ranks nationally in the Top 10 for population employment growth rate.

"If UH is going to continue to meet the higher education needs of the Houston area, we need to be building where people live," said Provost Paula Myrick Short, UH senior vice president for academic affairs. "There is tremendous growth in Fort Bend County. We are grateful for the incredible support of the legislature, which will help further develop this campus and expand higher education opportunities in the region."

The new UH campus in Katy – one of the fastest growing areas in the Houston region – will offer degrees most relevant to current industry demands, including engineering, business and nursing.

Read more about this story in the Daily Cougar at
thedailycougar.com/2015/08/19/uh-expansion-in-sugar-land-katy-plans-for-big-partnerships

ENGINEERING STUDENTS NOW HAVE SEAMLESS TRANSFER OPTION WITH UH

Beginning in fall of 2015, San Jacinto College students are eligible for a seamless transfer into the University of Houston Cullen College of Engineering.

San Jacinto College has signed an articulation agreement with the Cullen College, which offers San Jacinto College students who are currently taking courses for completion of the Associate of Science in Engineering Science an option to seamlessly transfer into the UH Cullen College of Engineering.

"This articulation agreement between the University of Houston Cullen College of Engineering and San Jacinto College will ensure that the transition process from one campus to another is as seamless as possible for engineering students," said Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the Cullen College of Engineering. "It will also provide students with a better understanding of the course requirements for transferring to the Cullen College, allowing them to save time and money by making the best course selection choices."

Qualified engineers are in high demand across the country, but the supply of engineering talent continues to lag behind. Kelly Services, a workforce solutions provider, ranked Houston as the city with the highest demand for engineers in the U.S. In terms of average annual salaries, Houston is the highest paying metro area for civil engineers ($112,480), chemical engineers ($128,380) and petroleum engineers ($168,280).

"I am very excited about this important step toward graduating more world-class engineers into the city of Houston," Tedesco said.

San Jacinto College students who want to transfer to the UH Cullen College of Engineering must complete the Associate of Science degree in Engineering Science (60 hours) and meet the Cullen College's admission requirements.

For more information, please visit www.sanjac.edu/article/engineering-students-now-have-seamless-transfer-option-uh-articulation-agreement-helps

UH LAUNCHES PLANS FOR SUPERCONDUCTOR MANUFACTURING INSTITUTE

The University of Houston will lead plans for an Advanced Superconductor Manufacturing Institute (ASMI), aimed at speeding the full commercialization of high-temperature superconductors. Energetics Inc. will support UH in this effort.

Venkat Selvamanickam, M.D. Anderson Chair Professor of mechanical engineering at UH, will serve as principal investigator for a $500,000 planning grant from the National Institute of Standards and Technology (NIST). The grant will be used to develop an industry-led consortium to address technical obstacles that have limited superconductor manufacturing, as well as to develop a business plan for the institute.

Selvamanickam is also the director of the Applied Research Hub at the Texas Center for Superconductivity at UH, which develops high-performance superconducting wire, with support from the U.S. Department of Energy, Office of Naval Research, Army Research Laboratory, National Science Foundation, the state of Texas and industry.

The University of Houston was one of 16 recipients of the NIST planning grant, among 118 applicants in a competitive selection process.

The United States has five Advanced Manufacturing Institutes but none involve superconductor technology. None of the planning consortiums funded in 2014, the first year the grants were awarded, deal with superconductor technology, either.

UH STUDENTS DESIGN ENERGY EFFICIENT, AFFORDABLE HOMES

Photo Credit: University of Houston Photographers

With plans to capture the power of Houston's sun and reuse its abundant rainfall, a group of University of Houston students has completed the first phase of an ambitious project to rethink affordable housing and energy efficiency.

Three interdisciplinary teams – each containing UH Engineering students – were named winners of the Energy Efficiency Innovation Challenge, sponsored by Direct Energy and UH Energy. Ultimately, organizers plan to build the winning designs in Houston's Third Ward, near the UH campus.

About 30 undergraduate and graduate students participated, representing the UH colleges of architecture, engineering, technology, business, law and mathematics and natural sciences. The student teams were asked to design an 800-square-foot, two-bedroom house that could be built for $80,000 or less, with monthly utility bills under $25.

"When this was first announced, people thought it was not possible," said Radha Radhakrishnan, joint chief energy officer at UH. "All the teams came in with less than $15 [in energy bills]."

The competition included a $6,000 prize to the winning team. Second and third place teams received $4,500 and $3,000 respectively.

In first place was team Envirow House, made up of UH students Giovanni Peña, Jessica Hedge, Inbisat Zahara and Travis Franks (mechanical engineering).

In second place was EcoHouse 3W, made up of UH students Kathleen Sobczak, Klvanc Biber, Khoula Mehmood, Mahek Hooda and Himanshu Patel (chemical and biomolecular engineering).

Team Chimera, made up of Oluseyi Fatayi Williams, Mark Williams, Eric Choe, Jesus Escobar and Julio Constantino (petroleum engineering), won third place.

The task required technical knowledge, creativity and aesthetic sensibilities to address one of society's most pressing problems. All of the teams relied on solar panels to produce electricity and rainwater catchment systems to supplement the public water system.

"When people think about nice architecture, they think about museums, stadiums, not inexpensive housing," said Peña, a graduate architecture student. "But design elements can be used there, too."

Zahara, who is majoring in finance and supply chain management, said the group studied the history of the Third Ward to guide their design. "We wanted to make sure people would keep their culture," she said.

Badar Khan, CEO of Direct Energy, said the competition is a natural outgrowth of Direct Energy's belief in a more energy-efficient future.

"We want you to buy less of what we sell," he told the crowd just before the winners were announced. "We waste a tremendous amount of energy in our homes."

Direct Energy helped to design the competition to make sure students were "tackling challenges that apply to the real world," he said. "Direct Energy goes beyond believing in a more energy efficient future. We're investing in the people who are going to help build it."

HEALTH & MEDICINE

REVEALING THE ROLE OF TRANSPORT PROTEINS IN BIOLOGICAL CELLS

by Audrey Grayson

Ashutosh Agrawal, assistant professor of mechanical engineering at the UH Cullen College of Engineering, has published a paper in the *Proceedings of the National Academy of Sciences* (*PNAS*) that provides unprecedented fundamental insight into the role of key proteins in regulating cellular transport in different mechanical environments.

Specifically, Agrawal's research looked at two proteins – actin and BAR proteins – and the roles they play in the transport of cargo into biological cells. Nikhil Walani, a mechanical engineering graduate student at the Cullen College, and Jennifer Torres, a mechanical engineering undergrad, were Agrawal's collaborators on this project.

When extracellular cargo reaches the cell's membrane, it is recognized by receptors that initiate a signaling cascade to remodel the membrane locally. Depending on the cell type and its mechanical environment, an elaborate set of proteins is engaged to work together to form an invagination, or vesicle, in the membrane. The cargo sits inside the vesicle and is completely enveloped by the membrane. Eventually, the piece of membrane surrounding the cargo forms a mature vesicle that snaps off and detaches from the rest of the cell's membrane. The closed, cargo-carrying vesicle is then free to travel to its destination inside of the cell.

One of such mechanisms, known as clathrin-mediated endocytosis (CME), is the key metabolic pathway for transporting molecules into cells. This process is required for many critical functions, including nutrition and communication between cells.

In mammalian cells, the formation of vesicles during this process is primarily driven by clathrin, a membrane-bending protein. In contrast, the formation of cargo-carrying vesicles in yeast cells involves clathrin, actin and BAR proteins that contribute to vesicle formation in different capacities. Experimental studies have shown that an increase in cellular tension in the plasma membrane necessitates the use of actin and BAR proteins in driving vesicle growth.

Although scientists have long known that the actin and BAR proteins are active players in the formation of cargo-carrying vesicles in a high membrane tension environment, their specific roles in the process have remained a mystery. That is, until Agrawal and his students at the Cullen College began investigating the role these proteins play in yeast cells.

To investigate this phenomenon, Agrawal and his team developed models to help predict and explain the shapes of vesicles that form when only actin proteins are driving the growth of cargo-carrying vesicles. Using these models, his team found that the formation of these vesicles is a relatively smooth and stable process until a critical amount of force is reached.

"Once the critical force is crossed, the vesicle undergoes a snap-through transition that drastically elongates and squeezes the vesicle," Agrawal said.

The next step was to develop a model for the effect of BAR proteins on the formation of vesicles. Agrawal's team found that in contrast with the rapid shape transition that took place during vesicle formation using only actin proteins, the BAR-driven vesicle formation was a gradual and controlled process.

"Basically, what we saw was that the actin provides a big push towards forming the vesicle, and right when the vesicle gets close to the critical point, the BAR proteins gently tip the system over and leave, letting the cargo-carrying vesicle undergo instability-driven growth," Agrawal said. "What this means is that the actin proteins are the driving force behind membrane deformation and vesicle formation, with BAR proteins acting as facilitators in this process."

This interplay of actin and BAR proteins that drives membrane deformation during the CME process could also be at play in many other shape-transforming processes in cells, Agrawal added. More research is needed in order to determine whether protein-induced instabilities are at play in other cellular processes, but Agrawal's *PNAS* article certainly lays the groundwork for future studies on this topic.

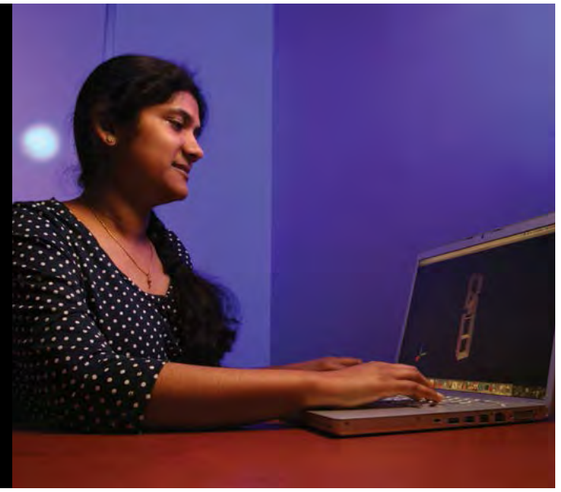
"Further research into these lingering questions could eventually lead to improved drug delivery," Agrawal said. "This is one major area worth investigating based on the fundamental groundwork we have laid out in this paper."

> "FURTHER RESEARCH INTO THESE LINGERING QUESTIONS COULD EVENTUALLY LEAD TO IMPROVED DRUG DELIVERY."

MATERIALS

PROFESSOR EXPLORES STACKING FAULTS TO STRENGTHEN COBALT

> "AS AN ENGINEER, DISCOVERING MECHANISMS THAT CAN MAKE MATERIALS STRONGER AND MORE DUCTILE IS EXCITING."



by Elena Watts

Yashashree Kulkarni, associate professor of mechanical engineering at the UH Cullen College of Engineering, earned a three-year, $225,400 grant from the National Science Foundation to study mechanisms of deformation in cobalt with high-density stacking faults.

Cobalt in the form of thin films is ubiquitous in magnetic data storage devices as well as microelectromechanical and nanoelectromechanical devices.

However, Kulkarni and her Texas A&M University collaborator Xinghang Zhang are exploring engineering processes that produce stronger versions of different crystalline forms of cobalt with improved ductility. The combination of strength and ductility in one material is highly desirable for structural engineering applications, yet somewhat uncommon in the materials science world. For example, making steel stronger by adding carbon makes it increasingly brittle, and materials that are naturally ductile like gold and silver are not strong.

When deformed, most crystalline materials that are ductile by nature form stacking faults, or planar defects, until they fail. Environmental stressors can cause natural formation of moderate numbers of stacking faults in cobalt and other crystalline materials, but Zhang has developed a method in his laboratory for prefabrication of cobalt with high-density stacking faults.

He has demonstrated that dense or closely-spaced pre-existing stacking faults in cobalt interact with defects created subsequently to provide not only increased strength but also improved deformability. Kulkarni is performing computational simulations to understand the atomistic underpinnings of the phenomenon.

"Zhang is designing cobalt microstructures at the nanoscale, and we're performing simulations on million-atom samples on supercomputers," Kulkarni said. "Stacking faults are conventionally thought of as defects generated when material deforms. To my knowledge, no one has looked at turning these stacking faults into mechanisms for strengthening."

While past research conducted individually and collaboratively by Kulkarni and Zhang specifically focused on methods to improve strength and ductility in copper for structural applications, this collaboration also emphasizes understanding the universal atomistic mechanisms responsible for such properties in order to apply them to any crystalline material.

Furthermore, the joint venture provides the student research groups at the different institutions with opportunities to exchange complementary knowledge through visits, lectures and seminars as well as frequent video conferences.

"As an engineer, discovering mechanisms that can make materials stronger and more ductile is exciting because it opens up avenues for designing novel materials for structural needs," Kulkarni said. "So we want to see how these planar defects lead to high strength and deformability at the scale of atoms."

NAVAL RESEARCH GRANT WILL SPEED UH WORK ON MATERIALS, ENERGY

A grant from the Office of Naval Research will help researchers from across the University of Houston's Cullen College of Engineering to more efficiently test advanced materials being developed with funding from the Department of Defense.

Venkat Selvamanickam, M.D. Anderson professor of mechanical engineering, said he will use the $810,000 grant from the Office of Naval Research to purchase a physical properties measurement system (PPMS), which will allow researchers to more quickly test the advanced materials being produced in their laboratories.

Selvamanickam, who also is director of the Applied Research Hub at the Texas Center for Superconductivity at UH (TcSUH), said the new equipment will allow his lab to expedite its research on the development of improved superconducting wire.

The money comes from an Office of Naval Research (ONR) program to fund new equipment needed for research sponsored by that office or other Department of Defense research programs.

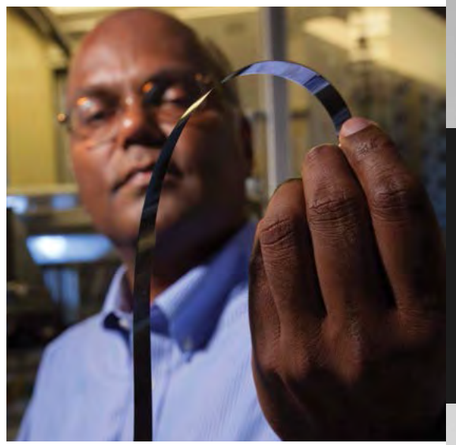
The new PPMS will benefit a variety of materials research, including solar cells, batteries, graphene, thermoelectrics and flexible electronics. It will allow testing at a wider range of temperatures, from near 0 degrees Kelvin to room temperature, and over a wide range of magnetic fields, up to 140,000 gauss. That's up from 90,000 gauss for the current equipment, which also is limited to use only for superconductor wires.

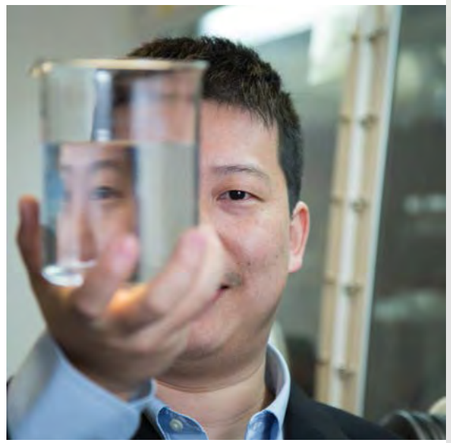
Yan Yao, assistant professor of electrical and computer engineering at the Cullen College, is among the other faculty who will use the new equipment. His research group focuses on green and sustainable organic materials for energy generation and storage. He also is a principal investigator for TcSUH.

"With the addition of PPMS, we will be able to obtain a fundamental understanding of how the transport properties of two-dimensional layered metal chalcogenides are influenced with the change of interlayer distance and the pillar materials," he said. That should offer valuable feedback for an effort funded by the ONR's Young Investigator Program to design better magnesium-ion intercalation materials.

Joseph W. Tedesco, Elizabeth D. Rockwell dean of the Cullen College of Engineering, said the new testing system has the potential to double the number of samples tested each week, in addition to providing a much wider range of information from each test.

"Many of our UH engineers are investigating novel materials with better properties for applications ranging from energy storage to healthcare," Tedesco said. "As the volume of novel materials discovered and tested by UH engineers continues to grow exponentially, so will UH's reputation as the epicenter of materials engineering research and education."





PROFESSOR'S SOFT MATERIALS RESEARCH MAKES COVER OF PRESTIGIOUS JOURNAL

by Elena Watts

The November 2015 inside cover of the journal *Soft Matter* features research conducted by **Pradeep Sharma**, professor and chair of the mechanical engineering department at the UH Cullen College of Engineering, his doctoral student Xiaobao Li and his collaborator Liping Liu of Rutgers University.

Under the umbrella of a three-year National Science Foundation grant, they discovered that altering the quantum field of soft nanostructures could cause significant mechanical deformation.

"It's gratifying that our research is what the editor decided to highlight," Sharma said.

For many years, material scientists have applied mechanical strain to semiconductors to tailor electronic properties for specific purposes. However, most of them did not appreciate that the opposite also holds true – until recently. Research conducted by Sharma's group has shown that this phenomenon is prominent in certain soft nanostructures where very large mechanical strains are achievable.

"So this is relatively new and interesting work, but most importantly we took into account aspects of the phenomenon that no one had ever thought of," Sharma said. "We're now trying to understand the ramifications of this fundamental scientific discovery."

Slight changes to the quantum fields of soft semiconductors, such as polymers, DNA and RNA, can cause drastic mechanical deformations. For example, simply shining light from a distance on a soft nanostructure could activate desired mechanical motion.

"Imagine that I shine a light on a Coke can, and it starts twisting, bending or stretching," Sharma said. "That's what we're talking about in the case of DNA, for example."

The discovery can lead to an enhanced understanding of the charge transport mechanism in DNA, a fundamental scientific question that remains unanswered, as well as to advanced sensor and actuator technologies.

"Being able to remotely trigger something far away would be an asset in the creation of future devices," Sharma said. "Our work caught the eye of the reviewers and editors, so I'm hoping it will be both useful and well-regarded."

> "BEING ABLE TO REMOTELY TRIGGER SOMETHING FAR AWAY WOULD BE AN ASSET IN THE CREATION OF FUTURE DEVICES."

MATERIALS

UH FERROFLUID RESEARCH MAKES THE COVER OF PRESTIGIOUS JOURNAL

by Elena Watts

Research on ferrofluids conducted by **Hadi Ghasemi,** assistant professor of mechanical engineering at the UH Cullen College of Engineering, and his NanoTherm Research Group published last November on the cover of *Applied Physics Letters*.

"I'm delighted that our work was selected for the cover," Ghasemi said. "I credit my doctoral students, Peyman Irajizad and Nazanin Farokhnia, for bringing competence, dedication and enthusiasm to our research project."

Ferrofluids, which contain magnetic nanoparticles, are used in magnetic drug targeting, magnetic hyperthermia cancer treatment and magnetic resonance imaging contrast agents, among numerous other applications. Basically, a magnetic field can remotely manipulate ferrofluids noninvasively in human bodies and experimentally in laboratories. Small volumes of ferrofluids are necessary for most applications, but existing techniques for dispensing such amounts have limitations.

"Microfluidics and acoustic actuation are current approaches to generate small volumes, but they are complicated, and they cannot be implemented for all applications," Ghasemi said. "So we need to generate a much simpler way to dispense ferrofluids."

Ghasemi and his students developed a novel method for dispensing small volumes of ferrofluids by constraining flux with a porous membrane and an inhomogeneous magnetic field. They can dispense a wide range of ferrofluids in quantities ranging from nanoliters to picoliters in single or multiple droplets at different frequencies either continuously or intermittently. They can pause dispensation of the droplets by simply deactivating the magnetic field.

"By tuning the magnetic field and changing the type of membrane, we can change the volume of the ferrofluid dispensed," Ghasemi said. "We can dispense one droplet, two droplets or one hundred droplets in one second."

The group also developed a mathematical model that accurately predicts the volume of the dispensed droplets, which provides potential to rational implementation of ferrofluids in a wide range of applications.

"Our goal is to elucidate fundamentals of thermal-fluid systems at nanoscales and pave the way for breakthroughs in smaller scale devices," Ghasemi said.

> "I'M DELIGHTED THAT OUR WORK WAS SELECTED FOR THE COVER."

SPACE

NASA INVITES SICSA FACULTY TO HUMAN MARS MISSIONS WORKSHOP

by Elena Watts

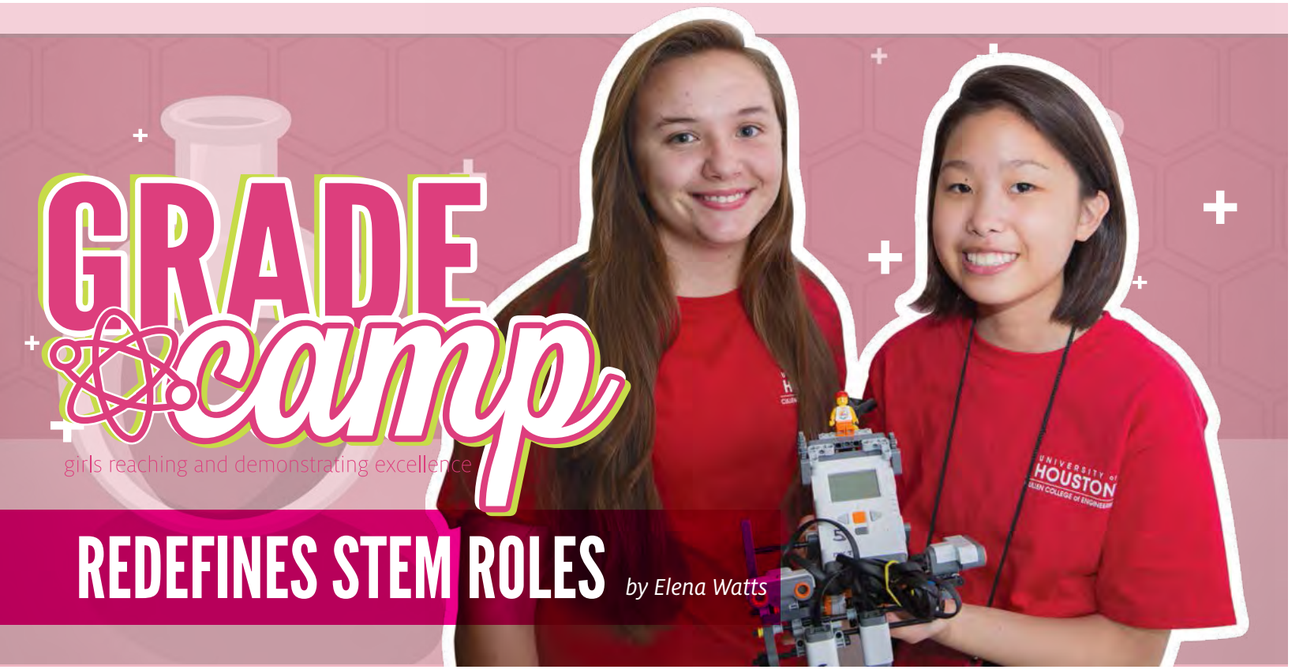
NASA invited Sasakawa International Center for Space Architecture (SICSA) faculty members at the UH Cullen College of Engineering to participate in the First Landing Site/Exploration Zone Workshop for Human Missions to the Surface of Mars. The workshop took place last October at the Lunar Planetary Institute in Houston.

The purpose of the workshop was to identify and discuss exploration zones on the Martian surface where humans can land, live and work. An exploration zone contained the landing site, habitation site and regions of interest. The regions were located within approximately 100 kilometers of the centralized landing site and were relevant for scientific investigation as well as development and maturation of resources necessary to sustain human life.

NASA's Human Exploration and Operations Mission Directorate (HEOMD) and Science Mission Directorate (SMD) intend to use the candidate zones as part of the process to plan exploration of Mars with humans. The immediate objectives are to identify locations that maximize potential for scientific discovery and human life support resources, to develop necessary concepts and engineering systems for humans to conduct work in the zones and to define precursor measurements needed in advance of human missions. Robotic spacecraft can gather data from specific Mars surface sites within the zones to support the activities of the directorates.

"It is anticipated that funding and support for future calls will be available for teams of scientists and engineers to conduct detailed characterizations of the zones that emerge from this workshop," noted Ben Bussey, NASA's HEOMD chief exploration scientist, and Richard Davis, NASA's SMD assistant director for science and exploration, in the invitation. "Input from the science and human spaceflight communities is critical to identification of optimal landing sites for future human missions to the surface of Mars."

Images courtesy of NASA/JPL-Caltech



REDEFINES STEM ROLES

by Elena Watts

Engineering and computer science professions attract fewer women than other STEM (science, technology, engineering and mathematics) fields in the United States. For more than a decade, professors at the UH Cullen College of Engineering have worked to change this longstanding tradition by hosting summer engineering camps strictly for girls.

Since 2002, G.R.A.D.E. Camp – which stands for "Girls Reaching and Demonstrating Excellence" – has introduced approximately 850 girls between the ages of 13 to 17 to the fundamentals of engineering through team-based, interactive activities. Each summer, the Cullen College's two week-long sessions have exposed campers to basic engineering concepts, career options and mentorship opportunities.

"The G.R.A.D.E. Camps inform young ladies about career paths they might not know exist for them," said Fritz Claydon, Cullen College professor of electrical and computer engineering who has also co-coordinated the camp since its inception in 2002.

Providing students with sufficient STEM education early is important because they need strong backgrounds in chemistry and physics to master calculus, which is often the first math course they encounter in college, said Claydon, who also serves as director of both the UH Honors Engineering Program and the Cullen College's Division of Undergraduate Programs and Student Success.

"Those preliminary courses that they take in 8th through 12th grades are so important because they build the foundation so they're well prepared after high school to pursue difficult degrees such as engineering," he continued.

Stuart Long, developer and co-director of the camp who has taught electrical and computer engineering at the Cullen College for more than four decades, said the camp curriculum is a product of many years of trial and error using hands-on activities and project-based demonstrations rather than theories about how students learn. Intervals of short lessons, fun activities and snack breaks have proven the best way to keep the girls engaged in learning.

"We don't put them in a room and lecture to them in hour chunks," Long said. "That's not going to work for anybody."

Problem-solving techniques, teamwork and presentation skills are emphasized during the summer camps. Teams of campers build and program LEGO Mindstorm robots to navigate a maze, and they present their projects to an audience of family and friends on the final day of camp.

"Communication is an important part of being an engineer," said John Glover, Cullen College professor of electrical and computer engineering who has co-directed G.R.A.D.E. Camp since it began. "So they work on their oral presentations – straight-forward explaining of what they did in G.R.A.D.E. Camp."

The campers learn to write computer algorithms by outlining detailed steps necessary to make peanut butter and jelly sandwiches. Among other principles, they learn about voltages, currents, motors and generators during morning classes, and they apply their knowledge to their LEGO Mindstorm robot projects during afternoon labs. Camp mentors help the girls overcome challenges by teaching them debugging techniques rather than giving them answers.

"We don't just tell them what to do in the labs," Glover said. "We switch them into problem-solving mode, so they feel that they – and it's true – solve the problems themselves."

Many campers have commented to Claydon over the years that they wished their schools taught science and engineering principles the way G.R.A.D.E. Camp taught them because they learned so much in one week.

Data suggests that approximately 70 percent of the G.R.A.D.E. Camp alumnae who have graduated from high school chose to pursue engineering in college. Some alumnae have even enrolled at UH and become G.R.A.D.E. Camp mentors.

FINDING THE WOMEN

Women are not adequately represented in engineering classrooms, and the differences between men and women are needed in the field, said Glover.

"Right now, culturally, girls are led to believe that engineering is for boys, so they stay away from it and that doesn't make any sense," Glover said.

Many studies link the scarcity of women in STEM fields to attitudes about gender differences, and some trace the situation back to gender stereotyping that begins with childhood toys. For example, LEGOS Friends sets, currently popular with young girls, place dolled-up female minifigures in stereotypical environments such as hair salons and shopping malls. Yet, advocacy and consumer pressure are slowly changing such cultural norms.

In 2014, LEGOS introduced the Research Institute, a limited-edition set of three female minifigures including a paleontologist, a chemist and an astronomer, which immediately sold out. LEGO Space Port sets also included mould-breaking female scientists and astronauts among their minifigures.

Sluggish recruitment and retention of women in engineering colleges and careers likely result from complex combinations of implicit and explicit cultural, environmental and even biological influences, but job availability and pay rates are certainly not among them.

Last year, *Forbes* published a list of the 20 best-paying jobs for women, which included petroleum, aerospace, and electrical and electronics engineering as well as positions in sales engineering and engineering management. Based on salary, work-life balance and expected employment growth, both mechanical and civil engineering made *U.S. News and World Report's* "25 Best Jobs of 2015" list. *CNN Money's* top 100 jobs, based on pay, 10-year growth potential and work satisfaction, included biomedical, civil, transportation and structural engineering.

In spite of these reports, women account for less than 20 percent of engineers with bachelor's degrees in the United States, according to the National Science Foundation's (NSF) "Women, Minorities and Persons with Disabilities in Science and Engineering" statistics. A paltry 6 percent of those are classified as underrepresented minorities and Asian women. Furthermore, only 25 percent of engineers with master's and doctoral degrees are women.

The 2014 U.S. Bureau of Labor and Statistics' "Women in the Labor Force Databook" lumped engineering and architecture occupations together and reported that only 14 percent of professionals who worked in those fields were women. The bureau also reported that female engineers earned 18 percent less than their male counterparts. Similar percentages of women earned degrees in computer sciences, while women outnumbered men in other STEM fields, such as biosciences, social sciences and psychology.

"If we're looking for ways to find more students to major in engineering, one way is to tap underrepresented sources, such as female students," said Long. "Only 2 percent of female high school students choose to major in engineering in college... so there are large numbers of qualified girls who could be engineers who never see the direction."

STEM OUTREACH

WOMEN INSPIRE WOMEN

Serrae Reed, a mechanical engineering undergraduate student at the Cullen College and co-director of G.R.A.D.E. camp, attended similar STEM camps her sophomore and junior years in high school, which she credits, in part, for her decision to major in engineering.

"At these camps, I had the opportunity to talk to students who were going through classes I was going to be taking soon, professors who were teaching them and women in industry," Reed said.

Reed chose the University of Houston because of the curriculum, the professors and the Honors Engineering Program. In her opinion, dispelling preconceived notions about engineers was G.R.A.D.E. Camp's most important achievement.

"At G.R.A.D.E. Camp, they have the opportunity to see that engineers come in all different shapes and forms, and that they have all kinds of interests," Reed said. "They get to see that women engineers are just as successful as men, and that there's a support system – people who want them to come into this field and people to help them when they arrive."

Women bring different skills to the table. While some might have missed introductions to coding, building and AutoCAD in middle school, they still have the ability to learn those disciplines and to use different ways of thinking to their advantage, Reed said.

Samantha Branum, also an undergraduate student at the Cullen College and camp co-director, said G.R.A.D.E. Camp helps to build the girls' confidence. She most enjoyed watching the skeptical girls transform into enthusiastic participants as they engaged in activities such as the speaker lab. The campers built speakers from Styrofoam plates, magnets and metal wires that they plugged into their phones with auxiliary cords to play music.

"The girls never think it's going to work, and then when it does, it blows their minds, and that's the coolest part," Branum said. "They never knew they could do these things as girls because nobody told them."

While the obvious benefit of G.R.A.D.E. Camp is student recruitment, the unintentional consequence is student retention, Long said. The camp pays about a dozen female engineering students, typically after completion of their freshmen years, to mentor the middle school and high school girls.

"We found that the very act of mentoring the girls changes the undergraduates' attitudes about engineering," Long said. "As a result, they are much more likely to stay in engineering, to do well in their classes and to graduate on time than the girls not involved in the mentoring."

CAMPERS GAIN CAREER INSIGHTS

Devyn Yanello, a 16-year-old junior at Hargrave High School in Huffman, and Kennedi Mitchell, a 14-year-old sophomore at Travis High School in Fort Bend ISD, said they gained better understandings of the many branches of engineering and their respective objectives.

"Overall, I think engineering is just going out and fixing problems, making sure things are done the right way and making sure things are safe," Mitchell said.

The Cullen College offers majors in mechanical, industrial, biomedical, petroleum, chemical and biomolecular, civil and environmental, and electrical and computer engineering. Subsea engineering, materials engineering, aerospace engineering and space architecture programs offer students additional opportunities.

"There are so many different types of engineering, so it's nice to know what each kind does," Mitchell said. "I don't think it's fair for people to assume that women can't do everything guys can do."

Torn between architecture and engineering, Anisha Lal, granddaughter of UH System Board of Regents member Durga Agrawal, also attended the camp to gain clarity about career opportunities. Consequently, she said she is more optimistic about engineering.

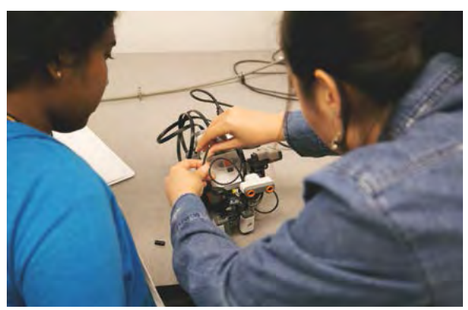
Questionnaires are given to the girls on the camps' opening and closing days and often reveal transformations in their attitudes toward engineering. During their final presentations, they always impress their parents with their explanations of the control theory behind the operation of their robots, Long said.

G.R.A.D.E. Camp was originally funded in 2002 by student tuition and a state grant aimed at increasing numbers of electrical engineering students in Texas. The National Science Foundation (NSF) funded the camps for the next five years followed by several years of support from Houston-area engineering firms.

"The tuition is a small part of the actual expenses," Long said. "And we give scholarships to those with financial need."

Watch our video about the 2015 G.R.A.D.E. Camp at www.egr.uh.edu/grade-camp-2015-video

> "GIRLS ARE LED TO BELIEVE THAT ENGINEERING IS FOR BOYS, SO THEY STAY AWAY FROM IT AND THAT DOESN'T MAKE ANY SENSE."



NSF CAREER AWARD ENABLES PROFESSOR TO DEVELOP 3D ELECTRONICS MANUFACTURING PROCESS

by Elena Watts

Cunjiang Yu, assistant professor of mechanical engineering at the UH Cullen College of Engineering, earned a $500,000, five-year CAREER award from the National Science Foundation (NSF) to continue development of his novel manufacturing process for three-dimensional (3D) curvilinear electronics.

While microfabrication with planar and rigid silicon wafers has been used in conventional two-dimensional (2D) electronics for more than a few decades, manufacturing processes for electronics in 3D curvilinear constructs have not yet been developed. With this NSF CAREER award, Yu will explore a platform for conformal stamp printing and manufacturing technology to provide a practical process for construction of 3D electronics.

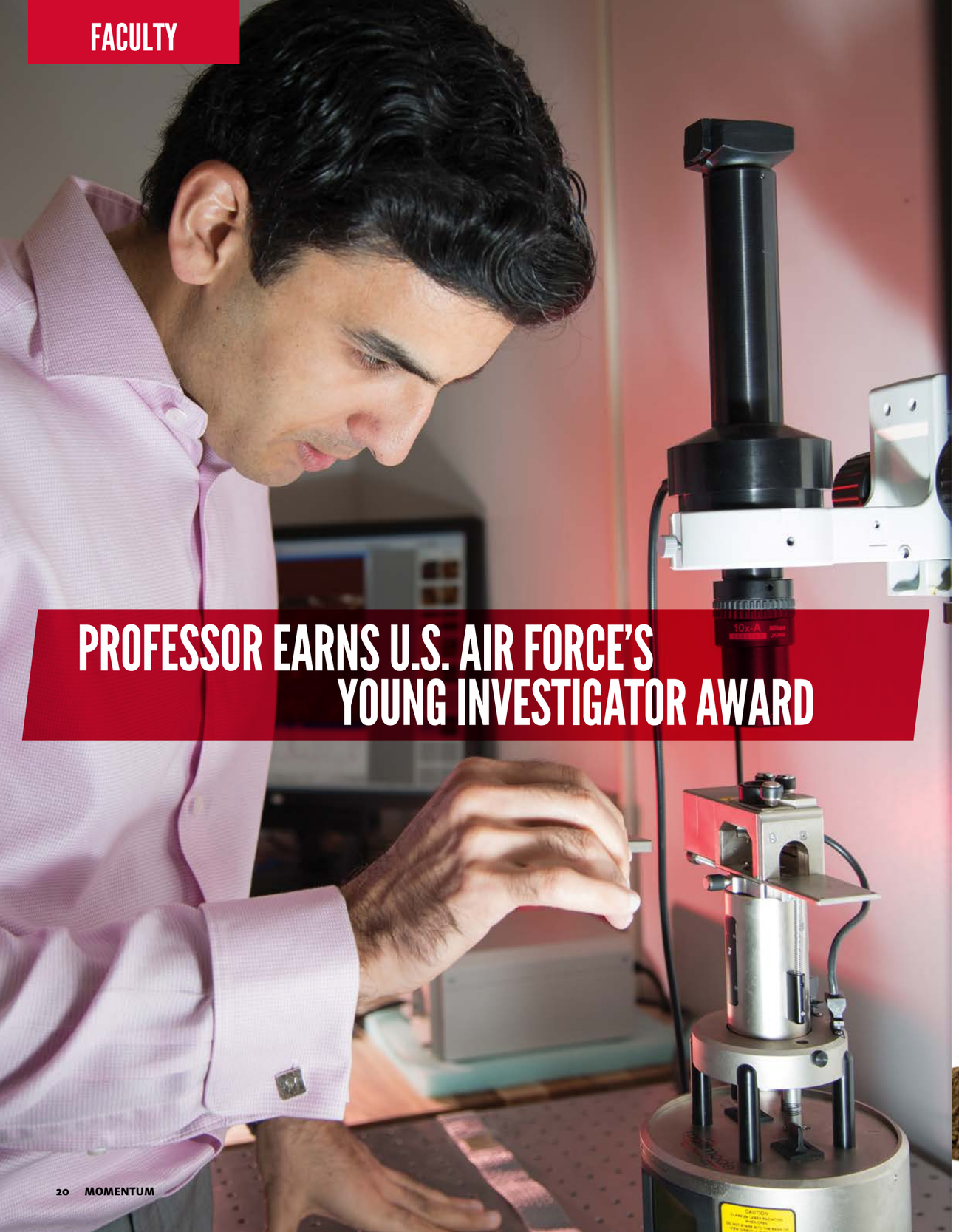
Using a deformable inflated elastomer balloon with a sticky surface, Yu grabs the ink from a conventional planar surface and presses the balloon to a curved or uneven 3D surface until it conforms, thereby printing the ink. The ink endures a safe level mechanical strain during the process and the speed of retracting the balloon determines whether the ink is grabbed or printed.

Yu's five-year project will explore the manufacturing process, study the interfaces between the stamp and the inks, and investigate the deformation mechanics and the pattern distortion of the inks during grabbing and printing.

The award will also support educational and outreach activities, and Yu intends to pursue a variety of avenues. He plans to develop a "3D Curvilinear Electronics Day" workshop for junior high and high school teachers and their students, especially those from underrepresented groups; to promote both undergraduate and graduate research; to develop new courses for engineering students; to incorporate research outcomes into the upcoming manufacturing graduate program at UH; and to disseminate knowledge to the general public.

"A piece of paper cannot conform when wrapped around a sphere, and during manufacturing, the devices need to be geometrically compatible," Yu said. "The elastomer balloon is capable of conformation to most surfaces – flat, curved and uneven – so the pre-fabricated electronics as inks on the balloon need to survive stretching or certain amounts of strain during the lifting and printing steps."

The findings from Yu's research project will remove a major roadblock to 3D curvilinear electronics manufacturing. Potential applications for Yu's novel process include telecommunication, biomedical, solar and camera technologies, among others.



PROFESSOR EARNS U.S. AIR FORCE'S YOUNG INVESTIGATOR AWARD

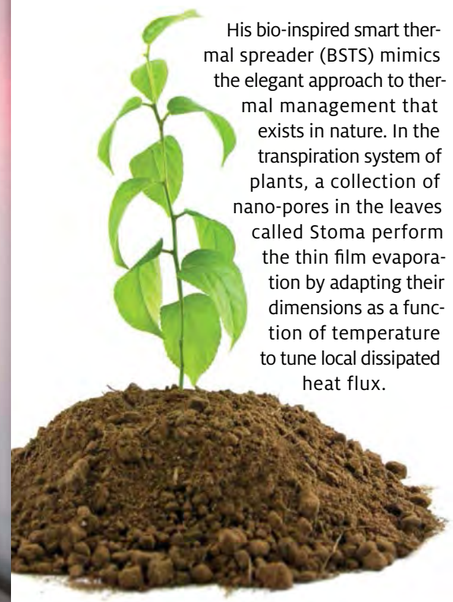
by Elena Watts

Hadi Ghasemi, assistant professor of mechanical engineering at the UH Cullen College of Engineering, earned the Young Investigator Research Program (YIP) award from the Air Force Office of Scientific Research (AFSOR). He is exploring a bio-inspired thermal management system for high-performance electronic and photonic devices with the $360,000, three-year grant.

The U.S. Air Force program supports young scientists and engineers who show exceptional ability and promise for conducting basic research, according to the AFSOR website.

For the last two decades, researchers have consistently developed smaller and higher functioning electronic and photonic devices. However, increased thermal energy generation that results from miniaturization and enhanced function has become a barrier to further advancement.

Currently, one of the most promising approaches to meet future thermal management demands is thin film evaporation. While the current techniques based on this approach manage space-averaged heat flux, they are not capable of addressing instantaneous local hot spots – the main cause of electronics and photonics failure. Ghasemi is exploring a new direction for thermal management that addresses both issues.



His bio-inspired smart thermal spreader (BSTS) mimics the elegant approach to thermal management that exists in nature. In the transpiration system of plants, a collection of nano-pores in the leaves called Stoma perform the thin film evaporation by adapting their dimensions as a function of temperature to tune local dissipated heat flux.

Ghasemi is studying this natural phenomenon to develop next generation thermal management technology for durable electronic and photonic device performance at safe temperatures.

"The interesting point is that the nano-pores adopt their shapes in a smart fashion based on demand – they decrease their sizes at high temperatures, while they increase their sizes at low temperatures," Ghasemi said. "So they tune heat flux through their leaves as a function of temperature."

For this project, Ghasemi will use in situ scanning probe microscopy to study the fundamentals of thin film evaporation in plants both experimentally and theoretically to guide development of his BSTS and to assess its performance.

"Through these studies, we envision a new way for sophisticated design of thermal management systems to accelerate advancements in high-performance electronic/photonic systems," Ghasemi said. "In general, this program will study fundamentals of heat dissipation in natural nano-pores and will implement the lessons in the next generation of smart thermal spreaders."

FACULTY, STAFF MEMBERS HONORED WITH TEACHING, RESEARCH AND SERVICE AWARDS

by Audrey Grayson

Last year, several mechanical engineering faculty and staff members were recognized by the University of Houston and the Cullen College of Engineering for their excellence in teaching, research and service.

In May of 2015, Dean Joseph Tedesco announced the recipients of the 2014–2015 Cullen College faculty excellence awards.

The Fluor Corporation Faculty Excellence award, the college's highest honor, was awarded to **Venkat Selvamanickam**, M.D. Anderson Chair Professor of mechanical engineering. **Gangbing Song**, John and Rebecca Moores Professor of mechanical engineering, received the college's senior faculty research award. Lecturers **Christiana Chang** and **Anastassios Mavrokefalos** and teaching assistant **Christopher Ortega** all received teaching excellence awards from the college.

April Blount, department business administrator for mechancial engineering, received the senior-level staff service awards for over 10 years of outstanding service.

In April of 2015, assistant professor **Ashutosh Agrawal** received the University of Houston's Teaching Excellence Award, an honor reserved for teachers who shine in the classroom and take their lesson plans above and beyond the national standards.

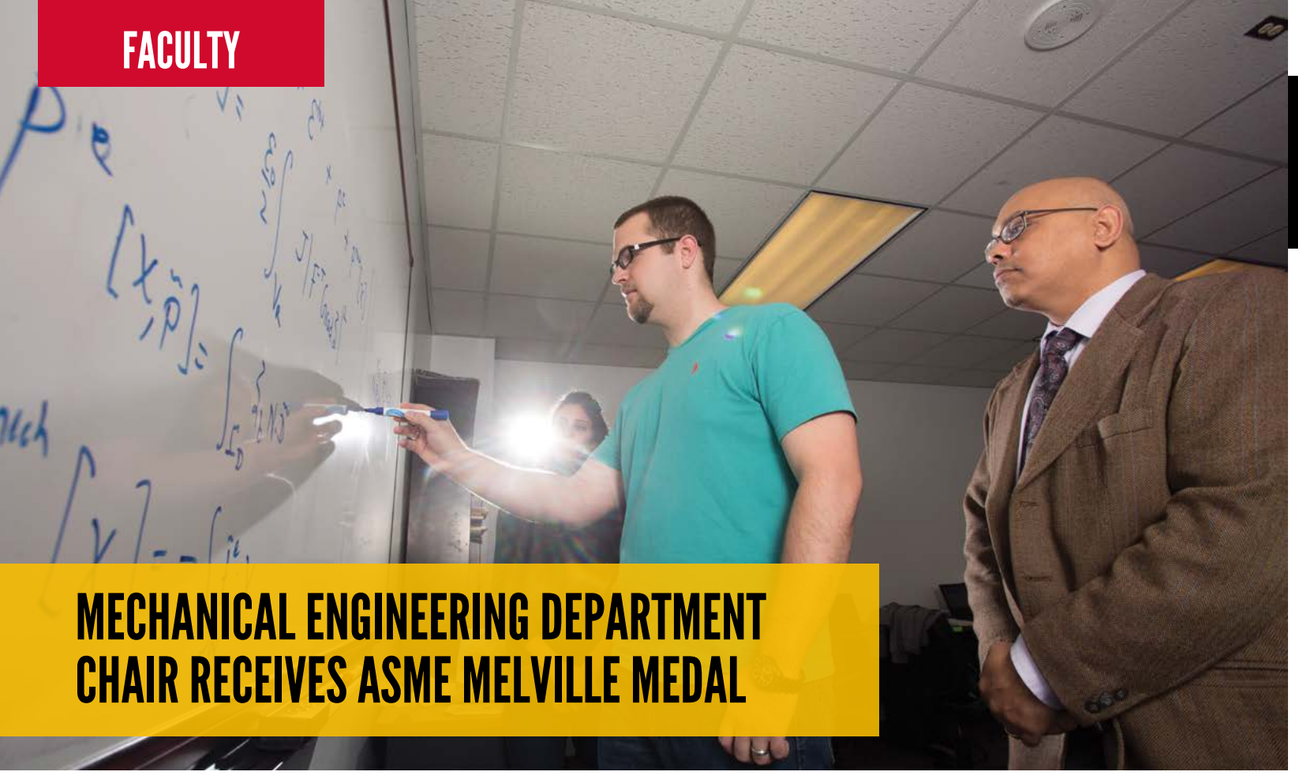
DEPARTMENT WELCOMES WIND ENERGY EXPERT AS NEWEST FACULTY MEMBER

by Audrey Grayson

The UH Cullen College of Engineering recently welcomed **Daniel Araya** as an assistant professor of mechanical engineering.

Araya comes to the mechanical engineering department from the California Institute of Technology where he earned both his M.S. and Ph.D. degrees in aeronautics. Araya also holds an M.S. and B.S. in aerospace engineering from Texas A&M University.

Araya's primary research interests include vortex dynamics, free-shear flows, atmospheric boundary layer flows, hydrodynamic stability, flow visualization techniques, passive flow control, urban wind farming, multi-rotor drone aerodynamics, renewable energy storage, biologically driven flows and space exploration.



MECHANICAL ENGINEERING DEPARTMENT CHAIR RECEIVES ASME MELVILLE MEDAL

by Audrey Grayson

Pradeep Sharma, M.D. Anderson professor and chair of the mechanical engineering department at the UH Cullen College of Engineering, received the 2015 Melville Medal from the American Society of Mechanical Engineers (ASME). The Melville Medal is the highest ASME honor for the best original paper published in a two-year period in any of the 28 ASME journals.

Sharma received the Melville Medal for his paper titled "A theory of flexoelectric membranes and effective properties of heterogeneous membranes," which was published in the *Journal of Applied Mechanics* in January 2014. Co-authors on the paper included Parnia Mohammadi, Sharma's former Ph.D. student, and Liping Liu, professor of mechanics, materials and mathematics at Rutgers University.

Formal presentation of the award took place at the 2015 International Mechanical Engineering Congress and Exposition held last November in Quebec, Canada.

Flexoelectricity is a phenomenon whereby certain materials produce electricity when bent, stretched, or otherwise exposed to mechanical strain. Although flexoelectric qualities have been observed in many materials over the years, there was no mathematical framework to explain how it worked in two-dimensional materials such as biological membranes or graphene.

Sharma and his collaborators developed the first-ever mathematical model to describe flexoelectricity in 2D materials, providing a framework for understanding how a material's mechanical behavior is linked to its electrical behavior.

"The mathematical theory we created has all kinds of interesting applications," Sharma said. "There's an entire class of 2D materials that have become very important to us technologically, and our model can be used for many applications that will not show up until much later on."

Examples of two-dimensional materials include graphene and molybdenum disulphide, both of which are just one atom thick, Sharma said. The membranes surrounding human biological cells are also a type of 2D material, he added.

The mathematical model developed by Sharma and his collaborators can be used to further understand biological membranes, such as those responsible for hearing.

"In order for our hearing mechanism to work, the membranes of ear hair cells must convert mechanical motion into an electrical signal," Sharma said. His post-doctoral researchers and a Ph.D. student are currently applying the mathematical theory to understand the human hearing mechanism.

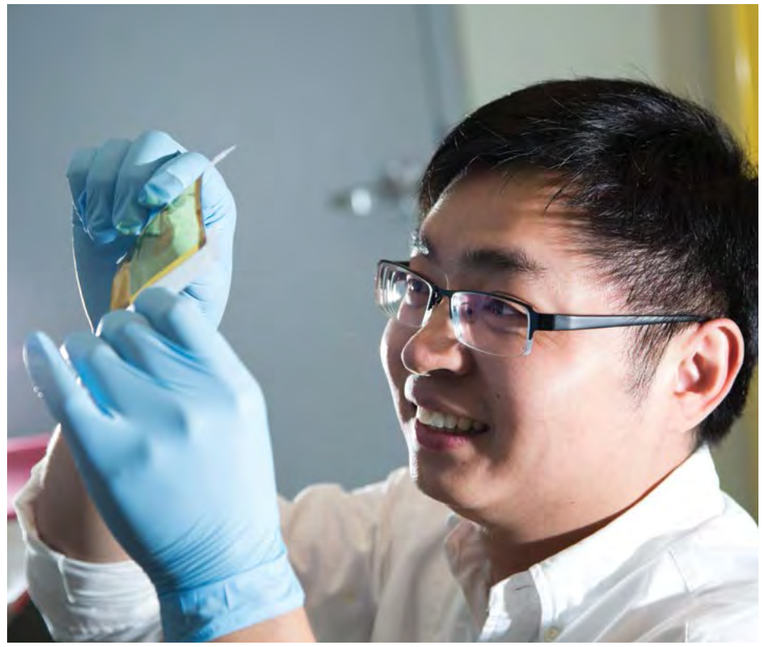
Sharma also detailed potential future applications of the mathematical model, including energy harvesting. For example, the motion of a heartbeat could someday be converted into electrical power and used to power a nanosensor or an implanted pacemaker.

The paper has been cited more than 10 times In the past year, but Sharma believes the mathematical model his team developed will be relevant to researchers for many years to come.

"We anticipate many future applications," he said.

UH ENGINEER WINS AMERICAN VACUUM SOCIETY'S PAUL H. HOLLOWAY YOUNG INVESTIGATOR AWARD

by Audrey Grayson



Cunjiang Yu, assistant professor of mechanical engineering, is the 2015 winner of the American Vacuum Society's (AVS) Thin Film Division Paul H. Holloway Young Investigator Award. In addition to a cash prize, Yu was presented his award at the 62nd AVS International Symposium & Exhibition last October.

The award honors young scientists who have contributed outstanding theoretical and experimental work in an area related to thin films. Yu received the award for his significant contributions in the areas of flexible, stretchable and wearable electronics.

"I'm very honored and grateful to receive this award," Yu said. "I feel like it is a vote of confidence for my research. This award will spur me to work harder to make more contributions to the scientific community."

Thin films are commonly used in electronic semiconductors and optical coatings, such as the metal coating placed on glass to create a reflective mirror. Now, researchers across the world are racing to perfect a new application for thin films: stretchable, bendable and wearable electronics.

Yu was among the group of researchers to first begin developing flexible, stretchable and wearable electronics – an endeavor that began in 2007 while he was earning his Ph.D. in mechanical engineering from Arizona State University.

In order to move away from the hard, bulky electronic components of modern computers, such as silicon chips and circuit boards, Yu developed novel, ultrathin silicon devices printed onto soft, polymer substrates. Yu's thin film electronics are only 1 micron thick – about 50 times thinner than a single strand of human hair. One of the goals of his research group is to develop thin, bendable and stretchable electronics with an electrical performance equal to current hard electronics.

Since 2009, Yu has published more than 20 articles in major scientific journals about his thin-film-based flexible, stretchable and wearable electronics.

"We want these wearable electronics to be everything-in-one. We want them to power other electronics, such as your cell phone or iPad, but we have also integrated them with sensors so that they can monitor the users' overall health and internal processes and display that information in a very user-friendly way," Yu said.

The eventual goal, Yu said, is to take these ideas out of the laboratory and into the consumer market.

"It's an extremely exciting area to be working in," Yu said. "The wearable electronics we're developing can be commercialized and brought to market in the near future."

For Yu, seeing a technology he developed make a real impact on people's lives would be a dream come true.

"For researchers and professors, one of the goals is to see their research have real impact. That's why I chose this area in particular – this can make a real difference and have a real application in everyday life. My students and I are all excited about this," Yu said.

Yu earned his B.S. in mechanical engineering and M.S. in electrical engineering from Southeast University in China. Prior to joining the UH Cullen College of Engineering faculty in October of 2013, Yu was a post-doctoral researcher in the materials science and engineering department at the University of Illinois, Urbana-Champaign.

The Paul H. Holloway award is named after the University of Florida professor who has a distinguished and continuing career of scholarship and service to AVS.

UH STUDENTS BUILDING FORMULA ONE-STYLE RACECAR

by Natalie Thayer

Though the Society for Automotive Engineers (SAE) once boasted an active University of Houston student chapter, the organization has been dormant on the UH campus for several years. Now, a group of dedicated Cullen College of Engineering students is bringing the student organization back into the fast lane – literally.

The UH Engineering students responsible for reviving SAE are designing and building a Formula One-style racecar from the ground up to compete in the Formula SAE Series (FSAE) races. The FSAE Series are part of the society's annual Collegiate Design Series, which encourages students from around the world to "go beyond textbook theory" by designing, building and racing a real vehicle, according to the organization's website.

> "[WE] HAVE WHAT MANY OTHER UNIVERSITIES' STUDENTS DON'T – AND THAT'S LIFE EXPERIENCE."

DESIGN PROJECT

The new UH SAE group, led by mechanical engineering students **Jacob Gallery**, **Shibly Abughazaleh** and **Grant Mottershaw**, is in the midst of a busy year. Last semester, the students began manufacturing the team's Formula One-style racecar at UH's Texas Center for Clean Engines, Emissions and Fuels (TxCEF) to enter the 2016 competition in Lincoln, Nebraska.

The FSAE competition has several vehicle divisions, including internal combustion engines, electric and hybrid vehicles, and includes two stages of testing. The first stage is comprised of rigorous design and safety tests, including tilt and braking tests. Only vehicles that pass the static tests move on to compete in the races.

The racing portion, also called the dynamic event, includes straight line acceleration, autocross and endurance challenges. For Gallery, the new UH SAE president, this is where the greatest excitement lies.

"If we can make it to the dynamic event, I'll be crying tears of joy," he said. "Sitting in the cockpit, flipping the glass down on the helmet and waiting for that green flag — that will be everything."

In the meantime, the UH FSAE team has built their internal combustion engine vehicle for the competition and is building the car's body and framework this spring.

NEW BEGINNINGS

Abughazaleh, UH SAE co-chair and treasurer, first began looking into SAE when he transferred to the Cullen College's mechanical engineering department two years ago. Despite the lack of a formal SAE organization, he sought out fellow students who shared his passion for automotive engineering and, with that, set the wheels in motion for the UH SAE revival.

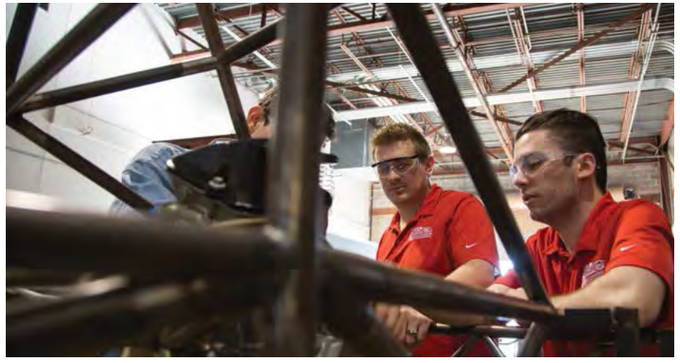
Abughazaleh connected with fellow Cullen College student Gallery early on. Gallery said he was immediately interested in the project after talking to Abughazaleh and was excited to join the organization at the ground level. In addition to leading the UH SAE as president, Gallery supports the team as the chief engineer on the FSAE design project.

Recognizing that the burgeoning UH SAE organization would benefit from focused fundraising efforts, Mottershaw approached Gallery about joining the organization's leadership team. As the UH SAE's co-chair and business development lead, Mottershaw is responsible for operations, financial management and new member recruitment.

The excitement surrounding the racecar design project is palpable. The process of turning concepts into realities, Mottershaw said, is a motivating force on its own. Yet, the mission of UH's SAE chapter extends beyond this year's car design. The organization aims to foster interdisciplinary collaboration, innovation and camaraderie across the UH campus and the Houston community, said Gallery.

Currently, the FSAE team is composed of students from various backgrounds and disciplines including mechanical, electrical and civil engineering, as well as architecture, industrial design and computer science. Gallery also said that by encouraging diversity amongst its members, the group is trying to promote an interdisciplinary effort by "[bringing] together a community where it's not only engineers, but it's everybody you would expect to see or work with in the future."

Gallery added that he believes University of Houston students are uniquely equipped to take on the challenge of building a winning racecar. "You have a number of people at this school that have what many other universities' students don't — and that's life experience," he said.



UH ENGINEERS WITHOUT BORDERS STUDENTS BUILD SCHOOLHOUSE IN NICARAGUAN VILLAGE

by Natalie Thayer

Last summer, five students from the University of Houston's Engineers Without Borders (EWB) student chapter traveled to the rural Nicaraguan village of Telpochapa to construct a schoolhouse from the ground up.

The trip took place last August and was the final implementation stage of a long-term EWB project that began six years ago. UH Engineering students **Ishan Chakrabarty**, **Conner Judson**, **Rafi Mohammed**, **James Schouten** and **Ayesha Sohail** were joined by Jody Muniz, a professional engineer who served as their industry mentor, and Juan Guzman, a mechanical engineering office assistant at UH who served as their translator.

Engineers Without Borders is an international non-profit humanitarian organization that partners with developing communities worldwide in order to improve their quality of life. The University of Houston's student chapter was established in 2006 with the goal of designing and implementing sustainable solutions for communities in need, both locally and globally. The UH EWB chapter is open to students of all majors and encourages interdisciplinary collaboration and problem solving.

Located in a remote region of the country, the village of Telpochapa sits in a valley and is only accessible by unpaved roads. Just to arrive at the work site, the UH team had to navigate difficult terrain in a 4x4 truck. The remote location and tough terrain made coordinating material deliveries a surprising challenge.

Several trips by a semi-truck were required to bring all of the materials from the nearest participating hardware stores to the worksite. During those trips, the semi-truck blew out several tires and lost its headlights.

As all of the materials arrived, Chakrabarty, Judson, Mohammed, Schouten and Sohail had their work cut out from them. Only the concrete foundation for the schoolhouse had been laid by a previous UH EWB travel group; the rest of the structure remained to be built. The students, eager to get their hands dirty, set to work mixing and pouring concrete, moving cinderblocks and shoveling an entire trailer's worth of rocks at the construction site. They were also joined by local construction workers and skilled laborers who provided guidance throughout the project.

"Honestly, the attitude of the group was that we wanted to help in a hands-on way," said Schouten, who served as the project manager on the trip.

Telpochapa's residents had requested help from EWB because the foundation of the previous schoolhouse had eroded, making the school unstable and unsafe. The new one-room schoolhouse was designed by EWB to withstand a 6.5 or 7.0 earthquake, as well as 150 mile per hour winds. The students also implemented additional reinforcements onsite to ensure long-term structural stability, strength and safety.

"Being able to help the village get a school where their children are safe and being able to show the community that we genuinely care was the most rewarding part of the experience," said Judson, who served as co-project lead on the trip.

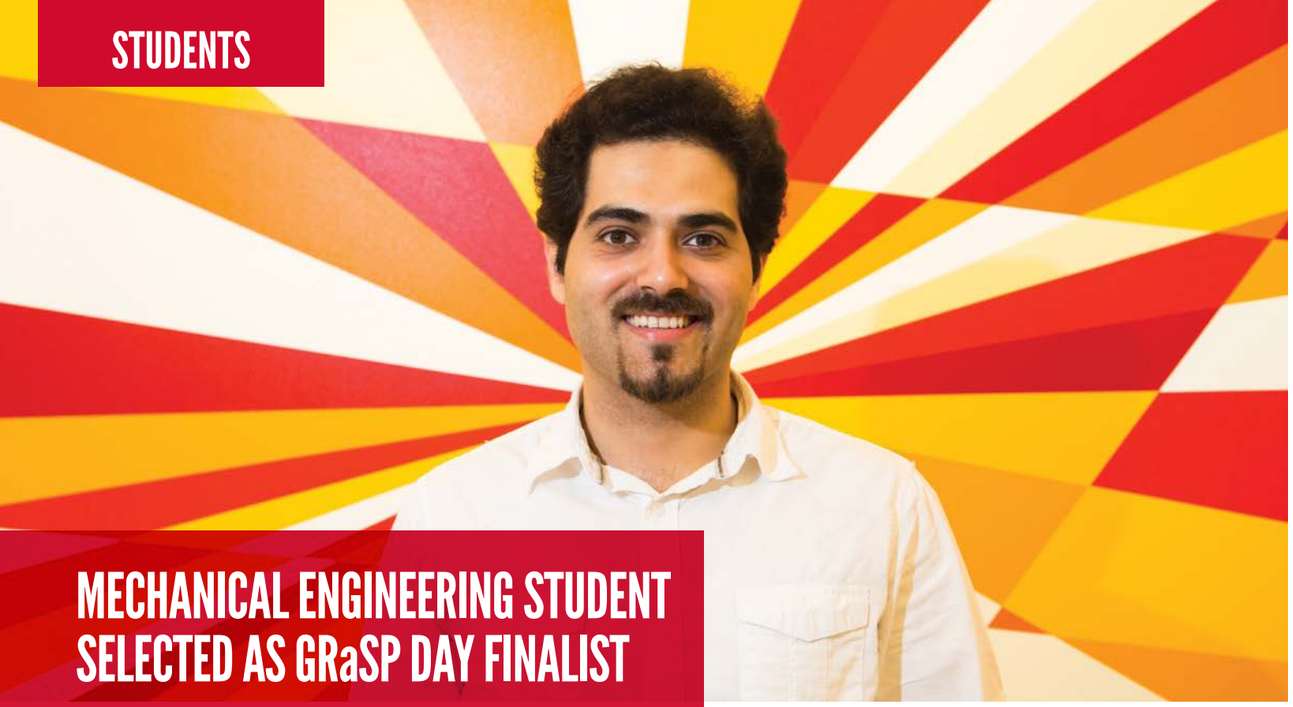
Seeing how the local children responded to the group's effort was another big reward, the group members agreed.

"You'd see their curiosity and awe and happiness," said Schouten. He added that Sohail, the only female member in the group, made a huge impression on the children.

"The kids all gravitated toward Ayesha. The girls didn't take their eyes off her and, near the end, they even wanted to help," said Schouten.

Although the schoolhouse project came to a successful completion by the end of their trip, UH's EWB chapter isn't slowing down their efforts to give back to other communities. The group is now in the early stages of planning the next project, determining the destination of the next trip and carefully researching how best to apply their efforts to future endeavors.

The UH EWB chapter has more than doubled in size this school year, and the student leaders are seeking input from current members to determine the scope and details of their next project. Judson, who is taking on the role of project lead this year, said that "because this is the start of a new cycle, we want to find out what projects are meaningful to our members."



MECHANICAL ENGINEERING STUDENT SELECTED AS GRaSP DAY FINALIST

by Natalie Thayer

The University of Houston's Graduate Research and Scholarship Projects (GRaSP) Day offers students the opportunity to network and introduce their research to a wide audience through oral and poster presentations. GRaSP Day celebrates the research, scholarship and creative endeavors of UH graduate and professional students across all disciplines.

This year, mechanical engineering doctoral student **Peyman Irazijad** was selected as a GRaSP Day finalist. He was invited to give an oral presentation about his research to the GRaSP audience last October.

A member of the NanoTherm Research Group led by his faculty advisor Hadi Ghasemi, Irazijad's research explores the fields of thermodynamics, heat transfer and nanotechnology. At GRaSP Day, he presented his work on dispensing nano-pico droplets of ferrofluids, which was recently featured on the cover of the November 2015 issue of *Applied Physics Letters*.

Though the potential benefits of this research are multifaceted, Irazijad said he believes his work has the potential to benefit the medical community in particular.

By combining drugs with ferrofluids, which contain magnetic nanoparticles, medical professionals may be able to more accurately control the delivery of drugs to a specific site in the body. This would provide the potential to decrease the amount of drugs needed and, simultaneously, increase the effectiveness of drug treatments for patients, he said.

Irazijad added that the device he works with is small, inexpensive and lightweight. These factors further contribute to its benefits, making it potentially viable for spacecraft and medical applications.

MECHANICAL ENGINEERING PH.D. STUDENT WINS PRESTIGIOUS TEACHING FELLOWSHIP

by Natalie Thayer

Mechanical engineering Ph.D. student **Christopher Ortega** was awarded the American Society of Mechanical Engineers (ASME) Graduate Teaching Fellowship for the 2015-2016 academic year. The fellowship, awarded by the ASME Board on Education to outstanding mechanical engineering Ph.D. students interested in an academic engineering career, supports his current studies and provides a full teaching assistantship in the department.

Ortega, a native Houstonian, is the not only the first University of Houston student but also the first Latino to be awarded the fellowship in the 23 years of its existence. After attaining his bachelor's degree in mechanical engineering from UH in 2012, he was admitted into the Cullen College's mechanical engineering doctoral program. Ortega has been an active member of ASME since 2009, participating in both the local UH ASME student organization and the South Texas Section. He is also the founder of the UH ASME student section's Intro to Cougar Engineers Program, an educational outreach event that introduces over 400 local high school students each year to engineering principles through a design competition.

Ortega comes from a family of UH alumni and is proud to carry on the legacy of representing the University of Houston.

DOCTORAL STUDENT HONORED WITH CULLEN COLLEGE'S BEST DISSERTATION AWARDS

by Natalie Thayer

A mechanical engineering doctoral student in the UH Cullen College of Engineering received the college's Best Dissertation Award for fall 2015.

Nikhil Walani was selected as one of this year's winners based on the originality and importance of the research presented in his dissertation defense, as well as his potential to make significant contributions to the future of the discipline.

Under the guidance of his faculty advisor, assistant professor of mechanical engineering Ashutosh Agrawal, Walani explored how nutrients and other molecules are transported across the membranes of biological cells, and the role that proteins play in this process. His dissertation was titled "Mechanics of Cellular Transport."

Walani, who earned his undergraduate degree in civil engineering, said he was drawn to mechanical engineering at the University of Houston because he wanted to study the fundamentals that govern the behavior of materials.

"I went from working with structures designed on a macro scale, where the measurements are in tens of meters, to exploring structures at the subcellular level, where most of the measurements are in nanometers," he said. "By this change of scale, I've gained a new perspective on the physics of structures. It's been fascinating."

Cells are surrounded by a membrane, which serves to protect the DNA and other organelles within the cell. In addition to forming a barrier, cell membranes allow for transport of essential proteins, ions and other nutrients across them. For the transport of nutrients and molecules, or cargo, that cannot penetrate this membrane, a specific set of proteins from the interior of the cell is called to action. These proteins drive the deformation of the membrane, causing it to wrap around the cargo, fuse at the neck and detach from the parent membrane, thereby creating a sealed vesicle to transport the cargo to various organelles inside of the cell.

Walani and Agrawal's research focused primarily on understanding the cellular transportation processes involving the protein clathrin, which plays a primary role in the formation of coated vesicles in eukaryotic cells.

This research has the potential to contribute to the future of engineering through biomedical applications, Walani said, because it provides scientists and engineers with more information about the specific roles of each protein involved in the cellular transportation process.

"By understanding how proteins behave in different mechanical environments, drug designers can develop more effective drugs because they can tailor the drugs accordingly," he said.

Walani was recognized at the fall 2015 convocation ceremony and received a plaque and honorarium of $1,000.

STUDENTS SWEEP FIRST UNIVERSITY TECHNICAL COMPETITION

by Melanie Ziems

Last April, the American Society of Mechanical Engineers (AMSE) hosted the first ASME South Texas Section "University Technical Competition" (UTC) for local student engineers to exhibit their research and compete for awards. The event took place at Rice University, but students from the University of Houston Cullen College of Engineering swept many of the categories, taking home several awards.

In the undergraduate research category, Alan Garcia, Ethan Windish, Daniel Camacho and Mitul Patel won with their Cameron-sponsored capstone design project, "Cold Temperature Effects on Elastomers." Additionally, Ph.D. candidate Sonika Gahlawt won the graduate research category with her presentation, "Understanding Elastic and Flexure Behavior of Half-Heusler Thermo-electric Materials."

"Quadcopter," a capstone design project by Carlos Arocha, David Marquise, Sarmed Omran and Quentin Walker, won the undergraduate design category. Ala E. Omrani also received an award in the subsea engineering category for "Hydromechanical Modeling to Cope with Gas Volume Fraction during Artificial Lift."

Li Sun, associate professor of mechanical engineering at the Cullen College, serves as the ASME advisor for the UH chapter and also advised the undergraduate research team. "This competition provided both undergraduate and graduate students a great opportunity to showcase their talent and knowledge among their peers as well as industrial experts," he said.

According to Sun, opportunities like the UTC are a rare chance for students to exhibit their research. "Such a platform is very much in need considering the nature of the mechanical engineering career and the reality that students rarely get opportunities to demonstrate their achievements. Our ASME students show tremendous interest and enthusiasm in the diverse competition category and they were very excited to have the opportunity to communicate with fellow students from other universities and industrial professionals."

Students from UH swept four of the five categories, and each category award carried with it a $1,500 prize. The event was organized by Ed Marotta of GE Oil and Gas, who said he was impressed with the UH Engineering students who competed in the event.

"The University of Houston students did show great fortitude and enthusiasm in their preparation and participation in the event, which translated to a great showing by them," he said.

MECHANICAL ENGINEERING STUDENT RECEIVES 2016 OUTSTANDING JUNIOR AWARD

by Natalie Thayer

With an enrollment of more than 3,000 hard-working and dedicated undergraduate students, finding ways to shine among a sea of overachieving students is no small task. This year, mechanical engineering student **Tam Nguyen** was named the college's outstanding junior. Hamdi Sherif, a mechanical engineering senior, was named the department's outstanding senior.

The Cullen College's outstanding students were recognized at the Outstanding Student Recognition Luncheon, hosted by the Texas Society of Engineering at Prairie View A&M University on Feb. 23, 2016.

Nguyen, who describes herself as a lifelong learner, said she was drawn to the Cullen College's mechanical engineering department because she enjoys solving complex problems and working with mechanical systems.

"When I see a problem with something in daily life, I often think about ways to solve or improve it," she said. "I find the process of finding a solution very gratifying."

As she embarks on her second semester as a junior at UH, she has a wealth of research experience behind her, a handful of distinguishing accolades on her resume and a summer internship at Shell on the horizon.

Last summer, she was a recipient of the 2015 Summer Undergraduate Research Fellowship (SURF) at the University of Houston. During the 10-week fellowship, she studied how chaos theory causes inaccuracies in weather prediction over a long period of time. Going beyond the SURF requirements, she also built a Lorenz waterwheel to demonstrate characteristics of her research.

However, it was in her faculty advisor's lab that Nguyen found her true passion. Since 2014, she has worked as a research assistant studying nanomaterials for lithium-ion batteries with Haleh Ardebili, Bill D. Cook assistant professor of mechanical engineering.

Lithium-ion batteries have various everyday applications and play an integral role in many people's day-to-day lives, powering everything from cell phones and electric vehicles to energy storage systems and even hoverboards. However, some lithium-ion batteries carry major safety concerns, including a high risk of flammability, as evidenced in recent cases of exploding hoverboards.

"Hoverboards explode because lithium batteries are not as safe as they could be, but we want to improve them," she said. "I want to make batteries that are safer, last longer, are more affordable and have better storage capabilities."

Nguyen said she plans to pursue a doctoral degree in mechanical engineering with an emphasis on nanomaterials to further her current research.

When she's not studying for classes or working in the lab, Nguyen can be found with her "second family" at the UH Society of Asian Engineering Students (SASE), an organization for which she serves as president. She also strives to become a bona fide "foodie" in the dining-out mecca that is Houston.

When asked what the secret to her success is, Nguyen said: "Dedication! I always try to put in my best and avoid doing just the minimum to get by."

SCHLUMBERGER FOUNDATION HONORS MECHANICAL ENGINEERING PH.D. WITH FELLOWSHIP

by Melanie Ziems

The need for female professionals in STEM industries is overwhelming, and the data is similarly dismal for underrepresented minorities, according to the 2015 National Science Foundation report "Women, Minorities and Persons with Disabilities in Science and Engineering." **Himani Agrawal,** a Ph.D. student studying mechanical engineering, recently won a fellowship to help change those statistics.

Agrawal was awarded the Schlumberger Foundation Faculty for the Future Fellowship, an award for female Ph.D. and post-doctoral students from developing countries studying science, technology, engineering and math (STEM) subjects. The fellowship, valued at $50,000, is only awarded to 5-6 percent of applicants who apply from around the world, and applicants must illustrate a commitment to inspiring young women to pursue studies in STEM. This is the first time a University of Houston student has been awarded the fellowship.

The fellowship application included five rigorous rounds and an interview with the Schlumberger Foundation Board of Trustees.

"This fellowship means a lot to me," Agrawal said. "I'm hopeful the support of the Schlumberger Foundation will help me a lot in getting a post-doc position after I finish my Ph.D." She added that part of her academic success has come from outside the classroom. "You can't focus only on academic excellence, you must also focus on extracurricular activities, especially outreach."

Agrawal is a graduate committee member of the Society of Women Engineers UH chapter, a group which hosts several outreach events throughout the year.

Learn more about the Schlumberger Foundation at https://www.fftf.slb.com

UH TEAM WINS THE TEXAS ENERGY INNOVATION CHALLENGE

by Jeannie Kever

Graduate students from the University of Houston won top honors in the Texas Energy Innovation Challenge with a plan to harness geothermal energy to treat water produced during hydraulic fracturing.

The competition, held last May in Austin, featured five teams of graduate and professional students from across the state, tasked with researching and developing the most creative and cost-effective use for water produced from the hydraulic fracturing of wells.

As the first-place winner, the UH team won $10,000 in scholarship funding. Each team was made up of graduate students from engineering, business and law; the other teams were from Texas A&M University, the University of Texas at Austin, UT-El Paso and Texas Tech University.

Hydraulic fracturing uses sand, water and chemicals, pumped at high pressure into a well, to fracture the dense rock formations and release oil and natural gas, with millions of gallons of water returning to the surface along with the oil or gas. There is a growing desire to recycle or reuse that water, although the cost has kept many companies from doing so. Most inject the water into disposal wells.

But concern about disposal wells – studies have linked wastewater disposal to small earthquakes, and many shale plays are in water-scarce regions – has spurred a search for new ideas.

The competition was sponsored by Power Across Texas, with a panel of judges from the energy industry.

UH team members, using the name GeoThermH2O, proposed to harness geothermal energy from decommissioned wells to reduce the cost of water treatment.

Team members included Amin Kiaghadi and Rose Sobel, both Ph.D. candidates in environmental engineering, Shanisha Smith, a lawyer who just completed a Master of Law degree, and Varun Sreenivas, an MBA student specializing in energy finance and the energy supply chain.

Faculty advisors included Hanadi Rifai, professor of civil and environmental engineering; Zachary Bray, assistant professor of law; Radha Radhakrishnan, clinical assistant professor in decision and information sciences; and Konstantinos Kostarelos, associate professor of chemical and biomolecular engineering. Executives from Houston-based Rockwater Energy Solutions served as industry mentors.

The team's research found that while membrane and distillation technologies provide the highest quality water treatment, both require huge amounts of energy, making treatment more expensive than disposal.

Under their plan, a closed loop system using a small volume of freshwater would be recirculated in the decommissioned well to power a desalination unit, capable of cleaning and recovering about 70 percent of the water. That treated water could become an inexpensive, drought-resistant source of water for agricultural and nonpotable municipal use.

The team also called for tax credits for water recycling and increasing the cost of disposal as a way to spur the use of the new technology.

MECHANICAL ENGINEERING STUDENTS EARN COVETED NASA RESEARCH FELLOWSHIPS

by Audrey Grayson

Two Ph.D. students in the Cullen College's department of mechanical engineering received highly coveted NASA Space Technology Research Fellowships. The fellowships cover the costs of their education from August 2015 to August 2016.

Andrew Robertson (advisee of Ken White) and **William Walker** (advisee of Haleh Ardebili) both received the prestigious fellowships. According to mechanical engineering department chair Pradeep Sharma, no Cullen College student has earned the status of NASA Space Technology Research Fellow in decades – let alone two in a single year.

For the past three years, Robertson has been working closely with White to study the bonding mechanisms in structural coatings. Structural coatings are used to preserve a variety of industrial, marine and commercial structures and components. The weakest part of any structural coating is the strength of the bond made with the substrate, and Robertson said that studies focusing on this area are particularly relevant for space applications.

"This topic is important to NASA because of their extensive use of coatings," Robertson said. "Rather than being applicable to only one type of coating, my research can be applied to any kind of coating to maximize its functionality and that's why I believe my application was selected."

In addition to the relevance of this research to NASA, White said Robertson was chosen to receive the fellowship because of his aptitude in explaining his work.

"I feel that the NASA selection committee recognized his intellectual capacity and maturity in presenting his research topic," White said.

Having the opportunity to work on research with real-world applications throughout his undergraduate and graduate student career has helped to set him apart as an engineering student, White said. "I have seen his creativity grow in response to the challenges of his advancements through our program, first as a fast track undergraduate, then as a first-time graduate student," he said.

Working with Ardebili, Bill D. Cook assistant professor of mechanical engineering, Walker's project focused on the thermo-electrochemical analysis of lithium-ion (Li-ion) batteries for space applications.

"This is a critical topic because the batteries currently used in the International Space Station and for other space related applications are transitioning to lithium-ion batteries, and the evaluation of their safety and thermal, electrochemical performance is imperative," Ardebili said.

Walker is developing computer models to predict the thermal performance of lithium-ion batteries during nominal operations and during thermal runaway scenarios. Walker carefully designs experiments to complement his computer models with real world results. Together, Walker and Ardebili published their results in the *Journal of Power Sources* in 2014 and plan to publish a second paper in the near future.

"His NASA fellowship is very well-deserved and will allow him to focus his time and efforts on this critical research for space applications," Ardebili said.

Walker agreed with Ardebili, adding that the fellowship will allow him to become an expert in the use of lithium-ion batteries for space applications.

"I was selected to take coursework and research hours that will enable me to become an expert in testing and analyzing thermal aspects to lithium-ion batteries with respect to understanding and preventing thermal runaway and thermal propagation," Walker said.

ALUMNUS HOSTS STEAM OUTREACH EVENTS FOR HOUSTON STUDENTS

by Audrey Grayson

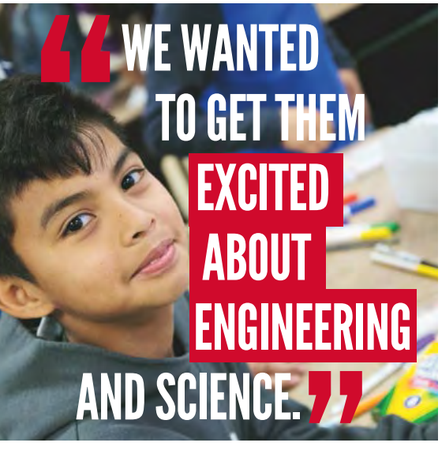
As the son of a migrant farm-working mother and an Air Force veteran father, **Reynaldo Guerra** said his path to pursue an engineering degree at the University of Houston came about by chance.

In his junior year of high school, Guerra was failing out of his math classes and, as a result, was kicked off of the basketball team. Motivated by his desire to continue playing basketball, Guerra said he began practicing his math skills as hard as he practiced his basketball skills. It didn't take long before Guerra realized he was not only good at mathematics – he actually enjoyed it.

"We are absolutely in need of engineers and scientists in this country, and especially in the city of Houston," Guerra said. "But when you go into some of the schools in low-income areas of Houston, you see that most of these kids have never met a scientist or engineer before. Some of them have never even heard the word 'engineering' in their lives."

Guerra graduated from the UH Cullen College of Engineering in 2003 with a bachelor's degree in mechanical engineering. As a student at UH, Guerra was involved in the student organization MAES, which then stood for Mexican American Engineers and Scientists. Guerra and his MAES classmates took it upon themselves to inspire more students into pursuing STEM careers by organizing events at Houston-area schools to introduce K-12 students to tough engineering concepts with fun, hands-on projects.

"We would try to be mentors to local elementary and high school students," Guerra said. "We wanted to get them excited about engineering and science and to try to get them to come pursue those fields at the University of Houston."



Since graduating from the Cullen College, Guerra has enjoyed a successful engineering career. He currently serves as the senior LNG proposal development engineer at Dresser-Rand, and has held previous positions at NASA, Accenture and ExxonMobil. But the drive to continue inspiring Houston students to pursue STEM fields never left Guerra, and he eventually reached out to his former UH classmates to reignite their STEM outreach efforts in local schools.

Guerra and his former classmates soon formed Camp STEMovation, a nonprofit organization dedicated to bringing STEAM (science, technology, engineering, art and mathematics) workshops and activities into Houston-area schools in low-income neighborhoods.

"The kids absolutely love it," Guerra said.

And it's easy to see why. Camp STEMovation held an event called "STEAM Extravaganza" at Rick Schneider Middle School last year, where students participated in five hands-on STEAM workshops with kid-friendly superhero themes.

Guerra's workshop challenges the students to build "super hero lairs" using strips of card stock paper and scotch tape. The students' superhero lairs were then subjected to three tests.

In the first test, appropriately called "sky fall," Guerra holds the student's structure and drops it. For the second test, called "monster stomp," Guerra stands on the superhero lair on one foot. The third and final test is for the superhero lairs to survive being struck by an asteroid. "So we take two big, fat, college-sized textbooks and pretend they are asteroids. Then we drop them on the superhero lair," Guerra said.

The students are awarded points based on how well their superhero lair survived all three tests. They are also judged based on the aesthetics of their structure as well as how many materials they used to build it. The students with the most points at the end of the challenges won science kits and a trophy.

"You can see these light bulbs going off in these kids' heads," Guerra said, adding that many of the students approached him during the event to ask him more about what engineers do, what you have to do to major in engineering and what types of jobs professional engineers can obtain. "So all of a sudden they go from having not even having heard the word 'engineering' to this being an option for them."

More importantly, Guerra said programs such as Camp STEMovation help to inspire students to pursue STEAM careers at an early age.

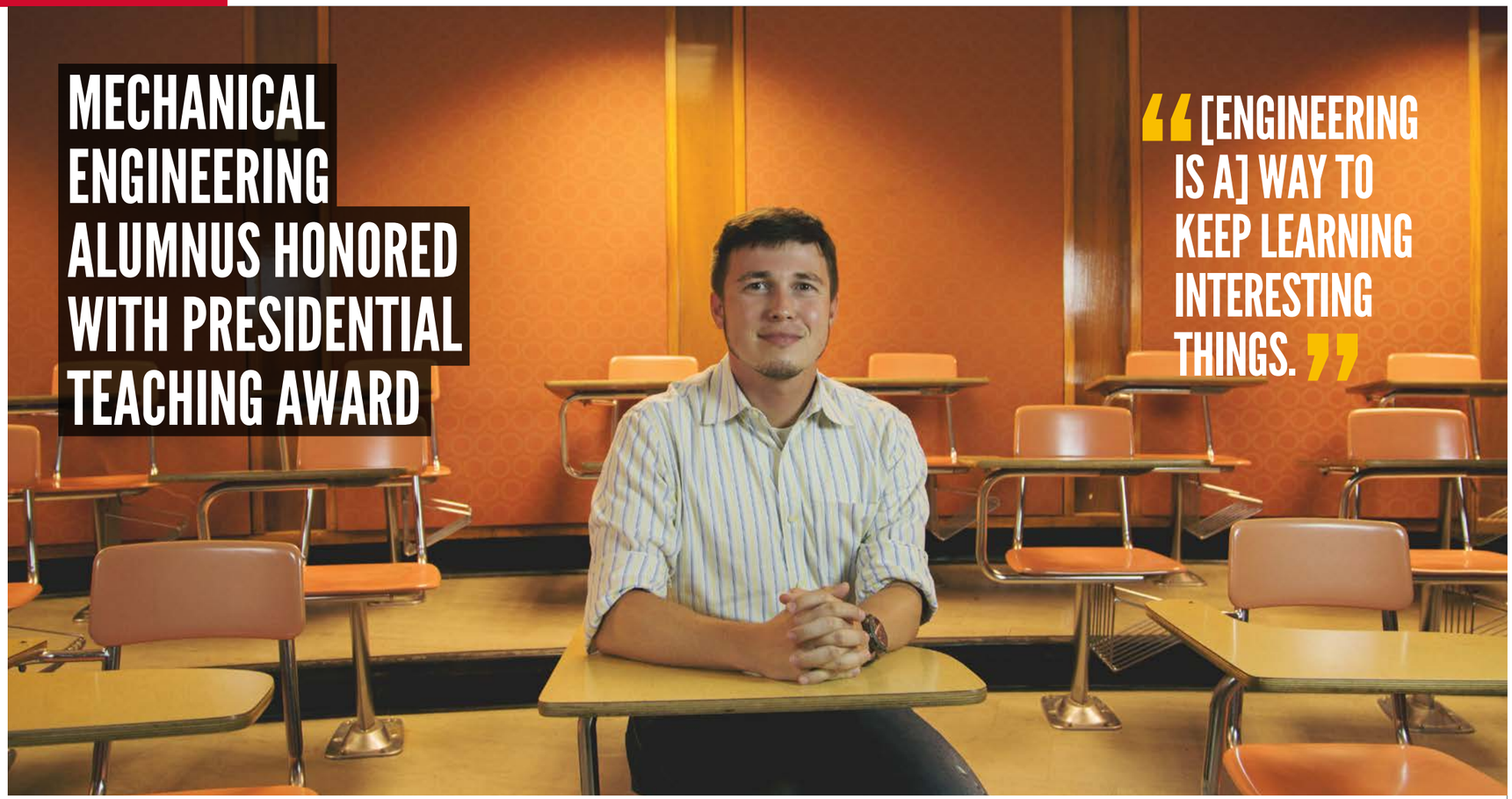
"We're starting when they're young so they can be thinking about it as they go through their school career. The sooner you know about wanting to go into science or engineering, the better you can prepare yourself," he said.

Guerra said he doesn't plan to slow down on hosting STEAM events for local K-12 students anytime soon. In fact, he hopes to see Camp STEMovation's offerings grow in scope and frequency as time goes on.

"We have had principals come to us crying because a student that was classified as 'troubled' and wasn't engaged at all is suddenly inspired by an outside group that comes in and gets them excited about engineering and science," Guerra said. "We're creating experiences for these kids you can already tell will later have a profound impact on them. That's the most exciting part to me."

Watch our video of the STEAM Extravaganza at www.egr.uh.edu/alumnus-stem-outreach-video

MECHANICAL ENGINEERING ALUMNUS HONORED WITH PRESIDENTIAL TEACHING AWARD



by Natalie Thayer

Mechanical engineering alumnus **Jonathan Claydon** was recently recognized as a state finalist for the 2015 Texas Presidential Awards for Excellence in Math and Science Teaching (PAEMST). The PAEMST are the nation’s highest honors, intended to recognize instructors who contribute to their communities as role models and leaders in the field of STEM education. The application process is arduous and requires nominees to submit a résumé, letters of recommendation, classroom video footage and an extensive narrative essay.

Claydon, who excelled in advanced math and science subjects like calculus and physics during his senior year of high school, was drawn to the UH Cullen College of Engineering because he saw engineering as a “way to keep learning interesting things.”

As an undergraduate student at UH, Claydon was a member of the Honors College, which he said strongly impacted his undergraduate experience. He found that the Honors Engineering Program provided him a “home base” within the University. In addition to living in one of the Honors College dorms on campus, he bonded with his classmates over long study sessions in the Honors Library and late-night peer tutoring sessions.

After receiving his bachelor’s degree in mechanical engineering, Claydon landed a job in the construction industry as a project engineer. However, after a couple of years in construction management, he realized the industry wasn’t for him and began to seek a new career that would be “more actively engaging during the day.” Enter, academia.

As Claydon was considering possible new career directions, he learned that a couple of his friends were exploring alternative teaching certifications. Claydon’s interest was piqued and he enrolled alongside them. Deciding which subject to teach was a “no-brainer,” Claydon said. Because of the extensive math classes he’d taken as an engineering student and his lifelong interest in the STEM (science, technology, engineering and mathematics) fields, Claydon enthusiastically jumped head-first into teaching high school mathematics.

It didn’t take long before Claydon found that teaching offered him what he was hoping for with a career change. He said the field kept him engaged throughout the day, offered interesting problems and provided lots of interpersonal interaction.

When speaking about his approach to teaching, Claydon emphasized the importance of valuing students’ time, listening to what students have to say and building trust through mutual respect. Claydon said he encourages peer-to-peer discussion and prefers hands-on projects over content lectures. And, perhaps most notably, Claydon said he recognizes that students have lives beyond the classroom and tries to maintain a holistic view of their commitments.

Claydon is one of five Texas state finalists. The next stage of the process will take place on the national level, and the 2015-2016 PAEMST winners will be announced this year. In the meantime, when asked what it feels like to be a state finalist, he said he was looking forward to the start of the new semester to be able to tell his students, “Hey, we did it! It was worth it; it paid off.”

Watch a video of our interview with Jonathan at www.egr.uh.edu/alumnus-teaching-award-video

NATIONAL OILWELL VARCO GIFT GROWS SUBSEA’S COMPUTING POWER

by Melanie Ziems

The mission of the UH Cullen College of Engineering is to serve the Greater Houston community by establishing innovative and industry-relevant engineering programs that help to drive the economy forward in the state of Texas. The Cullen College has succeeded at this mission in no small part due to the support of individual donors and corporate sponsors.

This was especially true for the Cullen College’s subsea engineering program, which was established in direct response to industry workforce needs and with overwhelming support from leaders in the energy industry across the Houston region and around the world.

In an effort to bolster private support for higher education, the Texas Higher Education Coordinating Board established TRIP – the Texas Research Incentive Program. It provides state institutions funds that match private gifts or endowments at a certain percentage for the purpose of enhancing research activities.

National Oilwell Varco (NOV) supported the Cullen College with a $500,000 gift for the Cullen College’s subsea engineering program, which will be paid in several installments. TRIP matched the first installment of $150,000 at 50 percent ($75,000) – with future matches to come as well.

The funds are already being put to use in the subsea engineering program, according to program director Matt Franchek. “[The money] NOV has given us, we’re able to magnify that gift thanks to the state of Texas, and we’re able to put it to use in the classroom for the students.”

Specifically, the program has purchased several high-performance computing clusters available for student use. Additionally, the program purchased a significant amount of memory for the clusters to store their information on – and then refer back to as they perform more calculations. Franchek calls the infrastructure a “computational city,” and it’s available to all subsea engineering students.

For Franchek, the computers are more than just a tool – they’re a pathway to a new method of engineering. “We want to see a computational approach to subsea engineering called analysis-led design,” he said.

When subsea engineers design a structure, Franchek said, “they’re doing lots of computations, and for these [structures] to grid out correctly and the computer to solve the code correctly, it’s huge. The equipment we build can be 60, 70, 100 feet tall, so to simulate that is a big deal. Without the gift from NOV, we would never be able to do this.” The new high-powered clusters are so powerful with computational calculations, Franchek said, that “when you hit return, you have to duck – the answer comes back so quick.”

The clusters themselves are housed at the Energy Research Park (ERP), but students in the Cullen College can access them through the Dell workstations in the Engineering Computer Center.

Franchek says that the high-powered clusters are only the beginning of a long-term plan for the subsea engineering program to create a computational infrastructure capable of handling multiple, massive simulations and predict optimal designs that fit a given project. This, he said, will allow students to focus more seriously on which of the computer-designated optimal designs will work best in practice, and why.

ALUMNUS SUPPORTS COLLEGE WITH $4.5M CHARITABLE GIFT ANNUITY

by Audrey Grayson


Larry and Gerri Snider

Over the course of his career as an engineer, **Larry Snider** (BSIE '55) lived and worked all around the world. Larry and his wife, Gerri, have called many places "home," from California and Iran, to Ohio and Pakistan. Yet no matter where his career took him, Larry said there was one place he always returned to: the University of Houston.

"My education at the University of Houston Cullen College of Engineering has helped me and my family in so many ways," Larry said. "That's why we feel it is so important to give back to the University that has given us so much."

Larry and Gerri decided to support the UH Cullen College of Engineering with a testamentary charitable gift annuity in the amount of $4.5 million. The gift is unique in that it allows the Sniders to provide an annual income to both of their adult daughters throughout their lifetimes.

"This plan for supporting the University is really a win-win," Larry said.

A charitable gift annuity is a contract between a donor and UH wherein the donor agrees to make a gift to the University while also agreeing to pay a designated beneficiary a fixed amount each year for the rest of their life.

"You can give money to the University and at the same time use that money to fund a charitable gift annuity, which pays an income to your children all of their lifetimes," he said. "Your children get a current income every year during their lives, and when they pass, the residuum of the annuity goes to the UH Cullen College of Engineering."

The Sniders have specified how the residuum will be used once it is transferred to the Cullen College. The first funding priority is for an endowed department chair. The remainder of the funds will go towards funding professorships and full-time scholarships.

The Sniders said they felt it was particularly important to share the news about their gift to the Cullen College in order to raise awareness among alumni who may not have known such a gift agreement was a possibility.

"If God has blessed you with financial success as he has done us, we would like to invite you to consider investigating whether establishing a charitable gift annuity is a good fit for your portfolio, as the Cullen College would really benefit from having many more alumni establish these win-win gift agreements," Larry said.

In addition to their most recent gift, the Sniders have supported the University of Houston and its Cullen College of Engineering by funding scholarships.

The R. Larry and Gerri R. Snider Native American Scholarship, established by the Sniders in 2003, offers $10,000 per year to any engineering student entering their sophomore year or above who is a citizen of a federally recognized tribe. Larry is a citizen of the Cherokee Nation, and gives preference to Cherokee student applicants.

In 2009, the Sniders also established two other scholarships at the Cullen College. Named after their daughters, the Melody Kathryn and Becky Snider Women in Industrial Engineering scholarships are available to female engineering students.

"We've always felt that education is so important, and it has helped us in so many ways," Gerri said. "We hope that this gift will help a bunch of people."

The Sniders said they feel very passionate about supporting hard working students who have to put themselves through college, as they can personally relate to such a struggle. Larry worked 40 hours per week while attending the Cullen College full-time. Gerri also worked full-time and managed their household.

After five years at the Cullen College, Larry earned his bachelor's degree in process engineering, a combination of industrial and chemical engineering. From there, Larry's engineering career took him around the world, moving his family a total of 35 times. He has worked for Sheffield Steel Corp., Kaiser Steel, Booz Allen Hamilton, Peat Marwick & Mitchell, Sterling Electronics, RAPOCA Energy, Korn Ferry International, and Coopers and Lybrand. Upon his retirement in 1995, Larry established RLS Professional Services LLC.

Larry received the UH Engineering Alumni Association's Distinguished Engineering Alumni Award in 1991 and the Lifetime Achievement Award in 2013. He and Gerri are also members of the Cullen College Bridgebuilder Society.

DEAN HONORS TWO ORGANIZATIONS WITH INDUCTION INTO THE BRIDGEBUILDER SOCIETY

by Natalie Thayer

At the Energy Leadership Board (ELB) dinner last November, two organizations were honored with inductions into the Bridgebuilder Society for the Cullen College of Engineering.

Established in 2000, the Bridgebuilder Society recognizes and honors those who have made transformational and impactful gifts to the Cullen College of Engineering. Induction into the society is the highest honor the Cullen College bestows upon a donor.

This year, Joseph W. Tedesco, dean of the Cullen College, recognized **The Institute for Rehabilitation and Research Foundation**, also known as TIRR Foundation, and the **Offshore Industry Crawfish Boil Committee** for their significant financial contributions and commitment to the future of the college.

The TIRR Foundation is a nonprofit 501(c)(3) organization that seeks to improve the lives of people who have sustained central nervous system damage through injury or disease. The TIRR Foundation created, directs and funds Mission Connect, a collaborative neurotrauma research project. Mission Connect is focused on supporting the discovery of preventions, treatments and cures for central nervous system damage caused by brain injuries, spinal cord injuries and neurodegenerative diseases.

Led by executive director Cynthia Adkins, the TIRR Foundation has provided significant support to Jose Luis "Pepe" Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen University Professor of electrical and computer engineering, and his Non-Invasive Brain Machine Interface Systems Laboratory at the UH Cullen College.

The Offshore Industry Crawfish Boil Committee has organized, managed and lead efforts to host the annual offshore industry, pre-OTC crawfish boil for 27 years. The popular on-campus event draws several thousand individuals to the University each year, including industry partners, alumni and community members. The tireless efforts of the committee


Tedesco honors TIRR Foundation


Tedesco honors Crawfish Boil Committee

members have resulted in more than $1 million dollars of financial support for programs and student scholarships in the Cullen College of Engineering.

AMERICAN JEREH SUPPORTS ENGINEERING STUDENTS WITH NEW SCHOLARSHIP

by Audrey Grayson

Oilfield-equipment manufacturer American Jereh International Corporation showed its support for the University of Houston Cullen College of Engineering by granting scholarships to two engineering students for the 2015 fall and 2016 spring semesters.

The demand for skilled engineers in the city of Houston, the energy capital of the world, is higher than in any other major U.S. city. Company leaders at American Jereh hoped to give back to the Houston community by helping engineering students at UH to successfully complete their degrees.

The academic curriculum at the UH Cullen College of Engineering is widely regarded as one of the most rigorous engineering programs in the nation. On top of the challenging course work, the majority of UH Engineering students work full-time or part-time to finance their education.

Consequently, many Houston companies in the energy industry choose to support the college and its students through academic scholarships, providing students with funding for textbooks, tuition and even on-campus housing.

American Jereh is the latest Houston-based company to provide such support.

Ricca Leatherman, vice president of human resources for the manufacturer, said that the company's chief executives were very impressed with the caliber of graduates from the college.

"We have some very successful UH alumni here that were hired right out of college. UH engineering students come across as highly intelligent, creative and innovative problem-solvers who are ready for the challenges ahead of them," Leatherman said.

While the purpose of the scholarship funding is primarily to ease students' financial burdens, it's also an opportunity for companies to recruit talented individuals to join their teams, Leatherman added.

As a global manufacturer of advanced oilfield equipment, American Jereh serves clients in over 30 countries with custom, integrated technology for land and offshore operations. When the company's North American headquarters was established in Houston, American Jereh's leadership was adamant on giving back to the community in a way that would have true impact.

"In our brainstorming sessions, giving back to UH Engineering was one of the first things that came up," said Leatherman. "We decided on UH Engineering because it's an excellent, up-and-coming program and because we want to help the students in Houston who are the future leaders of our community."

American Jereh provided scholarships in the amount of $3,000 for two undergraduate students pursuing degrees in electrical and mechanical engineering, respectively.

To learn more about giving opportunities at the UH Cullen College of Engineering, please visit advancement.egr.uh.edu/giving-opportunities/ways-give

To learn more about American Jereh International Corporation, please visit www.americanjereh.com

CULTURE & EVENTS

SICSA RECEPTION



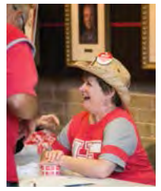




The Sasakawa International Center for Space Architecture (SICSA) hosted a reception last November, bringing together leaders in the space and aerospace industries to promote the center, its academic programs, and the success of its students.

2015 EAA HOMECOMING TAILGATE

The Engineering Alumni Association (EAA) hosted a homecoming tailgate last November. Attendees enjoyed free food, beer and games before the homecoming game kicked off.

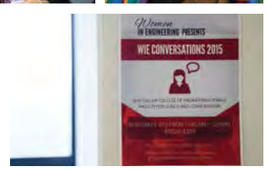





2015 WOMEN IN ENGINEERING CONVERSATIONS


The Women in Engineering (WIE) Program hosted an on-campus Conversations Event last November to encourage female faculty, students and alumni to meet and network over lunch. The WIE program seeks to establish a support system for female engineers.






2015 UNDERGRADUATE RESEARCH DAY



The UH Office of Undergraduate Research hosted the 11th annual Undergraduate Research Day last October, where over 175 undergraduate students showcased their research with oral and poster presentations.


2015 BOS PARTY

Engineering students celebrated the start of the fall semester last September at the annual Beginning of Semester (BOS) Party.

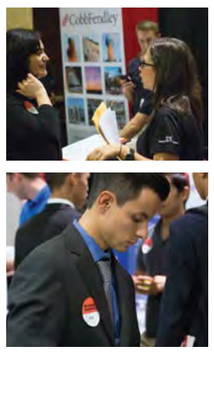





2015 ENGINEERING CAREER FAIR



Last September, over 2,500 engineering students flocked to the UH Hilton Hotel to attend the Engineering Career Fair. Representatives from 114 companies met with students at the fair.




2015 WOMEN IN ENGINEERING NETWORKING & WELCOME EVENT

The Women in Engineering (WIE) Program hosted a Networking & Welcome Back Event last October at the UH Hilton Hotel.

View more photos from the Cullen College of Engineering at https://www.egr.uh.edu/news/photo-gallery

UNIVERSITY of HOUSTON | ENGINEERING

UH Cullen College of Engineering
Department of Mechanical Engineering
Engineering Building 1
4726 Calhoun Rd, Suite N207
Houston, Texas 77204-4003