HOUSTON ECE CONNECTIONS

Department of Electrical & Computer Engineering Magazine
UH Cullen College of Engineering
Spring 2015

NEW FACULTY

RESEARCH BREAKTHROUGHS

STUDENT SUCCESS

COMING IN 2016

Multidisciplinary Research & Engineering Building (MREB)

The UH Cullen College of Engineering has met its fundraising goal of $10 million for the MREB – and the timing couldn't be better. The Cullen College will be doubling its size over the next 10 years, welcoming more than 4,000 new students and 50 new faculty members by 2025. The MREB will provide the critical infrastructure needed to increase student enrollment, associated faculty and research funding.

The MREB is expected to help generate approximately $36 million in research funding annually for the Cullen College of Engineering and to promote an approximate $612 million increase in annual economic activity in Houston alone. It will also allow UH to add more than 250 talented graduate students and hire new National Academy of Engineering faculty.

Construction began in November 2014. Completion is scheduled for the summer of 2016.

MEET THE NEW FACULTY

Aaron Becker
Assistant Professor
Ph.D., University of Illinois at Urbana-Champaign
Research interests: Swarm robotics, distributed robotics, human-swarm interaction, medical robotics, and motion planning.

Ryan Canolty
Assistant Professor
Ph.D., University of California, Berkeley
Research interests: Local cortical computation, long-range cortical communication, sparse time-frequency decompositions, cross-level and cross-frequency coupling, and network dynamics.

Jinghong Chen
Associate Professor
Ph.D., University of Illinois at Urbana-Champaign
Research interests: Design of analog, mixed-signal and RF/mmwave integrated circuits and systems for a variety of applications.

Xin "Felicity" Fu
Assistant Professor
Ph.D., University of Florida
Research interests: Computer architecture, energy-efficient computing, high-performance computing, hardware reliability and variability, mobile computing, heterogeneous computing and emerging technologies.

Julius Marpaung
Instructional Assistant Professor
Ph.D., Oklahoma State University
Research interests: Engineering education, robotics, computer architecture, design for testability (DFT), FPGA, hardware synthesizer, and video game development.

David Mayerich
Assistant Professor
Ph.D., Texas A&M University
Research interests: Biomedical imaging, microscopy, image processing, parallel computing, GPU computing, visualization and computer graphics.

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ECE CONNECTIONS

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UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

CHAIR'S MESSAGE

Houston, we have a Connection!

Welcome to the spring 2015 issue of ECE Connections. These are exciting times for the department, and we welcome the opportunity to share the stories of our progress with you.

Last year, we welcomed an extraordinary batch of six new faculty members, who bring exceptional knowledge and major funded programs to the department, including NIH Roo awards, NSF CAREER awards, and the CPRIT Scholar Grant.

Our award winning faculty members have continued to bring in new accolades. Zhu Han became an IEEE Fellow and won the Best Paper Award at GLOBECOM. Dmitri Litvinov won the University of Houston's highest recognition – the Esther Farfel Award. Stuart Long and Fritz Claydon were recognized by the U.S. White House for their exceptional work providing research experience for teachers. Yan Yao won the ONR Young Investigator Award. Wei Shih and Saurabh Prasad won NASA Early Career Awards. Our department is home to exceptional teachers. Dave Shattuck won the UH Career Teaching Award, the University's highest teaching award, and Diana de la Rosa-Pohl won the University Teaching Award at the instructor level.

Our research and educational programs continue to grow. Notably, ECE faculty published a record number of journal publications last year, wrote new books, and were featured internationally in the media, including The Discovery Channel, Der Spiegel, Science News, Nature, The Economist, The Wall Street Journal, PBS, and NPR.

Houston is a global hub of opportunity, and we benefited from a surge in corporate support last year. Our industry/university consortiums in Electromagnetic Compatibility, Electric Power Analytics, Downhole Communications, and Well Logging set new records for growth last year. Our Industrial Advisory Board, led by Alan Goodrum, grew its membership and member commitments to a new level.

As our enrollments continue to grow, our admission standards are also increasing. I am proud to say that our current body of ECE students at the UH Cullen College of Engineering is made up of the strongest and most talented individuals our department has ever had the pleasure of educating.

The ECE department at the Cullen College could not have achieved the level of success that it has without your continued dedication and support. Thank you for being a friend and supporter of our world-class academic and research programs!

Sincerely,

Dr. Badri Roysam
ECE Department Chair
Hugh Roy & Lillie Cranz Cullen Professor

IN THE MEDIA

TV

ABC 13 Eyewitness News
University of Houston Receives $3.3M Grant to Promote Women in STEM Fields
Featuring UH Cullen College of Engineering
(Aired August 30, 2014)

GRADE Camp Sets Girls Up For Bright Future
Featuring Stuart Long, Professor of Electrical and Computer Engineering
(Aired June 26, 2014)

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(Aired March 27, 2014)

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Featuring Badri Roysam, Chair of the Electrical and Computer Engineering Department
(Aired April 4, 2014)

Four UH Researchers Named to National Academy of Inventors
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PRINT

Houston Business Journal
Houston University Breaks Ground on $51 Million Research Facility
Featuring UH Cullen College of Engineering
(Published October 7, 2014)

Houston Chronicle
UH Study Measures Babies' Brain Signals as Start of Autism Research
Featuring Jose Luis Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen University Professor of Electrical and Computer Engineering
(Published November 14, 2014)

Houston Universities Working to Fix 'Gateway' Courses, Keep Students in STEM
Featuring UH Cullen College of Engineering
(Published June 6, 2014)

Finding New Energy Offers Never-Ending Challenges
Featuring David Shattuck, Associate Professor of Electrical and Computer Engineering and Associate Dean, Undergraduate Programs
(Published July 11, 2014)

UH Students Compete to Design HISD School
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(Published November 19, 2014)

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Featuring UH Cullen College of Engineering
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Houstonia Magazine
This Is Your Brain on Art
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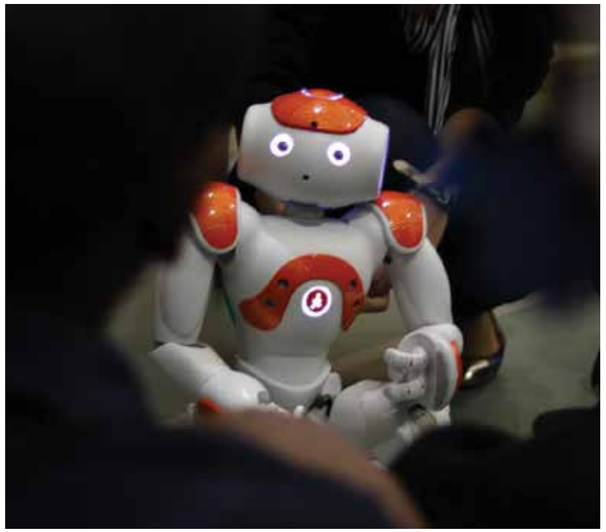
(Published August 26, 2014)

Phys.org
Splitting Water Into Hydrogen and Oxygen Using Light, Nanoparticles
Featuring Jiming Bao, Assistant Professor of Electrical and Computer Engineering
(Published December 15, 2013)

Science Daily
Diagnosing Diseases with Smartphones in Real Time
Featuring Jiming Bao, Assistant Professor of Electrical and Computer Engineering, and Richard Willson, Huffington-Woestemeyer Endowed Chair and John and Rebecca Moores Professor of Chemical and Biomolecular Engineering
(Published March 10, 2014)

Science News
Brain-Computer Interfaces Promise New Freedom for the Paralyzed and Immobile
Featuring Jose Luis Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen University Professor of Electrical and Computer Engineering
(Published November 4, 2013)

ELECTRICAL AND COMPUTER ENGINEERING NAMED TOP 50 GREAT AFFORDABLE PROGRAM



The electrical and computer engineering (ECE) department at the University of Houston Cullen College of Engineering has been growing in size, raising its standards and climbing national rankings for its world-class academic programs.

Now, the Cullen College's ECE department can add another bragging point to its long list of achievements and successes: the department has been named one of the top 50 "great affordable colleges for computer science and engineering" by Great Value Colleges, a premier website for offering data, program rankings and research on America's best colleges and universities.

In order to determine which schools made the cut as a top 50 great affordable college, Great Value Colleges combined each of the ECE department's rankings from US News and World Report with data on the adjusted average tuition for each college. Out of the 111 colleges on the U.S. News and World Report list of "top 100 engineering programs" and "top 100 computer science programs," only the top 50 highest-ranked and least expensive programs made the cut.

The Cullen College's ECE department was ranked fifth in the Southwest region for best and most affordable computer science and engineering programs, beating out both the University of Texas – Dallas and the University of Texas – Austin.

IEEE SPECTRUM POINTS TO ELECTRICAL ENGINEERING FIELD AS TOP HIRER

A recent article published in the IEEE Spectrum points to engineering fields – specifically electrical engineering – as being one of the top hiring industries in 2014.

According to the article, "Where the Jobs Are: 2014," the job website CareerBuilder posted 3.5 electrical engineering jobs for every job-seeking candidate, and demand in semiconductor and telecommunications industries is especially high.

"We're seeing an increased demand for [electrical engineers,] specifically quality and control engineers. There is also a demand for control engineers in the petroleum industry, and salaries in that industry are off the charts," said Jay Rogers, vice president of recruiting at the employment services provider Randstad.

The article also states that mobile applications developers, software developers, and software engineers "will all see a nearly [8] percent hike in salary this year, more than twice the average salary growth across all fields in 2014." The demand spans to Europe and the Asia-Pacific region as well. In Germany, the unemployment rate for engineers is 2 percent.

EEWEB.COM PROFILES ECE CHAIRMAN

Most Cullen College students recognize **Badri Roysam** walking down the hall. After all, Roysam is the chair of the electrical and computer engineering department and a popular face in the engineering complex at the University of Houston.

However, students might be surprised to learn that Roysam loves to cook and take photos, and his favorite book in high school was "Physics" by Robert Resnick and David Halliday. There are just a few of the snippets of his life explored by EEWeb.com in their new "featured engineer" article profiling Roysam inside and outside of his work at UH.

EEWeb.com traces Roysam's interest in electrical engineering back to his childhood and education in India, through his career as a professor and administrator in university engineering programs in the U.S. They also delve into the details of FARSIGHT, Roysam's software toolkit used to provide biological insight to biomedical scientists. Additionally, they ask his advice for students toying with the idea of studying engineering. "Engineering is truly the profession of the century," he said.

To read the article on EEWeb.com, please visit: http://www.eeweb.com/spotlight/interview-with-dr.-badri-roysam

ENGINEERING THE TECHNOLOGIES OF TOMORROW...

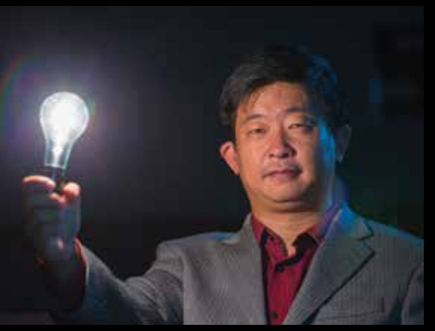
CITIES I ENERGY I ENVIRONMENT I HEALTH & MEDICINE I MATERIALS I STEM OUTREACH I TECHNOLOGY

...TO CHANGE LIVES TODAY.

CITIES

THE SMARTEST GRID ON THE BLOCK

Since 2008, CenterPoint Energy has installed more than 2.3 million smart meters at homes and businesses across the Houston and Galveston areas. From a customer's standpoint, the transition from the antiquated analog meters to the new smart meters was easy to miss because it seemed nearly seamless. For some, the enormous installation effort went entirely unnoticed. But for Zhu Han, associate professor of electrical and computer engineering at the University of Houston Cullen College of Engineering, the new technology meant opportunity.



Millions of smart meters installed across Houston wirelessly transmit information collected on customers' electricity usage to CenterPoint's central data center every 15 minutes. This data could be analyzed and put to use for many practical applications including predicting power demand, helping to manage power generation, and even assisting in the design and construction of power plants, Han said. But there's one problem – and it's a really, really big one.

With more than 2 million smart meters reporting data to CenterPoint 96 times per day, these meters collectively produce an incredible amount of information – more than 220 million distinct reports every 24 hours, to be exact. Data sets of this size and complexity are known as "big data," and therein lies the big problem that faces many energy utilities companies. Sifting through these enormous data sets to find meaningful trends and insights is the next big challenge for CenterPoint and energy providers nationwide.

"Luckily, this is what we do," Han said. "We write algorithms that can pull out the important information from these very large and complex data sets so the utilities companies can put the data to practical use."

Han established the Electric Power Analytics Consortium (EPAC) at the UH Cullen College of Engineering in 2013 and welcomed CenterPoint Energy and Direct Energy, two of the region's largest energy providers, as the consortium's founding members. The mission of EPAC, Han explained, is to develop algorithms and mathematical models to make the best use of the data gathered from smart meters and other components of new smart electric power grids.

"The real focus of this research is to develop data-driven solutions that directly benefit both CenterPoint's and Direct Energy's customers in the Houston region and beyond," said Han, who serves as principal investigator and director of EPAC. For CenterPoint Energy, this means developing predictive damage assessment models to better prepare for hurricanes or major storms and to restore power more quickly after severe weather events. For Direct Energy, Han and his team will analyze customers' energy usage in order to develop innovative tools, technologies and perhaps even dynamic pricing strategies that can help customers to save money on their energy bills while encouraging energy efficiency.

A UNIQUELY BENEFICIAL COLLABORATION

The structure of the Electric Power Analytics Consortium is somewhat unique, Han said.

At most universities, businesses fund research projects through grants given to individual professors to explore a specific scientific problem. At EPAC, however, power companies pay annual membership fees. As consortium members, these companies meet regularly with Han and his research team to discuss current industry challenges and ways in which smart grid data might be leveraged to address those challenges. The membership fees the companies pay also go toward funding graduate students and postdoctoral researchers at the Cullen College to work in Han's EPAC research group.

In this unique arrangement between academia and industry, research results are shared with all of the consortium's members, meaning the research Han and his team conduct for CenterPoint also benefits Direct Energy, and vice versa. Moreover, the industry members have direct access not only to world-class researchers and cutting-edge technologies at the University of Houston campus, but also to the academic papers generated by EPAC. And by funding additional graduate student and postdoc positions in the field of smart grid data analytics, the utilities companies are increasing the number of highly-skilled and trained individuals they can hire in the future.

But the benefits don't reside only with EPAC's industry members. Cullen College students involved in Han's research gain insight into the current challenges facing industry as well as hands-on experience, which are invaluable in preparation for their careers after graduation. Additionally, the ability to access real-world data on electricity generation, transmission, distribution and usage from CenterPoint and Direct Energy (rather than data generated from computer simulations) has vastly improved the performance and accuracy of the data analysis tools that Han and his team have developed.

Through regular meetings between EPAC's researchers and members, with all of the different viewpoints and perspectives they bring to the table, everyone involved in the consortium is able to gain deeper insights into the future of the smart grid and the technologies that drive it.

REDUCING BLACKOUTS FROM TEXAS-SIZED STORMS

CenterPoint Energy, a Fortune 500 electric and natural gas utility company that serves several U.S. states, became a founding member of EPAC in 2013, joining Han and his team for the consortium's first official meeting in February of that year. Based on that conversation, Han said they came to the conclusion that the first topic his team should address is the development of algorithms to improve recovery times after severe weather events such as hurricanes.

With many of the nation's most critical energy and petrochemical facilities located in the Texas Gulf Coast region, research into improving the reliability of the power grid both during and after hurricanes or major storms is vital not only to Texas, but to the entire U.S.

CenterPoint Energy has already invested heavily in this area, installing power line sensors, remote switches and other automated equipment that locate power line outages as they occur so that repair crews know exactly where to go to restore power more quickly than ever before. These investments have already paid off. According to CenterPoint, there was an opportunity to use the smart grid technologies to automatically reroute and restore power in a matter of minutes after an outage in 2012, which affected more than 611,000 customers. Without the new smart grid technologies, CenterPoint representatives said the power outage would have lasted at least half an hour for most customers.

Han will supplement these smart grid components with the creation of a predictive damage assessment model that will tell utilities companies what the path of a storm or hurricane will be, how much damage it will cause and which parts of the Houston region will be most affected by the weather event.

When Han and his team perfect their model for predicting the path and potential damage of hurricanes and storms, they plan to move on to developing models and algorithms that can help utilities companies optimize resources after a damaging weather event. "We can provide the utilities companies with an assessment of where to put their resources before the hurricane even hits. Then, after the hurricane comes, we can tell the companies the best strategy for utilizing their resources so that they can restore power to customers as soon as possible," Han said.

Walter Bartel, director of grid performance and reliability at CenterPoint Energy, said access to Han's predictive models for assessing how best to utilize power and energy resources during and after major weather events will help to improve power grid reliability in the region.

"We believe the investments we've made in intelligent grid and analytics technologies will improve how we identify where service problems are and how quickly we restore power after a major event. Combine these technologies with the technology UH students are being exposed to today, and we're confident we'll have progressive modeling capabilities that will better prepare us for future weather events," Bartel said.

More than 2 million of CenterPoint Energy's 2.3 million consumers experienced power outages after Hurricane Ike in 2008. Power was restored to 75 percent of those customers within 10 days.

"We are always looking for ways to be better prepared for the next big event," Bartel said. "Partnering with UH will improve our ability to restore power as quickly and efficiently as possible."

In addition to the models that Han is developing for CenterPoint Energy, his team is using a $250,000, three-year grant from the National Science Foundation (NSF) to create similar models that can be applied to the entire electrical power grid across the U.S. Han said that the real-world data provided by CenterPoint on power outages from storms and hurricanes in the Houston region should help him to develop far more accurate predictive models for the nation's electricity grid.

The predictive hurricane damage and power restoration models that Han develops for the NSF will look at this problem with a wider-angle lens, which will directly benefit not only Houstonians but also energy consumers across the nation. "With CenterPoint, we are looking at how to solve a current problem based on real-world data. With this NSF funding, we now have the motivation to look at not only current challenges within the smart grid, but future challenges as well," Han explained. "This kind of research will benefit CenterPoint and Direct Energy, but also power companies, utilities providers and energy consumers across the U.S."

BIGGER DATA, SMALLER BILLS

Direct Energy, the largest energy and home services retailer in North America, became the second founding member of EPAC last spring. However, it was long before this that leadership within the company started grappling internally with the issue of how to use smart meter data to deliver power more reliably to customers while also helping them to understand their energy usage and their options for saving money on their energy bills.

"That's why we're really excited about the research project we've designed with Dr. Han to take that information from smart meters and see if there were particular insights we could gain on our customers and how they're using energy so we can communicate to them some of the choices they have on saving energy and money," said Benjamin Heard, director of business development at Direct Energy.

Direct Energy has provided Han and his team with smart meter data records from the past two years for almost 100,000 customers in the Houston region. Using the millions of reports generated on these customers, Han will deploy algorithms that can give Direct Energy more information than ever before on the types of customers they have and how the customers are using energy in their homes and businesses.

When Han identifies the varying types of energy consumers, Direct Energy can use the information to communicate with its customers about how they might reduce their energy usage and save money on their utilities bills.

Although the research is still underway, Heard said that Han has already uncovered some surprising findings and insights about Direct Energy's customers which they weren't previously aware of. "We have been surprised at some of the degrees of variance among our customers," Heard said. "We tend to think of our customers on a broader scale and we tend to group them very generally. But one of the insights that Dr. Han brought is that within the groups of customers we identified there are many different types of patterns of usage."

Heard said that the consumer data EPAC has provided to Direct Energy will be deployed commercially within its operations. This means "new products or services that we could roll out not only to our customers here in Houston, but throughout the state of Texas," he said.

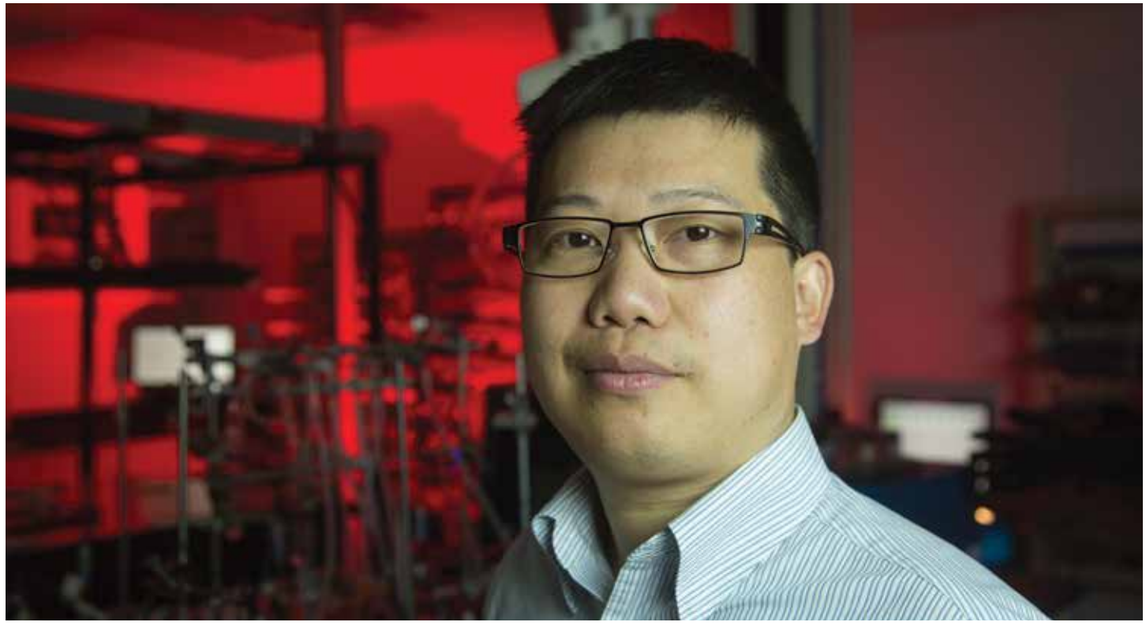
One possible outcome of this research is the deployment of a dynamic pricing strategy uniquely tailored to each of Direct Energy's customers based on how they use energy in their homes, Han said. For instance, customers who work a daily 9 a.m. to 6 p.m. schedule may be able to save money on their energy bills by signing up for a dynamic pricing plan wherein power costs far more during the daytime hours than during the nighttime hours. If these dynamic pricing plans were tailored to customers based on their current energy usage trends, the customers would not have to make any major modifications to their behaviors or power usage in order to benefit from the energy cost savings.

Smart and data-driven dynamic pricing could also help save the environment. By providing energy customers with more information about how they utilize energy, Han can raise their awareness. Some customers, for instance, may be surprised to find that the power consumption in their homes is high even while they are at work during the day, leading them to turn off more lights and unplug more devices while they are gone. This, in turn, would require less energy usage, which would mean less harmful emissions from power plants.

"This would save the customer money, it would save Direct Energy money, but also by changing pricing and changing how people think about and use energy, you can reduce carbon dioxide emissions and improve the environment," Han said. "So overall, by utilizing this data, our whole environment and society will benefit."

ENERGY

NSF AWARD BOOSTS SODIUM-ION BATTERY RESEARCH IN TEXAS



Last June, Texas Gov. Rick Perry drove an electric car made by Tesla Motors in front of the Texas State Capitol Building in Austin – a symbolic gesture meant to signify his intention of convincing Tesla executives to build their more than $4 billion battery factory here in the Lone Star State.

"The timing of all of this couldn't be better for battery research," said **Yan Yao**, assistant professor of electrical and computer engineering at the UH Cullen College of Engineering. Yao recently won a three-year award from the National Science Foundation (NSF) totaling more than $340,000 to develop sodium-ion batteries.

This research is particularly important to the state of Texas, which is the only state in the U.S. with an independent electricity grid. Because of this, the state has the benefit of making modifications to its grid without seeking federal approval to do so. "Now the state is looking into adding an energy storage function to the existing grid," Yao explained. "This is the motivation for my research group."

Yao's main research expertise is developing suitable alternatives to traditional lithium-ion batteries, which are used to power much of the modern world. Lithium ions are commonly used in batteries because they are light and have a high energy density, which allows them to hold large amounts of energy in a small space, said Yao.

Lithium, though, is an expensive metal. When building batteries to power a cell phone, for example, the cost of lithium ions may seem somewhat reasonable, but as we move toward building batteries that can power an electric car or store energy from an electricity grid, the need for far cheaper materials becomes increasingly urgent.

That's why Yao first proposed to study the underlying kinetics and mechanisms of sodium-ion batteries, an earth abundant material that's much cheaper than lithium ion. However, Yao explained that sodium-ion batteries are extremely difficult to make. Because the size of sodium ions is much larger than lithium ions, they charge and discharge energy much slower than their lithium counterparts.

Yao said he hopes that by understanding the fundamental limitations of sodium ion intercalation kinetics in existing host materials used for batteries, his team will be able to develop better sodium-ion batteries which can store and discharge energy as efficiently as lithium-ion batteries.

This research falls under the NSF's "SusChem" (or sustainable chemistry) initiative, which addresses the interrelated challenges of sustainable supply, engineering, production, and use of chemicals and materials. Yao said much of the research within his lab is devoted to finding low-cost, earth-abundant and sustainable energy storage solutions. In 2013, Yao received a grant from the Advanced Research Project Agency - Energy (ARPA-E) totaling about $750,000 to radically improve energy storage systems for electric vehicles. This year, ARPA-E provided an additional $200,000 for Yao to continue this research.

The media attention surrounding Tesla's Gigafactory helped to put the spotlight on the importance of battery research, Yao said. Since many of the non-lithium-ion batteries his lab is developing would work well for electric vehicles and even for power grid energy storage, he added that "it's a very exciting time for my lab group."

ENERGY

WATER-SPLITTING NANOPARTICLES FEATURED IN NATURE NANOTECHNOLOGY

Sunlight and water are plentiful and cheap, especially when compared to resources like petroleum. That's why a recent finding by **Jiming Bao** and his research collaborators is so important.

Bao is an assistant professor of electrical and computer engineering with the Cullen College of Engineering. In a recent issue of Nature Nanotechnology, he outlines his work with nanoparticles that can efficiently split water into hydrogen and oxygen. Simply disperse them in water then expose them to sunlight. Since hydrogen itself is a clean and efficient fuel – whether burned or used in fuel cells to generate electricity – such a finding could drastically alter the energy landscape.

Bao's nanoparticles are made of cobalt monoxide and measure just five to 10 billionths of a meter in size. Particles larger than this won't split water, said Bao, but at the nanoscale, the material's electrochemical properties change.

Specifically, cobalt monoxide's band edge position – the property that determines its ability to add or remove electrons from water molecules – shifts. When light hits a nanoparticle, it creates electrons as well as holes, which are spaces where an electron should be. The electrons move to the particle surface and convert water to hydrogen.

At the same time, the holes combine with the electrons in leftover hydroxide ions (one hydrogen and one oxygen along with an extra electron), generating O_2 and H_2. The combination allows the second hydrogen atom to split off from the oxygen.

Water splitting materials, Bao said, are not unheard of. What makes this so important is how much hydrogen these particles generate in comparison: up to 50-times more than existing catalysts. That's the type of figure that could forever change the future of the energy industry.

But there is one major drawback to these particles that will prevent them from having an immediate impact: they only work for an hour. After that, their ability to split water drops rapidly. Still, the finding proves that highly efficient water splitting is possible. That alone is a major advance, said Bao. "The next step is to engineer the material to increase its lifetime. Now we have to come up with ways to regenerate it or redesign it so it will last longer."

ENVIRONMENT

ECE PROFESSOR WINS NASA'S NEW INVESTIGATOR AWARD

Assistant professor Saurabh Prasad (far left) conducts research with students

Saurabh Prasad, assistant professor of electrical and computer engineering, won NASA's New Investigator Award to develop novel approaches for advancing state-of-the-art geospatial image analysis. The algorithms he develops to extract information from these images will be used to study the ecology of the Gulf Coast wetlands.

The New Investigator Program was established by NASA in 1996 to support outstanding scientific research and career development of scientists and engineers at the early stages of their professional careers. Only 21 proposals were selected from more than 130 submitted.

The algorithms Prasad is currently developing can take enormous data sets from geospatial sensors and turn them into maps that accurately characterize the ground cover. Prasad said that his mapping algorithms could be utilized to quantify metrics such as vegetation health, water quality, changes in vegetation cover, and sediment deposits over time, among other indicators of ecosystem health.

Currently, our ability to understand the complex ecosystem of the Gulf Coast wetlands relies on teams of scientists who must travel by boat, from point to point, to gather data on the local plants, animals and hydrology (the movement and quality of water) in the wetlands. This information, as difficult and tedious as it is to collect, is vital to our understanding of climate change and its overall impact on the environment.

Thanks to Prasad's efforts, scientists can one day use satellite and aerial imaging data in conjunction with field measurements for a much more robust understanding of coastal wetlands at various levels of detail – from very high resolution ground-based hyperspectral imagery that quantifies local processes, to wide-scale aerial and satellite imagery that can inform scientists on holistic trends related to ecosystem health.

ENVIRONMENT

PROFESSOR DEVELOPING NEW TECHNOLOGIES FOR DETECTING SUBSEA OIL SPILLS WITH DOI AWARD

The U.S. Department of the Interior's (DOI) Bureau of Safety and Environmental Enforcement has awarded electrical and computer engineering assistant professor **Wei-Chuan Shih** with nearly $900,000 over two years to investigate new sensing techniques for detecting oil spills and hydrocarbon leaks in subsea oil and gas operations.

One of the challenges faced by the offshore petroleum sector is monitoring for oil leaks at unmanned production platforms. Current regulations require the companies responsible for these platforms to monitor them for oil leaks on a regular basis. This is typically done by visual inspection carried out on a helicopter – an imperfect solution at best. Helicopters are expensive to operate and cannot fly during the night or under inclement weather, while visual inspections can miss leaks.

In the case of subsea oil and gas operations, which take place hundreds to thousands of feet below the surface of the ocean, leaks often go undetected until the oil reaches the surface of the water. But Shih said he hopes to develop new sensing technologies through this DOI award to detect very small quantities of contaminants such as oil and hydrocarbons in subsea environments.

His idea involves an optical fiber integrated with a gold plasmonic nanostructure consisting of light-excited electrons. Plasmonics enables very strong light-matter interactions near the surface of these gold nanostructures, which Shih said will allow certain "hotspots" along the fiber to interact with particles in the environment.

Based on how excited the electrons in the fiber become – that is to say, how much they oscillate in response to a certain interaction – Shih and his team are able to develop what he calls "fingerprints" of various subsea contaminants. "By measuring the returned or transmitted light, one can potentially identify the local chemical and molecular environment," he explained.

Shih's collaborators on the project include Ramanan Krishnamoorti, professor of chemical and biomolecular engineering as well as the university's chief energy officer, and Zhu Han, associate professor of electrical and computer engineering.

In addition to detecting potentially harmful chemicals at the ocean floor, Shih said the sensors he's developing will allow his team to study little-understood hydrocarbon-water interactions such as emulsion, wherein water and oil blend together through the constant motion of ocean waves. Emulsion makes the already tedious process of cleaning up an oil spill all the more complicated, and Shih said he hopes the data his team collects will provide insight into more effective remediation efforts after a spill occurs.

Shih also noted that if the technology his team develops is proven to be successful at early detection of oil and hydrocarbon leaks at subsea drilling and production sites, the cost of implementing his sensing system would be negligible compared to the cost of monitoring these sites with helicopter fly-overs, let alone the cost of an offshore oil and gas project.

"This system wouldn't require any new infrastructure, and the cost to implement it would be very reasonable," Shih said.

HEALTH & MEDICINE

PROFESSOR TEAMS UP WITH LOCAL ARTIST TO STUDY AESTHETIC EXPERIENCES IN THE BRAIN

It's rare to find science and art so inextricably tied together. It's rarer still to find yourself playing the role of scientist, artist and art observer all at the same time.

But patrons of the Menil Collection had the once-in-a-lifetime opportunity to do just that at Houston conceptual artist Dario Robleto's exhibit, *The Boundary of Life is Quietly Crossed.*

Visitors to Robleto's exhibit between November 2014 and January 2015 were greeted by a team of researchers from the University of Houston's Cullen College of Engineering led by **Jose "Pepe" Luis Contreras-Vidal**, Hugh Roy and Lillie Cranz Cullen University Professor of electrical and computer engineering. The research team gave museum-goers the option of wearing an EEG skullcap to record their brain activity while they observed Robleto's artwork.

Pepe's research team consisted of Jesus Cruz, Sho Nakagome and Justin Brantley, all electrical and computer engineering Ph.D. students working within Pepe's Non-Invasive Brain Machine Interface Systems Laboratory at UH.

Pepe's team is currently using these EEG results to map the neural networks activated by aesthetic experiences – that is to say, what our brainwaves look like as we observe and experience works of art in a public setting.

This is where the line between science and art becomes blurred. "In this case, Dario is inviting visitors to become a part of his artwork, just as we are inviting Dario and those coming to see his work to be a part of our research," Pepe said.

Conducting this research will bring Pepe's team one step closer to achieving one of his laboratory's ultimate goals: to reverse-engineer the human brain by mapping individual experiences, thoughts and emotions.

Pepe, a world-renowned expert on brain-machine interface systems, hopes to use this research to create thought-controlled robotic exoskeletons so seamless that people with disabilities will be able to not only regain movement functions such as walking, but also to communicate their emotions through movement.

This research also represents a first-of-its-kind in terms of setting and scope, Pepe added. Although previous studies have looked at the human brain's response to art and aesthetics, such research was conducted in a laboratory setting wherein research subjects were asked to perform specific tasks or consider certain pieces of art while their brain activity was measured.

"As far as I know, this is the first time this research has been attempted at an art exhibit inside of a museum," Pepe said. What's more, this is the first time a study has looked at the brain activity of potentially hundreds of freely behaving subjects in a public setting

Dario Robleto: The Boundary of Life is Quietly Crossed is a culmination of three years of work, first inspired by the seemingly mythical story of the Voyager's Golden Records – one of which contains "arguably the most important EEG ever recorded," Robleto said.

The first-ever recorded brainwaves to be launched into space belong to Ann Druyan, executive producer and writer for the Emmy-nominated series Cosmos: A Spacetime Odyssey. Her EEG was taken in 1977 as she reflected on her love for her new fiancé, famed cosmologist and author Carl Sagan.

Sagan was chosen by NASA to lead a committee tasked with creating a time capsule of human life to stow aboard the Voyager spacecraft – the first probe with a trajectory that would send it outside of the Earth's solar system.

Much like Robleto and Pepe's collaboration, the inspiration behind the Golden Records was some parts art, some parts science, Robleto said.

As Robleto saw it, the art of the Golden Records could be found in the symbolic gesture itself – to send a small piece of our existence here on Earth into the dark and unknown expanses of universes beyond. The science was in the small sliver of hope that perhaps one day, light-years away in the stretches of interstellar space, extraterrestrial life might encounter the Voyager 1 space probe and uncover this artifact of human love in the form of Druyan's EEG recordings.

In addition to Druyan's brain activity, the Golden Records contain recordings of her heartbeat (as recorded by the EKG) as she thought of Sagan, to whom she secretly became engaged only a few days earlier. Although impossible with technologies at the time, Druyan and Sagan hoped that a future technology would be capable of deciphering human love within these recordings.

"Ann and Carl assumed it would be millions of years in the future and some alien technology that would ever have the capabilities of deciphering emotional content within these brainwaves," Robleto said. "I wanted to update the story, which is why I sought out Pepe."

Robleto said he began researching experts in the field of mapping neural networks and deciphering brainwave activity within EEG recordings. As a Houston native, it didn't take long for Robleto to stumble upon Pepe's research, which was taking place just a few short miles away at the University of Houston.

Jose Luis "Pepe" Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen University Professor, observes art while wearing EEG cap

"I knew if there was anyone that could answer this question that Ann and Carl first asked more than 30 years ago – if it was possible to listen to an electronic recording of an EEG and decipher that it represented human love – it was Pepe," Robleto said.

Robleto pointed out that much of the narrative that inspired his Menil exhibit filters through the city of Houston. This story began three years ago, Robleto explained, while he was studying the first artificial heart implanted in a human as an art-research fellow at the Smithsonian Institute in Washington, D.C. The so-called Liotta-Cooley heart was successfully implanted in a patient in Houston in 1969.

"That's when everything started connecting," Robleto said. While studying the engineering of this mechanical heart, Robleto said he was filled with questions: "How did we ever obtain the technology where we could record ourselves at all? It reminded me of Ann's story and the Golden Record, and while I was meditating on that, I began to wonder: Where is the first heartbeat ever recorded? Whose heartbeat was it? Why did it happen? Is the recording still accessible?"

When the search for answers to these questions led him to Pepe's research, Robleto said he felt as though he had come full circle with his exhibit. "Pepe is the present tense of the history that I'm laying out here – of the quest to first record the heartbeat which led to the quest to then record the brain. These events are all interconnected, but Pepe represents where the technology and the future are headed. It's very appropriate that he would be in the show," he said.

To the Menil Collection's curator, Michelle White, this kind of active engagement with the sciences and the science community is precisely what sets Robleto apart from other artists and makes his work so profound.

"What's so unique about Dario is that he's not only reflecting on science but he's acting as a researcher, too. He's producing knowledge alongside what Pepe and his team are doing," White said. "That's really quite special."

The exhibit, presented by the Menil Collection and the UH Cynthia Woods Mitchell Center for the Arts, was open to the public from Aug. 2014 to Jan. 2015. Robleto was inspired to develop this exhibition and the accompanying public programs through a two-year joint research residency with the UH Cynthia Woods Mitchell Center for the Arts.

Watch our video on Pepe and Dario's collaboration at www.egr.uh.edu/video-menil-collaboration.

HEALTH & MEDICINE

DIAGNOSING DISEASES WITH SMART PHONES

Smart phones are capable of giving us directions when we're lost, sending photos and videos to our friends in mere seconds, and even helping us find the best burger joint in a three-mile radius. But thanks to two Cullen College researchers, smart phones may soon be boasting another very important function: diagnosing diseases in real time.

The researchers are developing a disease diagnostic system that offers results that could be read using only a smart phone and a $20 lens attachment.

The system is the brainchild of **Jiming Bao**, assistant professor of electrical and computer engineering, and **Richard Willson**, Huffington-Woestemeyer Endowed Chair and John and Rebecca Moores Professor of chemical and biomolecular engineering. It was created through grants from the National Institutes of Health and The Welch Foundation and was recently featured in ACS Photonics.

This new device, like most diagnostic tools, relies on specific chemical interactions that form between something that causes a disease – a virus or bacteria, for example – and a molecule that bonds with that one thing only, like a disease-fighting antibody. The trick is finding a way to detect these chemical interactions quickly, cheaply and easily. The solution proposed by these professors involves a simple glass slide and a thin film of gold with thousands of holes poked in it.

This task starts with Bao, who takes a standard glass slide that is covered in a light-sensitive material known as a photoresist. He uses lasers to create a fishnet pattern on the photoresist, which is then developed and washed away. The spots surrounded by intersecting laser lines – the 'holes' in the fishnet – remain covered, basically forming pillars of photoresist.

Next, he exposes the slide to evaporated gold, which attaches to photoresist and the surrounding clean glass surface. Bao then performs a procedure called lift-off, which essentially washes away the photoresist pillars and the gold film attached to them.

The end result is a glass slide covered by a film of gold with ordered rows and columns of transparent holes where light can pass through.

Willson and Bao's device diagnoses an illness by blocking light with a disease-antibody bond – plus a few additional ingredients.

Willson tackles this part of the project by attaching disease antibodies to the holes' surface, then flowing a biological sample over the slide. If the sample contains the bacteria or virus being sought out, it will bond with the antibody in the holes.

This bond alone, though, isn't big enough to block the light. Willson then flows a second round of antibodies that bond with the bacteria over the slide. Attached to these antibodies are enzymes that produce silver particles when exposed to certain chemicals. With this second set of antibodies now attached to any bacteria that are in the holes, Willson exposes the entire system to the chemicals that encourage silver production. He then rinses off the slide. Thanks to the chemical properties of the gold, the silver particles in the holes will remain in place, completely blocking light from getting through.

One of the advantages of this system is that its results can be read with very simple tools, like a basic microscope used in elementary school classrooms. With a few small tweaks, a similar reading could almost certainly be made with a smart phone's camera, flash and an attachable lens.

This technique, then, promises an affordable system with readouts that are easy to interpret. "Some of the more advanced diagnostic systems need $200,000 worth of instrumentation to read the results," said Willson. "With this, you can add $20 to a phone you already have and you're done."

HEALTH & MEDICINE

THE SECRET SOFTWARE OF MEDICAL DISCOVERY:

BOOSTING IMAGING TECHNOLOGIES IN THE TEXAS MEDICAL CENTER AND BEYOND

Modern optical microscopes can provide doctors and researchers with crisply defined, three-dimensional images of cells and tissue. These images show everything from wide-scale changes across entire organs to crucial interactions between individual cells in breathtaking detail.

But as the old adage goes, the devil is in the details – details that, in this case, can't be deciphered so easily when viewed with the naked eye. This has been a barrier to progress in several fields. Although there are large amounts of information to be gleaned from these images, the technologies needed to extract data from them have lagged.

That was the inspiration behind electrical and computer engineering professor **Badri Roysam's** FARSIGHT toolkit, a software suite designed to rapidly analyze images collected from advanced microscopes. FARSIGHT quantifies the complex interactions and changes among individual cells, allowing researchers to gain unprecedented biological insights.

The driving force behind the FARSIGHT project is a group of talented electrical and computer engineering students at the Cullen College. Working within Roysam's laboratory, the undergraduate, graduate and doctoral students are tailoring FARSIGHT's algorithms so the software can be applied to a variety of research projects at universities and clinical centers around the world.

However, researchers and clinicians here in the city of Houston are uniquely benefitting from this powerful software. With the world's largest medical center located just a few short miles down the road from the Cullen College, researchers across Houston and the Texas Medical Center are collaborating with electrical and computer engineering students at UH to boost their research through the use of the FARSIGHT toolkit. Currently, FARSIGHT is helping to accelerate medical discoveries in fields ranging from neuroscience to cancer immunotherapy.

UNRAVELING THE BRAIN'S MYSTERIES

The brain is by far the most complicated organ, and the neuroscience field has hardly begun to unravel its many mysteries. Consequently, injuries and conditions affecting the brain are difficult to understand using current imaging modalities. This is one area in which the FARSIGHT toolkit is making progress.

ALZHEIMER'S DISEASE

Alzheimer's disease is a very important public health issue. There are currently 5 million people living with the disease, which is the sixth leading cause of death in the U.S.

Jason Eriksen, assistant professor of pharmacology at the University of Houston College of Pharmacy, has collaborated with Roysam and his students for the past three years to help accelerate his research on this complex and debilitating disease.

Much of Eriksen's research focuses on drug development by targeting brain changes that occur as a result of Alzheimer's disease with treatments to prevent or delay their onset. His group is currently looking at changes in the brain's blood vessels that are indicators of the disease. "We're interested in answering questions as to why that occurs," Eriksen said. "FARSIGHT gives us a really nice scientific advantage in doing this. It's absolutely revolutionary, in fact."

Prathmesh Kulkarni, an electrical and computer engineering Ph.D. student at the Cullen College, is working closely with Eriksen's group to develop new algorithms for FARSIGHT that identify the specific types of cells and vessels within the brain that Eriksen wants to analyze. According to Eriksen, Kulkarni has been "very helpful in getting our research to move forward so rapidly."

Without FARSIGHT, Eriksen's team would look at the blood vessels under a microscope and quantify only a few individual features of the vessels that are easy to see with the naked eye; for example, the length of a vessel or its number of branches. But with FARSIGHT, Eriksen said his group can look at not only these intrinsic features of the blood vessels (such as shape and size), but also the intricate and often subtle interactions between blood vessels and the cells they come into contact with.

"Trying to study those spatial relationships is very difficult for humans. It's not something that a person could easily do," Eriksen said. "We would have to start looking at different cells individually and then try to figure out how these cells interact with one another, but there would be a fair amount of guesswork in that."

Although his research is ongoing, Eriksen and his team are close to releasing some interesting findings that might lead to more tailored treatments and therapies for Alzheimer's patients. "Next year, we should have some spectacular things to say."

TRAUMATIC BRAIN INJURY

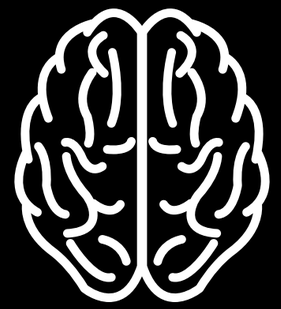
In the U.S., there were 2.5 million reported traumatic brain injuries (TBIs) in 2010 alone, according to the Centers for Disease Control and Prevention (CDC).

Kedar Grama, a graduate student in the department of electrical and computer engineering at the Cullen College, collaborated with researchers in the laboratory of Pramod Dash, Nina and Michael Zilkha Distinguished Chair in neurodegenerative disease research at the University of Texas Medical School at Houston and the scientific director of Mission Connect, and Dragan Maric, a staff scientist at the National Institutes of Health, to create a comprehensive map of brain cellular changes caused by TBIs.

Grama deployed machine-learning algorithms within the FARSIGHT software suite to analyze images of rat brains. This produced a much richer set of quantitative measurements to detect changes in cell structure throughout the brain, in addition to identifying the type and state of each cell.

Grama's algorithms showed that widespread brain alterations can take place after a TBI occurs – even in portions of the brain quite distant from the original injury or damage site. He pointed out that current imaging procedures often focus only on the original site of injury and can miss critical changes in other brain regions. These changes, he said, could eventually manifest in additional clinical conditions months or even years down the road.

The project was so successful that Grama entered his work into the 2013 Mission Connect Annual Scientific Symposium poster contest in the traumatic brain injury student category and took home the first-place prize.



NEUROPROSTHETICS

It may sound like science fiction, but it's science fact: researchers can implant a device inside of a patient's brain that can control prosthetic legs using the patient's own thoughts.

These devices, called neuroprosthetics, can also be used for patients with spinal cord or brain injuries, stroke victims and amputees, among others. But there's one huge problem with the device that must be solved before it's approved for patients.

After implantation, the brain's immune cells often begin attacking the device. Eventually, the device fails to receive signals from the brain and must be removed. Before FARSIGHT, researchers and clinicians were in the dark about why this happened and how it could be prevented.

Roysam is currently heading up a multi-institutional team of researchers from Rensselaer Polytechnic Institute, Seattle Children's Research Institute, the University of Michigan and MPI Research, a medical research company based in Michigan. In 2011, the group received a three-year, $4 million grant from the Defense Advanced Research Projects Agency (DARPA) to explore this problem using Roysam's FARSIGHT software.

This project is now nearing its close, and **Yan Xu,** a research assistant in Roysam's FARSIGHT lab who has been central to the collaboration, said the findings are insightful.

For the past three years, Xu has written machine-learning algorithms for the FARSIGHT toolkit that can specifically highlight intercellular interactions between the brain's immune cells. "In a resting state, the brain's immune cells, called microglia, look like trees with many branches, and when activated they gradually shrink their branches until the branches disappeared completely," Xu explained. "Then they come to the shape of an amoeba and they would conglomerate around the implanted device. That would block the signal from the brain to the device."

Xu and her collaborators published their findings in the Frontiers in Neuroinformatics journal last April. Moreover, the code and algorithms that Xu wrote in order to tailor FARSIGHT's toolkit for this project are now fully implemented into the FARSIGHT software. "It's a great feeling," Xu said. "Students like me really are helping to drive this technology forward."

CANCER IMMUNOTHERAPY IN THE FAST LANE

Navin Varadarajan, assistant professor of chemical and biomolecular engineering at the Cullen College, has won millions of dollars in funding from the National Institutes of Health (NIH), the National Cancer Institute (NCI) and the Cancer Prevention Research Institute of Texas (CPRIT), among others, to conduct cancer immunotherapy research.

Immunotherapy, which involves engineering the body's own immune cells to attack and kill off cancer cells, has proven to be one of the most promising cancer treatments to date. Varadarajan's research in this area has been especially promising thanks to a custom-designed nanowell array he developed. This polymer slide contains hundreds of tiny chambers that are precisely the right size to harbor a few cells. Varadarajan said this invention has allowed him to examine the interactions between immune cells and cancer cells in never before seen detail. "But without FARSIGHT, the analysis of the data arising from these assays would be challenging," Varadarajan said.

"We don't even see FARSIGHT as an external component. We think of it as an integral part of the assay itself. FARSIGHT has become part of the toolkit that comes with the assay," he added.

FARSIGHT, Varadarajan said, has allowed his research team to uncover so much knowledge about these cell-to-cell interactions that a single experiment by his team generates 1 terabyte of data from FARSIGHT.

One of Varadarajan's many funded projects focuses on examining the role that T-cells play in fighting leukemias and lymphomas. Amin Merouane and Nicolas Rey, electrical and computer engineering doctoral students, work closely with Varadarajan's team to write algorithms as unique as the research itself.

"There's nowhere else to get this software. There are no commercial packages that specifically address this problem that we're looking at," Varadarajan said. "It ties to the uniqueness of what we do. Most people in the world don't make these small containers to look at cells, so we need a very specific kind of software package to examine these cell-to-cell interactions and extract meaningful information from these images."

Varadarajan collaborates with a group of physicians and researchers at the University of Texas MD Anderson Cancer Center including Laurence Cooper, Dean Anthony Lee and Cassian Yee. Merouane said the implications of being involved in a collaborative research project with real clinical impact is not at all lost on him. "As an engineering student, I never imagined that I would be doing something which would have a real clinical impact. It feels really good to be doing something this significant," he said.

Part of the beauty of this collaboration, Varadarajan noted, is the accessibility of Roysam and his students. "Nothing beats them just being right here. We can – and we do – call them all the time when a new issue arises. We have weekly meetings with his student team. We are really, really happy that they're right here," he said.

HOW TO MEND AN ARTIFICIAL HEART

The field of artificial tissue engineering is still a relatively new one, but a biomedical engineering researcher at the UH Cullen College of Engineering is already blazing new trails in the area by growing entire artificial hearts inside of his laboratory.

Associate professor **Ravi Birla** has received almost $1 million in funding from the NIH to conduct this research on 3-D artificial heart muscles. Birla said his laboratory relies heavily on the FARSIGHT software to take much of the guesswork out of the incredibly complicated process of profiling artificial heart tissues. "The field of tissue fabrication is so new that practically anything we can manipulate within a cell has some impact on the tissue properties, but most of these changes are unknown," he said.

Birla and his team feed a list of variables, such as the number, size and ratio of different cell types, into the FARSIGHT software, which then generates a spreadsheet highlighting the variables that have the most significant impact on a tissue's properties. Birla's group then applies this knowledge to a new set of engineered heart tissues and measures the results.

The lab results from Birla's team are then fed into FARSIGHT once again by electrical and computer engineering students so that the algorithms they've developed can learn from these outcomes in order to more accurately predict future results.

"So what FARSIGHT allows us to do is take this large, unknown, open-ended variable space and slowly narrow it down in a systematic and predictable manner," Birla said. "It allows us to determine what will happen at the end. Nothing else would allow us to do that. It's a remarkable tool."

HEALTH & MEDICINE

RESEARCH AIMS FOR BETTER UNDERSTANDING OF MICROVASCULAR DISEASES

New technologies being developed by a University of Houston researcher to produce three-dimensional models of tissue and whole organ microstructures offer the promise of better diagnosis and treatment for a variety of diseases.

David Mayerich, assistant professor of electrical and computer engineering, received a $984,505 grant from the National Institutes of Health/National Library of Medicine to focus on large-scale reconstruction of microvascular networks.

A wide range of diseases are closely tied to microvascular structure, including several cancers and neurodegenerative diseases.

Mayerich joined the UH Cullen College of Engineering this fall after completing a Beckman Fellowship at the University of Illinois. He specializes in high-performance computing and biomedical imaging and is creating open-source visualization methods, designed to make the information available to biologists for analysis and use in their own research.

His lab focuses on developing new technologies for three-dimensional imaging of whole organs at subcellular resolution. This work is important for biomedical research and ultimately could be valuable at the clinical level, he said.

The work Mayerich proposed under the NIH grant is complementary to work proposed in a $2 million grant that the University received from the Cancer Prevention & Research Institute of Texas to recruit Mayerich to Houston. The CPRIT project involves high-throughput instrumentation and analysis for whole tumor phenotyping.

Both projects were designed to work together, he said. Visualizing large images of tissue microstructure – the subject of the NIH grant – is challenging because biological samples are often densely packed, and high-resolution imaging typically allows only samples of less than half a millimeter to be scanned.

Mayerich has developed much faster methods, allowing data to be collected from whole organs. With the grant, he will use these imaging techniques to convert that data into three-dimensional models, offering researchers and clinicians additional tools.

"The models, we hope would be something researchers and clinicians could use to diagnose and treat disease," he said.

Assistant professor Wei-Chuan Shih (left) and professor Jack Wolfe

PROFESSORS' NEURAL PROBE HELPS TO UNLOCK MYSTERIES OF THE BRAIN

In April of 2013, President Obama announced the launch of the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative, an ambitious "grand challenge" aimed at vastly increasing our understanding of the human brain. The goal of the Initiative, Obama said, is "to unlock the mysteries of the brain, to improve our treatment of conditions like Alzheimer's and autism and to deepen our understanding of how we think, learn and remember."

The BRAIN Initiative will provide funding of more than $3.5 billion over 12 years to accelerate the development and application of new technologies that will allow researchers to understand how individual brain cells and complex neural circuits interact at the speed of thought.

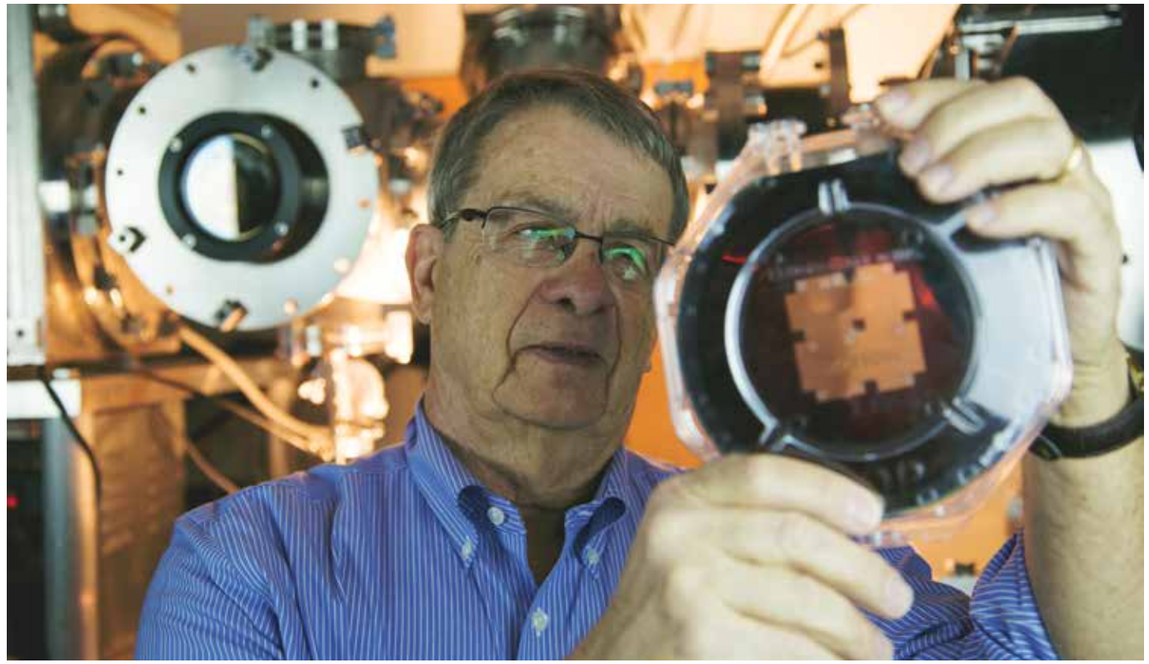
"There's a big gap between what we want to do in brain research and the technologies available to take us there," said Francis S. Collins, director of the National Institutes of Health (NIH), which sponsors a major part of the Initiative. "The initial awards are focused on developing the tools and technologies needed to make the next leap in understanding the brain."

One of those initial NIH awards went to **Jack Wolfe** and **Wei-Chuan Shih,** both professors in the UH Cullen College of Engineering's department of electrical and computer engineering. Their collaborator on the project is Gopathy Purushothaman at the Vanderbilt School of Medicine. Together, they aim to develop a novel brain probe for use in optogenetic studies of the brain. Their award totals $428,406 over two years.

Optogenetics, named the "method of the year" by the journal Nature Methods in 2010, is a transformative technology wherein a tiny volume of suspended virus particles is injected into a region of the brain associated with a specific behavior (for example, walking in a counterclockwise circle). The virus transfers a gene to the specific neurons responsible for the behavior, which causes the neurons to become sensitive to and excited by light.

Shining a light on the sensitized neurons will cause them to emit electrical pulses that, in turn, cause the animal to walk in a counterclockwise circle.

Because the neurons respond to light extremely quickly, neuroscientists are able to track the link between brain activity and behavior at the speed of thought. The



technique can be equally applied in the sensory systems, in learning, and even in creative thought. Optogenetics is also useful in understanding how the brain is disrupted by neurological and psychiatric disease.

The ultimate hope, said Wolfe, is that light stimulation of the brain's neurons will one day be added to the current treatment options for brain disorders.

But the neural probes that are currently available for optogenetics studies have some drawbacks. For starters, they can't probe very deep inside of the brain – only a few millimeters, in fact. This poses a problem when it comes to studying the brain, as many of the its neural networks are located as deep as 50 millimeters. Secondly, current probes are much larger in diameter than the probe being developed by Wolfe and Shih, which means they cause more damage when inserted into the brain.

By comparison, the probes being developed at the Cullen College are less than 60 microns in diameter, while commercially available probes measure between 125 to 500 microns in diameter. Wolfe and Shih's probe is so fine, in fact, that it is smaller than a single strand of human hair. Their goal is to make the probe even smaller – about a third of the size of a human hair, or about 30 microns in diameter – by the end of this project.

At the core of Wolfe's novel probe is a single strand of optical fiber. Using lithography, the researchers print sets of electrodes directly onto the fiber. These electrodes record and transmit information on brain activity resulting from light stimulation.

Even more impressive, they are able to print more than one set of electrodes on a single fiber at varying distances from one another. This will allow researchers to monitor neurons in different layers of the brain simultaneously with a single probe, a research technique that has not been previously available for deep brain probes. "We will be able to create accurate, three-dimensional maps of the brain's neural circuits for the first time ever," Wolfe said.

Unlike many probe prototypes in use today, the probe being developed by Wolfe's team is compatible with high-throughput manufacturing at very low cost. That is to say, the new probe could be cheaply and reliably manufactured, making it an optimal option for use in research centers and clinics around the world.

"The emphasis is on being able to make them very quickly and reliably," Wolfe said. "A wide variety of tests will be performed to make sure they are reliable in all the ways they need to be."

This finer, stiffer and longer probe would be particularly helpful to researchers such as Purushothaman, whose primary research interest is mapping the neural networks involved in the brain's vision system. Current probes can only reach a few millimeters into the brain, but critical structures, such as the thalamus, a switching center for visual signals, are located several centimeters inside of a primate's brain.

"As you can imagine," Purushothaman said, "this is a very exciting development for myself and many other researchers who have been waiting for a probe that is long enough to reach deep into the brain."

The brain's circuitry, even in a small piece of brain tissue, is incredibly complicated, Purushothaman said. "There are thousands of neurons that are very specifically connected, so it's like having a highly complex integrated circuit in a very compact space that is in three dimensions."

"This probe gives me the ability to understand how those neurons are connected and how they work together in the circuit," he added. "That is a major benefit to my research, and that's precisely the goal of the BRAIN Initiative – to decipher, in as much detail as possible, the brain circuitry."

Although this study is still in its early phases, all three of the researchers said there is a very high chance their probe will be tested in human clinical trials. "Once we get this project done we will have a working product which can then move into the clinical arena," Purushothaman said.

HEALTH & MEDICINE

PROFESSOR EARNS GRANT FOR ELECTROMAGNETIC COMPATIBILITY RESEARCH

Approximately 75 percent of the three million people worldwide with implanted pacemakers need magnetic resonance imaging, or MRI, in their lifetimes, and an estimated 500,000 of them live in the United States, Canada and Mexico. However, pacemakers, which control abnormal heart rhythms, limit access to the potentially lifesaving diagnostic technology because of electromagnetic interference.

Ji Chen, professor of electrical and computer engineering at the UH Cullen College of Engineering, is overcoming limitations for patients with pacemakers and other implanted medical devices with his electromagnetic compatibility research.

In 2014, the National Science Foundation awarded Chen, his UH collaborators and Missouri University of Science and Technology with their second five-year grant totaling $225,000 through the Industry/University Cooperative Research Centers program. The initial five-year $280,000 grant was awarded in 2009 to establish the Center for Electromagnetic Compatibility Research.

"The grant gives us credibility to attract industry partners," Chen said. "We're trying to build a one-stop shop, with all companies coming to the two universities for electromagnetic compatibility research."

The center works with 25 industry partners who fund the majority of the research with annual membership dues that give their engineers access to two annual on-site meetings and weekly conference calls with university researchers. Each company pays $60,000 per year, which totals $1.5 million annually, for membership privileges.

Chen and his team work mainly on electromagnetic interference with medical industry partners including St. Jude Medical, Biotronik and Cyberonics, while Missouri University works primarily on high speed signaling systems with electronics industry partners including Apple, Samsung and Sony.

"We make sure we work closely with the industry partners," Chen said. "The conference calls are open conversations that get very technical."

Magnetic fields and radiofrequency energy used by MRI machines and other electronics interfere with the electromagnetic energy fields of pacemakers and other implantable medical devices. The devices can malfunction and burn human tissue as their temperatures increase.

"We tested one device in an MRI exam, and the temperature increased 70 degrees," Chen said. "It's like putting metal in a microwave."

Existing commercial software is incapable of modeling the entirety of the complex systems, and central processing units take months to run simulations for one solution. With David Jackson, also a UH Cullen College of Engineering professor of electrical and computer engineering, and a team of 15 students, Chen has developed computational modeling algorithms that analyze the complex interactions between human bodies, implantable medical devices and electronics on a graphic processing unit that produces numerous solutions in a matter of days.

Their research has resulted in filters that protect medical devices from harmful electromagnetic interferences, and validation of their study is underway.

"We are very happy that we are part of a group known for electromagnetics in medical research," Chen said. "We work closely with the FDA, and our results show up constantly in their presentations."

HEALTH & MEDICINE

BABY SEE, BABY DO?

UH RESEARCH TARGETS YOUNGEST SUBJECTS

In research aimed at determining how babies and toddlers begin to understand the actions of others, a University of Houston research team is studying brain activity triggered by playtime interactions.

The study involves children from six months to 24 months old.

The interactions between the children and researchers are literally child's play. But information about brain activity recorded as the child reaches for a toy or imitates the researcher – pushing a button on a toy, for example, or playing with a toy car – may provide clues to how children learn the meaning of actions performed by others, and how they learn to imitate those actions.

"The more we know about typically developing children, the better we will be able to develop interventions or early diagnoses, when the brain is still able to be retrained."

Jose Luis Contreras-Vidal, professor of electrical and computer engineering at the UH Cullen College of Engineering and director of the University's Non-Invasive Brain Machine Interface Systems Laboratory, said the work is designed to teach researchers more about how typically developing children learn and react to those around them. That knowledge could lead to develop better diagnosis and treatments for children with autism and other developmental disorders, he said.

"The more we know about typically developing children, the better we will be able to develop interventions or early diagnoses, when the brain is still able to be retrained," he said.

The work is part of a multi-institution project funded by a $6 million grant from the National Institutes of Health, with related projects underway at the University of Chicago, the University of Maryland and the University of Parma, Italy.

In this study, approved by the University's Committee for the Protection of Human Subjects, children wear a cap – similar to a swimming cap – covered with sensors that read brain activity. Additional sensors are attached to their forearms, torso and head to record body movement. The children, accompanied by a parent or guardian, are tested in a small room, decorated to resemble a childhood nursery, located in Contreras-Vidal's main lab on the UH campus.

Contreras-Vidal or a member of his research team tries to engage them, choosing from a basket of toys and encouraging the child to reach for the toy and imitate the researcher's movements.

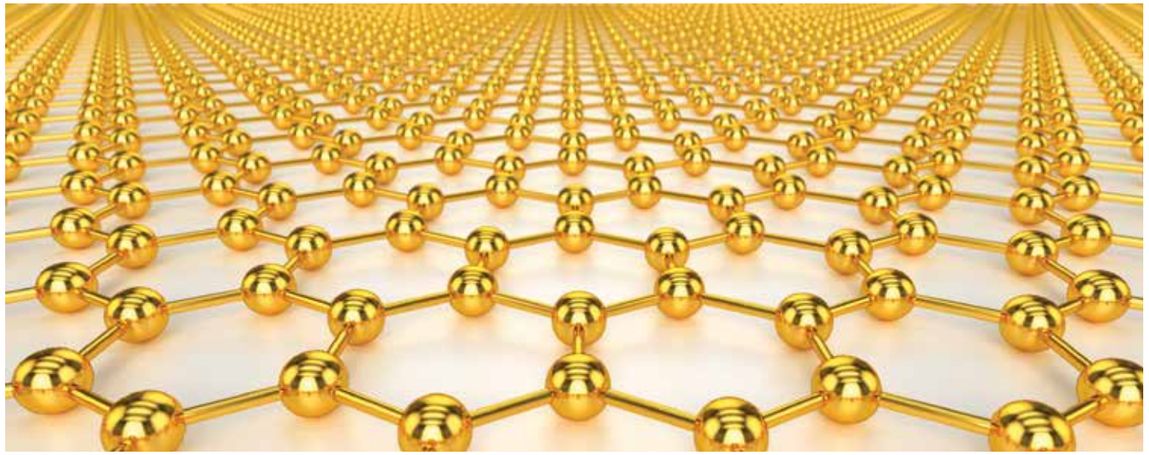
"It can be a challenge, because you cannot really talk with them," he said. "My experience is, if they are happy, they can do many things for you. Maybe they cannot do what you are doing, but they try to do so."

The test takes between 10 and 20 minutes and is ended if the baby doesn't want to cooperate, Contreras-Vidal said. The total time commitment is about an hour.

To learn more about this research, please visit www.egr.uh.edu/news/201410/baby-see-baby-do-uh-research-targets-youngest-subjects.

MATERIALS

PROFESSOR AND PH.D. STUDENT PUBLISH ARTICLE IN NANOTECHNOLOGY



When a material known as graphene was first produced inside of a lab in 2004, the science and technology community buzzed with predictions that it would become the "next big thing" for the semiconductor industry.

Graphene is essentially a one-atom-thick sheet of carbon that conducts heat and electricity with incredible efficiency, making it a very appealing material for the semiconductor and electronic device manufacturing industries.

Graphene can also be treated as a two-dimensional building block to create new structures. A bilayer graphene is created when one layer of graphene is stacked on another layer of graphene. Although the basic properties of single layer graphene are well understood, the properties of bilayer graphene remain a mystery for the scientific community.

Now, **Jiming Bao**, electrical and computer engineering assistant professor at the UH Cullen College of Engineering, has confirmed the band structure of twisted bilayer graphene. He published his findings in the journal Nanotechnology. His paper, "Four-fold Raman enhancement of 2-D band in twisted bilayer graphene: evidence for a doubly degenerate Dirac band and quantum interference," was selected to be highlighted on the journal's website, www.nanotechweb.org.

Perhaps one of the most puzzling properties of twisted bilayer graphene is that it is essentially a two-dimensional metallic material, making it interact with light and other materials in unusual and unexpected ways. Electromagnetic wave simulations have shown that graphene has the ability to act as an optical waveguide for surface plasmon, essentially serving as a pathway along which these electromagnetic waves can travel. Bao's group is currently exploring these peculiar plasmonic properties of graphene with the support of a National Science Foundation CAREER Award.

Working with bilayer graphene synthesized by electrical and computer engineering professor Steven Pei, Bao's group investigated the material using Raman spectroscopy. Typically, Raman intensity would be expected to double in bilayer graphene when compared to single layer graphene, but Bao's team observed a four-fold increase in Raman intensity with bilayer graphene.

Bao conducted much of his work alongside electrical and computer engineering Ph.D. student Yanan Wang, who noted that Raman enhancement was seen in previously published papers, but the phenomenon was never used to determine the underlying band structure of graphene itself.

"This is a classical example or interpretation of quantum mechanics," Bao said. "We can use this phenomenon to further explore the very interesting product of graphene and further characterize bilayer graphene." Bao added that with graphene's enormous appeal to the semiconductor industry, understanding the material and its properties has never been more crucial.

STEM OUTREACH

RET PROGRAM EARNS SPOT ON PRESIDENT'S HIGHER EDUCATION COMMUNITY SERVICE HONOR ROLL

Not only is the University of Houston's Cullen College of Engineering home to world-class research, it's also a recognized leader in science and engineering outreach. The latest proof: the college's Research Experience for Teachers (RET) Program is one of three University of Houston initiatives that together earned UH a spot on the 2013 President's Higher Education Community Service Honor Roll with Distinction.

The honor roll program is run by the U.S. government's Corporation for National and Community Service. It recognizes higher education institutions that "reflect the values of exemplary community service and achieve meaningful outcomes in their communities through service." Out of more than 800 institutions that applied for this award, UH was one of just 113 named to the Honor Roll with Distinction. The formal nomination for the award was submitted by Larry Hill, a research professor with UH's Graduate College of Social Work. In addition to the RET Program, the UH efforts included in the nomination materials were the Houston Public Broadcast System and the College of Optometry's Mobile Eye Institute.

The Cullen College's "Innovations in Nanotechnology" RET Program is led by **Fritz Claydon** and **Stuart Long**, both professors of electrical and computer engineering, and **Debora Rodrigues**, assistant professor of civil and environmental engineering. Funded by the National Science Foundation (NSF), the program brings about 12 middle and high school teachers to the college every summer to conduct nanotech-related research with a faculty expert.

With the assistance of a faculty mentor, teachers are then asked to design lessons for their students based on their time as a researcher. Through the program, dozens of lessons and activities have been posted on teachengineering.org, a highly regarded website dedicated to providing teachers from kindergarten through 12th grade with engaging and informative lesson plans. "Because of the efforts we've made and the success we've had, the NSF is saying that the gold standard for [lesson plan] deliverables is the UH model," said Claydon.

In addition, some of the RET participants have earned national recognition. High school physics teacher Mila Bersabal, a two-time RET participant and current RET Program master teacher, was the 2009 State of Texas winner for the Presidential Awards for Excellence in Mathematics and Science Teaching. Through the RET Program, she devised a lesson plan that had students use light waves to measure the spacing of nanoscale patterns (measured in the billionth of a meter) on CDs and DVDs.

Another notable RET participant is Madeline Landon, a 2009 RET high school student intern. Landon used her time in the program to study the use of seashells to remove harmful lead from drinking water. The project showed that the seashells' chemical makeup caused chemical reactions that removed up to 90 percent of lead from water. This project earned first prize in Environmental Science in the ExxonMobil Texas Science and Engineering Fair and a "second award" in the Intel International Science and Engineering Fair.

"This college is committed to improving science and engineering education throughout the country, and the RET Program is a big part of that," said Claydon. "I'm glad to see that the program has been recognized with this honor. It shows that we're really making an impact. The students, teachers and faculty mentors who support the program deserve a lot of credit for this success."

TECHNOLOGY

PROFESSOR EARNS GRANTS TO DEVELOP DEVICE-TO-DEVICE COMMUNICATION

Signals from smart phones are routed through base transceiver stations when they communicate, regardless of their proximity to their destinations. Signals from phones belonging to friends calling or texting in the same room must find distant base stations before they connect, just as signals from friends' phones located in opposite corners of the city must find base stations.

Zhu Han, associate professor of electrical and computer engineering in the UH Cullen College of Engineering, earned two National Science Foundation grants to develop and employ technology that allows smart phones and other devices in close proximity to communicate directly.

The foundation awarded Han with $185,000 to optimize the performance of cellular networks through device-to-device communication and $227,500 to apply the improved technology to mobile social networking. The three-year grants enable Han to employ two doctoral students, Yanru Zhang and Yunan Gu.

Han and his team are taking the game-theoretic approach in their development of an algorithm to allocate resources for distributed optimization of cellular networks. Device-to-device communication, which base stations can monitor rather than control, is the future, Han said.

Base stations currently control channels and the amounts of power they use, among other cellular network variables. Their capacity to handle demands of existing networks is insufficient, and future generations of networks are expected to grow significantly.

Meeting cellular network demands becomes more computationally feasible with the new technology, which can also increase efficiency, lower overhead expenses and reduce phone energy consumption, Han said. Furthermore, device-to-device communication can reduce interference, which causes slow Internet downloads and dropped or poor quality cellular phone connections. Such problems are inherent in mobile networks, regardless of their generation, so the improved technology can alleviate but not cure them, he said.

Han and his students are also using device-to-device communication to mobilize social media. Networking through smart phone applications such as Facebook and Twitter becomes mobile when devices in close proximity can share location information directly. The technology then allows the devices to avoid communication from strangers and find communication from friends. The lower-level adjacency of the technology that can enable this process is not configured yet, Han said.

"Location can be a bigger part of social networking," Han said. "We want to take advantage of that."

FACES OF ELECTRICAL AND COMPUTER ENGINEERING:

MEET THE NEW FACULTY

The UH Cullen College of Engineering's Department of Electrical and Computer Engineering welcomed six new faculty members last fall. Along with their top-notch research, they bring to UH a slew of awards, grants and publications. We are proud to welcome the following world-class researchers and educators to the electrical and computer engineering department.

David Mayerich,
Assistant Professor

How did you become interested in computing and biomedical imaging?
I got interested in computing when I was young. I played a lot of video games, and I actually went to graduate school with the intention of doing something like video game or computer graphics design. But I got involved in a biomedical imaging project, and all of the stuff really carries over and I got really interested in that.

What has been the most rewarding part of your research so far?
I really like doing things that are clinically applicable. Initially, my Ph.D. work was very research-oriented. It was doing brain-mapping, which is a long-term thing. Since then, I've kind of moved toward near-term, clinically viable projects like cancer research doing microvascular researching. The most rewarding thing is getting something out there that people who aren't electrical engineers and computer scientists can use.

What is the near-term future of your research?
My primary research focus is doing what's called high performance phenotyping, so being able to take a complete organ (like a brain) and completely reconstructing the three dimensional structure and the chemical composition. In the near-term, I'd like to see this stuff available online, essentially a Google Maps for the body so that researchers can access 3-D tissue information for all kinds of organs, for all different types of diseases.

What is one thing you want your students to take away from your classroom?
I'm more of a practical person, so I want them to be able to use the stuff in my courses to solve real-world problems. I want to give them a chance to do things like program and create applications and develop stuff.

What do you do to unwind after a long day at UH?
I've got two hobbies: fencing (Mayerich's wife is a fencing coach) and playing video games. I usually like RPGs [role playing games] and I also play a lot of board games with friends.

Julius Marpaung,
Instructional Faculty

What is the most fascinating aspect of robotics to you?
The idea of making a very complicated system from scratch.

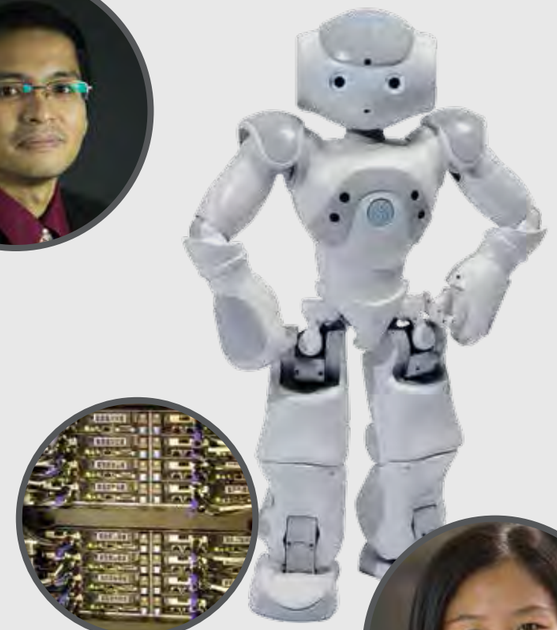
How and when do you think robotics will play a much larger role in our day-to-day lives?
I believe I can't put a timeline on it. What I've seen so far with many companies overseas and in the U.S. is that they're focusing on the autonomous cars. I'm looking forward to seeing things up and running in five to 10 years.

How will that look in our society?
I don't know how society will look or adapt to a new system. I believe we'll have to play it by ear. I'm hoping it will be a positive experience. I'm not seeing anything negative coming out of it, but we'll cross that bridge when we come to it.

Who inspired you to pursue engineering?
The person who inspired me the most is Dr. Louis Johnson from Oklahoma State University. He got his bachelor's and master's degrees from MIT and he's been my advisor since 2006. We're still talking about research in robotics and computer architecture. He's [played] a big role in where I am now.

What is the most rewarding part of teaching?
I think the most rewarding thing is to pass on knowledge to students in a way they won't forget. Every student is unique. They're coming from different backgrounds and the way you pass on knowledge and information to them, that will be unique and different from individual to individual.

What are you looking forward to most about discovering Houston?
The food! When I moved to Houston, I was totally surprised how you could find Asian food, Greek food, Tex-Mex, Mediterranean food. There are so many places that aren't listed online, so I rely on my peers and my students to fill me in on which restaurants to visit.



Xin "Felicity" Fu,
Assistant Professor

How did you become so interested in computing?
A long time ago, when I was young, my parents bought a very old computer for me to play with, and from the very beginning, I was interested in computers. Actually, my bachelor's degree is in computer science. I was quite interested in programming, and when I started my Ph.D., I turned to wondering what actually happens in the processor. I knew how to program but I never knew how it was organized, so I got interested in opening the processor and seeing what happens inside. So [from there] my research became computer engineering – what the processor looks like, how to make it run faster.

Who inspired you the most to pursue engineering?
My parents and my siblings. They're all in computer science. They gave me a lot of books to read, and that's what got me interested.

What do you enjoy most about teaching?
I love communicating with students. I like to talk to them and answer their questions. I feel happy when I can help them figure out their problems. They make me feel young.

What are you hoping to accomplish in your first year at UH?
I have a lot of plans. I want to build out my lab. I want more Ph.D. students working with me so we can build a larger group and contribute more to the community. We'll be working on getting funds to support the lab and the research.

What is your favorite part about Houston?
I transferred from the University of Kansas, which is in a college town. This is a totally different style. The traffic is something I don't like, but I love the big city. Everything is easier [and] it's so convenient to live here. The weather here is much better, too.

Aaron Becker,
Assistant Professor

What do you think is the most interesting aspect of working with robotics/automation?
Since kindergarten, I've wanted my own robot and to make machines that move things around. At their best, automation is embodied intelligence. I dutifully studied calculus, linear algebra and statistics, but these areas only became real to me after using them to solve robotics problems, like calculating the ideal size swarm to carry a piano, determining the angles for a robot to dominate at beer pong, or estimating the time a randomly-bouncing robot lawnmower would take to mow a yard.

What impact do you think robotics will have on the world in the next 50 years? 100 years?
As Niels Bohr said, prediction is very difficult, especially about the future. Extrapolating from my own three decades of living is thrilling. These years brought GPS, the Internet, cell phones, MRI scanners, and the first artificial heart. Our homes are increasingly automated and our cell phones wirelessly support video calls with friends worldwide, and are a combination digital assistant who can talk with us, [be a] tour guide and a movie studio with almost unlimited memory. Robotics leverages these technologies and it is difficult to stay ahead of the science fiction writers.

Robotics will continue to deal with aging, morality and privacy. In the next 50 years, we'll gain a new perspective on robotics as prosthetics and augmentations increase our capabilities and extend our quality of life well past the centenarian mark. The defining line between us and them will be blurred. Robots will co-create with us, open new realms for exploration, and make our workspaces and roads safer. But as the list of things robots are better at than humans will grow, robots will increase our abilities for exploitation, and robotics will make warfare increasingly impersonal. Robotics are here to stay; the question is if our ethical capabilities can exceed our technical capabilities.

What is important for students to know before they go into your class?
Students should have a goal for any class they take, and they should know a little about their professor. For my class, a great goal is to have a problem they'd like to automate. To learn about me, they should visit my YouTube channel (https://www.youtube.com/user/aabeckers), and subscribe to see the robots I've used.

What has been your biggest inspiration in your career so far?
My wonderful wife Laney and I have three young boys. My boys love robots and building toys. Often when I come home, their first question is, "Do you have a new movie of your robots?"

To you, what is the best part about living in Houston?
This is a toss-up between the Hermann Park Zoo, our proximity to the NASA Johnson Space Center, or the simple fact that I can plant a grapefruit tree in my front yard and harvest grapefruit in February. I'm originally from semi-rural Iowa, and Houston is a wonderful city to live in.

Jinghong Chen,
Associate Professor

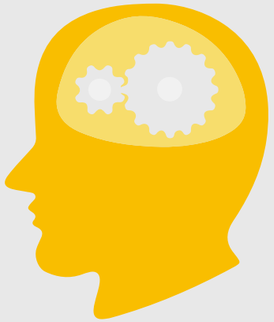
What motivated you to change career paths from working in the industry to working in an academic setting?
Working in an academic setting provides more freedom to do research and opportunities to pass on my knowledge to the younger generations.

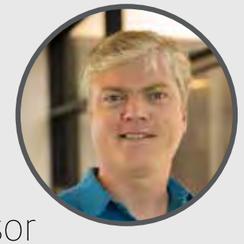
What are the practical implications your research could ideally have on wireless technology in the next five to 10 years?
We live and work in a digital society, surrounded by cell phones, laptops, cameras, iPods and other electronic devices constantly in use. And the desire for more automation, more information, and more broadband access with better, faster, cheaper mobile infrastructure continues to increase exponentially across the globe. But the physical world around us is analog. Music, speech, images, physiological signals, radio waves – any physical signal is continuous in time and in value. As our information society transitions to more and more digital media and communications, the need for interfaces between real-world analog signals and digital signals (bits) keeps growing drastically. For instance, voices need to be converted to digitized pulses and vice versa on cell phones; music has to be translated into bits for storage and converted back to sounds we can enjoy; images on digital cameras need to be changed to digitized pixels and then reversed. The challenge is how to keep all our digital devices connected to the real world with better quality, more pixels, more bits, while needing less — less space, less energy and less cost.

As an educator, what is the most important lesson you hope to teach your students?
Apply what we have learned to solve real world problems.

After a long day at work, how do you unwind?
Reading, exercising and spending quality time with my family.

What would you tell an incoming student who may be considering studying engineering, but isn't sure?
Engineering requires strong STEM (science, technology, engineering and mathematics) skills. Engineering is exciting and the pay is excellent. If the incoming student isn't sure about engineering, I would encourage him to talk to the professors, attend engineering seminars, come to the engineering open houses, and, if possible, get involved in engineering student organizations.





Ryan Canolty,
Assistant Professor

Do you prefer working with human patient populations in hospital settings for your research, as opposed to performing theoretical research? Why or why not?
The great thing about my position is that I can do both! I love working with human neurosurgical patients, because there are some things that you can only learn about from humans. For example, only humans use complex language – so to study language, you need to work with humans. Having the resources to integrate theoretical work with such empirical studies is one of the advantages of being a researcher here at the University of Houston.

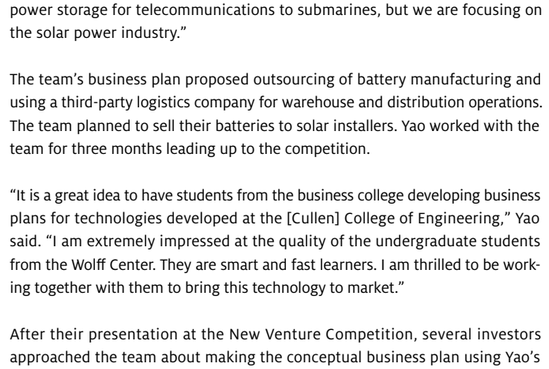
As you have spent your career studying neuroengineering, what is the most fascinating thing you've learned about the human brain?
That is a tough question (there are a lot of fascinating aspects to brain research!). One of my favorites, though, is the fact that the brain appears to use different brain rhythms (neuronal oscillations) to communicate different information. For example, it appears that theta (~5 Hz) and gamma (~40 Hz) oscillations are used for feedforward processing (from primary sensory areas to higher-order association cortex) and beta (~20 Hz) oscillations are used to regulate feedback processing (from higher association cortex to primary sensory areas). Therefore, understanding neuronal oscillations better may provides use with a window on complex brain processing.

What aspect of teaching do you enjoy most?
I like that moment of discovery where everything that was cloudy just "clicks," and you can see the understanding dawn on your student's faces.

In your first semester at UH, what are you most surprised to discover about the university community?
I'm still discovering new things, but I've been pleasantly surprised by how quickly the University is transforming into an even stronger powerhouse. Many great new hires and construction of great facilities.

Where do you hope to see your research go in the next five years? 10 years?
The primary goal of my lab is to clarify the fundamental principles that govern local computation and long-range communication in brain networks. Doing so will not only help us understand how natural brains work, but will allow us to interface technology with different brain systems in more effective ways. That sounds pretty exciting to me!

BUSINESS STUDENTS WIN BIG WITH YAO'S TECHNOLOGY



The University of Houston's Cullen College of Engineering and C.T. Bauer College of Business joined forces to compete in the University of Nebraska-Lincoln New Venture Competition.

The New Venture Competition, one of the oldest business plan competitions in the nation, pits student teams against each other in a battle of the business savvy. Teams present manufacturing and business plans surrounding new technologies to industry heavy-hitters and the most successful plan wins.

The UH team, named "Energetik," was composed of Jonathan Brown, Jonathan Cohen-Kurzrock, Rowbin Hickman, Noy Shemer and assistant professor of electrical and computer engineering **Yan Yao**. Together, they created an award-winning business plan based on Yao's battery research.

"Dr. Yao's successful research and development of this technology will create a battery that is safe, significantly lighter and smaller than any other batteries on the market, allowing for a competitive energy density and most importantly, a longer lifetime," Cohen-Kurzrock said. "This battery's application can range from power storage for telecommunications to submarines, but we are focusing on the solar power industry."

The team's business plan proposed outsourcing of battery manufacturing and using a third-party logistics company for warehouse and distribution operations. The team planned to sell their batteries to solar installers. Yao worked with the team for three months leading up to the competition.

"It is a great idea to have students from the business college developing business plans for technologies developed at the [Cullen] College of Engineering," Yao said. "I am extremely impressed at the quality of the undergraduate students from the Wolff Center. They are smart and fast learners. I am thrilled to be working together with them to bring this technology to market."

After their presentation at the New Venture Competition, several investors approached the team about making the conceptual business plan using Yao's technology a reality.

ECE PROFESSORS NAMED DIRECTORS OF HONORS ENGINEERING PROGRAM

Electrical and computer engineering (ECE) professor Fritz Claydon has been appointed director of the Honors Engineering Program at the UH Cullen College of Engineering, with ECE associate professor Len Trombetta appointed as associate director.

The Honors Engineering Program (HEP), which began in 2010, is jointly offered by the Cullen College of Engineering and The Honors College as a program that cultivates community among honors students pursuing an engineering degree, and provides an enhanced academic experience through project-based courses, mentorship opportunities and visits with industry partners. Designed to promote innovative thinking, HEP combines team-building activities (such as building Habitat for Humanity homes or visiting local companies) with more intensive classroom lessons.

The program also gives these academically-gifted students a larger selection of more comprehensive versions of existing engineering courses in smaller classroom settings taught by leading Cullen College faculty. Cullen College students currently make up about 20 percent of The Honors College enrollment.

"Our goal is to immerse students in a curriculum in which they see the relationship between their course subjects and the problems that await them as practicing engineers," Claydon said.

ECE DEPARTMENT PUBLISHES ON SMALL SATELLITE RESEARCH INVESTMENT

Small satellite research has taken flight in the Cullen College's electrical and computer engineering (ECE) department, providing students and faculty unprecedented access to space education and research.

Small satellites (or "CubeSats") are generally classified as small, cube-shaped satellites that weigh less than 3 kilograms. Compared to standard-sized satellites – which typically cost hundreds of millions of dollars to develop and launch – CubeSats can be developed for about $5,000 and launched for under $100,000.

Last year, ECE faculty members **Ji Chen** and **David Jackson** received seed funding from the Cullen College to launch a research program aimed at developing improved antennas for small satellites. Shortly thereafter, NASA offered Jackson and Chen up to $200,000 over two years to continue their research within the Small Satellite Research Laboratory.

While the return on investment for the Small Satellite Research Laboratory was great news for college, the real winners, in this case, are the students who now have the opportunity to conduct cutting-edge, NASA-sponsored research within the small satellite lab. Undergraduate and graduate students involved in research within the Small Satellite Research Laboratory work side-by-side with NASA experts in researching, developing and testing new technologies for CubeSats with the very high probability that their work will be deployed into space by the end of the year.

Now, ECE chairman **Badri Roysam**, along with Chen, Jackson and NASA collaborators Steve Provence and Steven Huning, have published an article in the January 2014 issue of "ECE Source" which details the benefits of investing in small satellite research at the college-level for both undergraduate- and graduate-level ECE students.

The article, titled "Elevating the ECE Capstone Design Experience with CubeSats," was the featured article in the January 2014 issue of "ECE Source," the newsletter of the Electrical and Computer Engineering Department Heads Assocation (ECEDHA). To access the full article, please visit http://ecedha.org/ece-media/newsletter/january-2014/cubesats-article.

COLLEGE MOURNS PASSING OF PROFESSOR EMERITUS

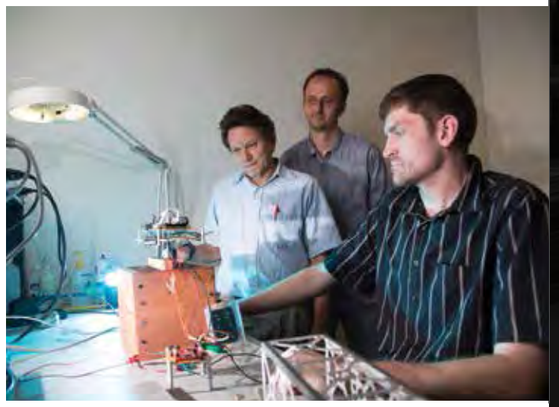
The University of Houston's Cullen College of Engineering is mourning the passing of Liang C. Shen, professor emeritus of electrical and computer engineering. Shen died in September at his home in Houston.

Shen began his long career at UH in 1967, when he joined the ECE faculty after receiving his Ph.D. from Harvard University. From 1977 to 1981 he served as chair of the department, and in 1979 he founded the Well Logging Laboratory, now the Well Logging Consortium.

During his career, Shen supervised 39 master's students and 11 Ph.D. students and published over 90 articles in top international journals. He authored one of the most widely adopted undergraduate electromagnetics textbooks in the nation, "Applied Electromagnetism, 3rd Edition," which is still used by students at UH today. In 1987, he was elected IEEE Fellow. In 1999, he received the Fluor Corporation Faculty Excellence Award from the Cullen College, the school's highest honor.

Shen retired from his teaching position in the Cullen College in 2004 and was appointed professor Eeeritus the next year. Stuart Long, professor of electrical and computer engineering, met Shen at Harvard and remained close with him throughout his career. When Shen retired from UH, Long spoke at his goodbye party.

"I am most happy to have had the opportunity to work with Liang, but I am also very sad that he is retiring," Long said at the party. "He is a true gentleman and a scholar, whose lasting hallmark will be the integrity of his research. For the past 30 years he has been my teacher, my role model, my mentor, my source of knowledge, my co-author, my chairman, my example as an administrator, my colleague, and most importantly, my friend."



LITVINOV RECEIVES UNIVERSITY'S HIGHEST HONOR AND JOINS NATIONAL ACADEMY OF INVENTORS AS A FELLOW

The world owes **Dmitri Litvinov** a lot.

Litvinov is the John and Rebecca Moores Professor in the Cullen College's electrical and computer engineering department, a professor of chemical and biomolecular engineering and of chemistry, and the vice provost and dean of the UH Graduate School. He is also the director of the materials engineering program and the nano-engineering minor program, the Center for Integrated Bio and Nano Systems and the UH Nanofabrication Facility.

Litvinov's long list of titles is an indication of the many accomplishments he has made during his decade-long career with UH. For this, the university awarded Litvinov with its highest faculty honor, the Esther Farfel Award, which is given annually to a professor who excels in teaching, research and service.

Before his career in academia, Litvinov made industry strides that became ubiquitous in everyday life around the world. Litvinov worked in the research division of Seagate Technology where he championed the development of perpendicular magnetic recording, a technology used in most computer hard drives. He holds 26 U.S. patents and two pending patents.

Litvinov joined UH in 2003 to pursue his passion for education, basic research and technology development. Both his research and teaching focus on nanoscale materials and devices and their applications to information technology and medical diagnostics. He enjoys his work most when the pursuit of his personal interests benefits others.

"In everything I do, I always strive to arrive at a win-win scenario for myself, the students, my colleagues and the university," he said. "It is not much fun if I am the only beneficiary of my own work; it needs to provide tangential benefits to others, too. There is a great degree of satisfaction in this approach."

Litvinov's passion for inventing also earned him fellow status of the National Academy of Inventors (NAI) in 2013.

To be eligible for fellow status, an individual must be a named inventor on at least one patent and must be affiliated with a university, nonprofit, research institute or other academic entity. According to the NAI website, fellow status is awarded to "inventors who have demonstrated a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society."

RETIREMENTS

EARL JOSEPH "JOE" CHARLSON

Contributed by: Wanda Wosik, Associate Professor of Electrical and Computer Engineering

Professor Earl Joseph "Joe" Charlson retired from the UH Cullen College of Engineering in the fall of 2014.

After receiving a Ph.D. from the Carnegie Institute of Technology, now Carnegie Mellon University, his career mainly focused on solid state and thin film electronics as well as integrated circuits. His experience includes many industrial positions, which spanned from his junior year Achievement Scholarship in Westinghouse Electronics Division in Baltimore, Maryland, through various engineering and consultant ranks in microelectronic companies and national laboratories.

His contribution to electron devices and integrated circuits was truly pioneering and included new designs, innovative fabrication processes, and simulation models, which were first developed for bipolar and MOS discrete devices. Later they evolved and led to BJT and MOS integrated circuits.

Some examples of Joe's fascinating adventure with microelectronics go back to the first bipolar transistor designs for shipboard radar, nuclear bomb electronics, MIS and glow discharge solar cells, TTL low power Schottky ICs, and NMOS planar processing with associated device and fabrication modeling. His track record in multidisciplinary science is also quite impressive and reaches from basic material science to his biomedical pioneering work on sensing in electrophysiology.

Joe was very successful in his research, with multiple grants received from many federal and state agencies and well as many corporations and private companies both nationally and internationally.

Joe joined the electrical and computer engineering department at the UH Cullen College of Engineering in 1999 after serving as the associate dean for administration at the University of Missouri-Columbia. At the University of Houston, he became associate dean for administration and graduate studies from 1999 to 2004, as well as graduate program director for the electrical and computer engineering department in 2011.

He was beloved by students for teaching his VLSI courses and for being able to answer any questions they would have. His first award, among many others, was the Most Admired Professor Award by Eta Kappa Nu received in April 1974. He has graduated 39 Ph.D. Students and supervised many M.S. theses. He remains closely associated with the ECE department as a professor emeritus and is still instrumental to the department's activities.

From the very beginning of his professional life, professor Charlson was recognized for his unusual talents in science and engineering, which made him a true Renaissance Man. He is one of the historical architects of our modern microelectronics.

RICHARD LIU

Contributed by: Jack Wolfe, Professor of Electrical and Computer Engineering

Richard Liu joined the electrical and computer engineering department at the UH Cullen College of Engineering as a post-doctoral fellow in the Well-Logging Laboratory (WLL) in 1988. He earned a position as visiting assistant professor in 1991 and rose through the ranks to full professor in 2003.

His research program at UH was broad-based with support from the National Science Foundation, the National Center for Earthquake Engineering Research, the Texas Department of Transportation (TxDOT), the Texas Higher Education Coordinating Board and the Well-Logging Consortium. The Well-Logging Consortium is comprised of the leading companies in oil exploration and production including British Petroleum, Baker-Hughes, Chevron, ExxonMobil, Great Wall Drilling Company, Oliden Technology, Saudi Aramco, Schlumberger, and Weatherford.

Liu's work received TxDOT's Most Innovative Research Project Award (2005). He served on the Technical Advisory Committee of the Texas Department of Transportation as well as the prestigious and influential Committee on Radiation Source Use and Replacement of the National Academy of Science.

The leadership of the Well-Logging Laboratory passed to Liu after the retirement of Liang C. Shen in 2004. WLL undertook many new projects under Liu's leadership in the areas of rock physics, logging tool performance, simulation, design and data telemetry. It was heavily involved with the latest trends in oil exploration including theoretical and experimental studies of induction and measurement-while-drilling (MWD) tools to obtain a better understanding of tool response in complex logging environments, such as dipping formations, thin invaded beds, anisotropic formations and shale-sands. During Liu's 10 years as director, the Well-Logging Laboratory continued to build its reputation as the leading academic research organization in the resistivity logging area, worldwide.

The WLL operates the Nuclear Logging Calibration Facility as a service to the well logging industry. It has a set of Potassium-Uranium-Thorium standard pits. These pits, which are located on campus constitute the only Class 1 nuclear logging calibration facility in the US. It is heavily booked year-round by industrial logging companies.

Liu has published 59 articles in archival journals, three book chapters, and 96 conference publications. He has given 21 invited presentations, primarily to industry, and received 11 patents on his work at UH. He has been named Honorary Professor at the China University of Geophysics (2007), Chang An University, Xian, China (2009), and Jianghan Petroleum Institute, Jianghan, China (1999).

Liu has taught nine different undergraduate courses in the ECE curriculum and created new five graduate courses. Under his guidance, 25 Ph.D. and 38 M.S. students received their degrees. These graduates form the backbone of the well-logging industry in Houston today.

ACCOLADES

- **Zhu Han** was named a fellow of the Institute for Electrical and Electronics Engineers (IEEE).
- **Julius Marpaung** won a New Faculty Research Award from the University of Houston's Division of Research.
- **Jung-Uk Lim** won a New Faculty Research Award from the University of Houston's Division of Research.

UNIVERSITY RECOGNIZES ECE FACULTY

Each spring, the University of Houston recognizes exceptional faculty members across the university at the annual UH Faculty Excellence Awards Ceremony. This year, three faculty members from the Cullen College's Department of Electrical and Computer Engineering received awards in teaching and research.

Teaching Excellence Award (Instructor/Clinical)
Diana de la Rosa-Pohl

Teaching Excellence Award (Group Teaching)
Stuart Long and Fritz Claydon (GK-12 Program)

ECE UNDERGRAD MAKES MAJOR STRIDES IN THE TECH WORLD

Rakshak Talwar, an electrical and computer engineering undergrad at the Cullen College, raised $7,445 on the crowd-funding website Kickstarter for his "Programmable Capacitor." This figure is more than double his original goal of $3,000 and was raised in just 15 days.

Traditional capacitors are so ubiquitous that it's difficult to find an electronic product that doesn't use one. However, one big drawback to these energy-storing components is that one-size-does-not-fit-all; different devices need different types of capacitors. But Talwar's Programmable Capacitor is adjustable to over four billion value combinations, making it compatible with virtually every circuit imaginable – and it only costs $25.

He originally planned to produce an initial batch of 100-200 capacitors, but with the extra money he ended up filling 233 orders.

A tinkerer from birth and an inventor by nature, Talwar had been creating circuits for only a few short months before he came up with the idea for his capacitor. His one-size-fits-all capacitor saves time for inventors, who would otherwise have to search through a pile of loose parts for the capacitor that fits their specific need. With the Programmable Capacitor, one compact board can be used for all circuits.

Perhaps more fascinating, however, is Talwar's devotion to open sourcing his inventions. Instead of racing to patent his capacitor, he secured a creative commons license. Once his initial 233 capacitors are shipped this year, his design files will be available online – for free. Anyone who wants to build upon his idea must keep their design files public as well, thanks to his creative commons license.

Talwar believes his massive Kickstarter success is "empirical evidence" that he can eventually make money off his inventions without patenting them. The idea of never earning large profits doesn't seem to bother him, though. "[Steve Jobs] is my biggest idol. He said – and I completely agree with him – 'I don't want to be the richest guy in the graveyard when I die. I want to go home every night and say I did something wonderful.'"

SCHOLARSHIP CONNECTS DOCTORAL STUDENT WITH BIOMEDICAL SCIENCES

When **Dhivya Ketharnath** was in high school, she knew she wanted to be an engineer, but she never would have predicted she would be conducting nanoparticle research for cancer therapy applications inside some of the finest biomedical laboratories the City of Houston's medical center has to offer.

Now, thanks to a grant from The Texas Center for Superconductivity at the University of Houston (TcSUH), along with UH's College of Natural Sciences and Mathematics and the Cullen College of Engineering, Dhivya will continue pursuing her Ph.D. in electrical engineering with a $2,500 stipend to continue her research within the TcSUH laboratories.

The Houston Electrical League (HEL) Scholarship is awarded each year to two outstanding undergraduate or graduate students with fantastic accomplishments both in academics and research. The merit-based scholarship is given to students currently conducting research within TcSUH's multidisciplinary laboratories. The mission of these scholarships is to encourage interdisciplinary research with a focus on finding applications in biomedical sciences and engineering.

Under the guidance of faculty advisor Jarek Wosik, a research professor with the Cullen College's department of electrical and computer engineering and TcSUH, Dhivya is conducting research on manipulating nanoparticles using radio frequencies and AC magnetic fields for cancer therapy applications. Through the HEL scholarship and TcSUH, Dhivya enjoys unique access to the Houston Methodist Research Institute (HMRI), where she conducts in-vitro cell studies at their laboratory facilities. In addition, Dhivya said HMRI doctors provide her with mentorship and guidance with her research.

At the Cullen College in general and the TcSUH in particular, a high premium is placed on providing funding for students and faculty members who take on ambitious, multidisciplinary research efforts. By investing in research and students such as Dhivya, the center has established award-winning research programs in medical imaging and nanomedicine and created lasting partnerships with a variety of collaborators at the Texas Medical Center.

PH.D. STUDENT EXPANDS RESEARCH TO COVER CROSS-EYED MONKEYS

Mehmet Agaoglu, a Ph.D. student in the electrical and computer engineering department at the UH Cullen College of Engineering, is attracting national attention for his work researching strabismus (the disease which causes humans to go cross-eyed) in Rhesus monkeys at the College of Optometry.

Last spring, he won the members-in-training contest at the Association for Research in Vision and Ophthalmology's (ARVO) annual conference for his strabismus research and corresponding poster. His award included a travel grant to attend the ARVO conference for free.

Agaoglu began working part-time at the College of Optometry as a programmer while pursuing his engineering degree. "Their research is in a very highly technical, computationally intense area," he said. "Their work requires highly skilled engineering, because they have a lot of equipment and they need programming to make the devices talk to each other. So I went there and was able to program really quickly because I knew the concepts."

While on the job, Agaoglu said he was noticed by Vallabh Das, associate professor of optometry, and was recruited to begin conducting actual strabismus research in the primate lab. Rhesus monkeys, sometimes known as macaques, are conditioned at a young age to develop the eye condition. Das and his team then work to determine how to treat the underlying cause, which they believe to be the brain – even though popular logic currently points to eye muscles as the culprit.

"If you do corrective surgery [on a strabismus patient], they cut some of the muscles – but it only works in 40 percent of the cases," he said. "Most of the time the strabismus actually becomes worse and the patient ends up with worse vision… because [we think] the brain is adjusting its input to the muscles and pulling them back."

To test their hypothesis, Das' team records output from the different brain regions that control the eye muscles of the monkeys. "By recording these motor regions, we're trying to show that the strabismic monkeys and normal monkeys have the exact same muscle and motor command properties, so the difference must be somewhere in the brain where the command originates," Agaoglu said.

The scope of Agaoglu's strabismus research is staggering, but it's just a side gig. In pursuit of his computer engineering doctoral degree, he also studies "ballistic eye movements" under the direction of his advisor, Haluk Ogmen, professor of electrical and computer engineering. The human eye moves involuntarily at least three times per second in an effort to keep retinal images from fading or losing contrast. Agaoglu is performing computational experiments to determine how the brain accounts for these eye movements and processes the information in the scene.

(From left): Richie Dettloff, Nicole Neveu, and Joseph Casana

UNDERGRADS TOP DOCTORAL STUDENTS IN PAPER COMPETITION

Undergraduate student work at the UH Cullen College of Engineering won the overall Best Paper Award at the recent IEEE International Conference on Wireless for Space and Extreme Environments, topping papers presented by industry, government and academic researchers.

The paper, "Transparent Microstrip Antennas for CubeSat Applications," grew out of a senior design project taken on last spring by electrical and computer engineering students at the college.

Small, cube-shaped satellites that weigh less than 3 kilograms are used for many applications. Once these satellites are launched into space, they communicate through wire whip antennas, which rely on mechanical systems to deploy – systems that often fail. NASA researchers approached the college seeking a better solution.

The student team consisting of Nicole Neveu, Joseph Casana, Richie Dettloff and Mauricio Garcia ended up taking on the project for their senior design course. Their advisors on the project were ECE faculty members Ji Chen, David Jackson and Jack Wolfe.

To avoid relying on any mechanical deployment systems, they knew they had to develop an antenna that is attached to or printed on one side of the satellite itself. This presented a problem: All six sides of CubeSats are covered in solar panels, which generate the energy that powers the satellite's electronics. Covering too much of a solar cell would cut the power it needs to perform.

The solution they devised was a silver mesh antenna on a quartz surface. When placed on a CubeSat solar cell, the cell's power output only dropped by 15 percent. In addition, the new antenna was designed to send and receive signals in a single direction – a desirable property in CubeSats, which rely heavily on satellite-to-satellite communication. As a result, this new antenna has a longer communication range and uses less power than the old whip antennas.

While the design is still being refined, it may be used in satellites launched into space later this year.

ECE STUDENT, RESEARCHER WIN POSTER AWARDS AT MISSION CONNECT SYMPOSIUM

A researcher and a graduate student with the department of electrical and computer engineering (ECE) at the UH Cullen College of Engineering both won best poster awards at the 2013 Mission Connect Annual Scientific Symposium held in Houston in December 2013.

ECE researcher **Atilla Kilicarslan** received the overall best spinal cord injury poster award for his project titled "Neurorex – A Thought Controlled Robotic Exoskeleton for Gait Restoration." Kilicarslan delivered a three-minute elevator pitch for his poster to a panel of judges, who chose his poster presentation as the best among the 15 other presentations.

Kilicarslan works closely with ECE professor Jose Luis Contreras-Vidal, a leading expert on brain-machine interface systems. Contreras-Vidal and his research team (of which Kilicarslan is a member) focus on the development of noninvasive methods to interface the human brain with machines in order to help patients with mobility issues – such as paraplegics, stroke patients or amputees – regain their ability to walk and utilize their limbs using only the power of their thoughts.

ECE graduate student Kedar Grama received first place in the traumatic brain injury student category for his poster titled "Comprehensive detection and quantitative profiling of brain cytoarchitectural alterations caused by pathophysiological conditions using multiplex imaging and computational analysis."

Grama's research focuses on the widespread brain alterations that can take place after a traumatic brain injury occurs – even in portions of the brain quite distant from the original injury or damage site. Current imaging methods often miss critical changes in certain brain regions that can eventually manifest into additional clinical conditions down the road. Using a machine-learning algorithm to analyze images of rat brains, Grama was able to produce a much richer set of quantitative measurements to detect changes in cell structure throughout the brain, as well as identify the type and state of each cell.

ECE SENIOR WINS OUTSTANDING HONORS THESIS AWARD

Ramon Montano, an electrical engineering alumnus of the UH Cullen College of Engineering, was honored for his work on transparent antennas for cube satellites with the Outstanding Honors Thesis Award. The award, an initiative spearheaded by Joseph Tedesco, dean of the Cullen College, is in its pioneer year with Montano as its first recipient. In 2012, he began his undergraduate research with the Provost Undergraduate Research Scholarship (PURS), which introduced him to the CubeSat research being done in the Cullen College.

"Dr. [David] Jackson gave me some real simple tasks to learn the software, simulate a few different types of antennas, and come up with some rudimentary results," Montano said. When the PURS research scholarship ended, Montano continued his work with CubeSat antenna designs. He travelled to Wisconsin to present his research and attended several national symposiums held in Houston. By the time he began his senior honors thesis, he was ready to conduct some serious analysis.

Montano spent much of his senior year reading articles about different materials used for satellite antennas. "But the bulk of the time went into simulations," he said. "Some simulations are known to run from a couple of hours to a couple of days. So toward the end of the semester, I spent a couple of all-nighters running simulations because I needed better results."

PH.D. GRADUATE WINS COLLEGE'S BEST DISSERTATION AWARD

Ji Qi, who recently earned her doctoral degree in electrical and computer engineering from the UH Cullen College of Engineering, has won the college's 2014 Best Doctoral Thesis Award. Qi's mentor for her thesis was Wei-Chuan Shih, assistant professor of electrical and computer engineering.

Qi has conducted interdisciplinary research that touches on novel spectroscopic microscopy instrumentation, plasmonic nanostructure engineering, and practical biomolecular sensing with single molecule sensitivity. She is the first to demonstrate a fundamentally new plasmonic entity – nanoporous gold nanoparticles – featuring high-density hot spots for intense light concentration. Coupled with the advanced instrument and assays she developed, her dissertation work has laid the foundation for potential impact in cancer diagnosis and treatment, environmental toxicology, energy conversion, and photocatalysis.

Last year, the journal Nanoscale featured her article as its cover story. Qi's article is titled "Surface-enhanced Raman spectroscopy with monolithic nanoporous gold disk substrates."

WIND ENERGY INNOVATION PRESENTATION WINS IEEE RECOGNITION FOR BEST PAPER

Electrical engineering graduate student **Radhakrishna Kotti** presented award-winning research that earned Best Second Paper recognition at the 15th IEEE Workshop on Control and Modeling for Power Electronics (IEEE COMPEL 2014). Kotti worked with Wajiha Shireen, Engineering Technology Professor from the University of Houston College of Technology.

The conference emphasizes the latest advances in modeling, analysis and control of power electronic devices, circuits and systems. It was held last June at the College of Industrial and Telecommunications Engineering of the University of Cantabria in Santander, Spain.

Kotti's presentation was titled "Adaptive Sensorless Maximum Power Point Tracking Control of a Permanent Magnet Synchronous Generator (PMSG) Based Wind Energy Conversion System." Supported by funding through the Department of Energy (DOE) Smart Grid Energy Training Coalition Grant, the project addresses the wind energy industry's challenges in designing solutions that increase and optimize efficiencies of the micro grid will be filed for a provisional patent by UH.

"I am very proud to have earned this recognition by IEEE, and grateful for outstanding faculty mentors, Dr. Wajiha Shireen, Dr. Raymond Cline, and co-author Shyam Janakiraman," said Kotti. "The opportunity to travel to Spain to present this research was an unforgettable opportunity which could not have been possible without their support," he added.

"Winning this award is an excellent example of the high quality of research work that is produced through our commitment to strong collaboration between engineering and technology," said Cline, the research program manager for the Smart Energy Training.

"We are honored to be recognized for the discovery of new ways to improve operating and cost efficiencies for alternative power sources through the outstanding work that is being done here at UH," said Shireen.

Shireen, Kotti and Janakiraman traveled to the IEEE Power & Energy Society Conference, in Washington, D.C. last July to present similar wind energy research.

ALUMNA GIVES BACK WITH SCHOLARSHIP

Nwamaka Nzeocha, an electrical engineering graduate of the Cullen College, awarded a $1,000 scholarship to a current engineering student through her "Dare to be Different" scholarship contest.

"I wanted to make the scholarship something that I'm very passionate about, which is thinking outside the box, but not in a cliché way," Nzeocha said. "Not every engineer that graduates has to be a factory-type, run-of-the-mill engineer. I want to encourage people. If you have an idea that may be a little bit different, it may not be something you saw in a textbook or something you were trained to do, but you've been groomed with all that engineering knowledge and you can use those skills to do something that can really impact somebody's life, really change things for the better."

Nzeocha found a way to use her electrical engineering education both inside and outside of the oil and gas industry. During the day, Nzeocha works as an electrical engineer at Chevron, but when the work day is through, she works on what she calls her "baby": EasyWeave.com, an online sales platform for hair extensions.

To participate, scholarship applicants submitted a short video explaining their unique entrepreneurial ideas. The winner was Joe Udoh, an industrial engineering major at the college who runs Program Lords, a web based system that allows students to schedule tutoring sessions with their more senior peers. Program Lords, Udoh said, has allowed him to learn many of the basics of running a business, including scheduling, hiring and firing, business validation and market research. Udoh now wants to franchise Program Lords to give other students the same valuable experiences.

"This has made me a better business savvy individual," Udoh said in his video. "I would like to take this idea and create a platform out of it, a way for other individuals like myself, who dare to be different, to be able to learn how to run a business."

ENGINEERING ALUMNI ASSOCIATION AWARDS $61K TO STUDENTS DURING EWEEK

The University of Houston Engineering Alumni Association (EAA) hosted its 10th annual EWeek Reception and Program last February, handing out approximately $61,000 in scholarships and awards to UH engineering students and organizations. UH EAA EWeek has now awarded nearly $329,000 during the past 10 years, said Cynthia Oliver Coleman, the event's founder and chair.

About 260 people attended this year's gathering. Two groups tied for the event's top sponsor: Ryder Scott Company Friends of UHPE, which was represented by Dean Rietz, and the UH Petroleum Engineering Advisory Board, represented by Ron Harrell.

A number of companies and individuals contributed to the scholarship and award fund. These included, AADE Houston Chapter, AECOM, Aker Solutions, American Society of Indian Engineers, Black Cougar Engineers, BMC Software, BP, Cameron, Civil Engineering Cougars, ConocoPhillips, Cougar Engineers, Cynthia Oliver Coleman/ExxonMobil, ExxonMobil, ExxonMobil Women Cougar Engineers, Fluor Corporation, FMC Technologies, Friends of Cougar Biomedical Engineering, Marathon Oil Corporation, Phillips 66, Ryder Scott Company Friends of UHPE, Schlumberger, Society of Women Engineers Houston Area, UH Petroleum Engineering Advisory Board, UH Petroleum Engineering Alumni, UH PROMES Alumni, and the EAA.

The winner of the Engineering Challenge was also announced during the event. The challenge has different UH engineering alumni donating so their respective student organization will have the chance to win the grand prize. This year's winning organization was the UH chapter of the American Society of Mechanical Engineers. The top individual donor in the Engineering Challenge was Andrew Weaver, BSME '01.

Several awards and honors were handed out during the reception. Among them were awards for the student organization community outreach competition. The UH chapter of the Society of Hispanic Professional Engineers took the grand prize, while the Society of Women Engineers won both the runner-up prize and the early bird prize.

ENGINEERING ALUMNUS BRINGS STEM TO HOUSTON KIDS

When **Monse Lozano** was a teenager growing up in the Houston Heights neighborhood, he dropped out of public high school, earned his GED and found work at a local phone company. A decade later, the UH Cullen College of Engineering alumnus and engineer at NASA's Johnson Space Center creates robotic technologies launched into space and used aboard the International Space Station.

It's an uncommon career path, but Lozano bucks tradition in more ways than one. He's also in the process of starting a nonprofit organization aimed at teaching electronics through art to Houston's youth.

Lozano's nonprofit is called Vampire Squid Labs (VSL), and he's currently in the process of getting the group certified as a 501(c)(3) with the IRS so it can obtain funding and certification necessary to offer classes later this year.

Vampire Squid Labs' goal is to introduce technology in understandable ways to younger audiences through art, which is near and dear to Lozano's heart. Student projects on the horizon include creating synthesizer circuits so the students can perform musical concerts and building small vibrating robots that can hold paintbrushes and create works of art.

The focus is on "making it fun, avoiding all the technical stuff," he said. "There is a lot of hands-on creation in the labs and with the projects."

The electronics classes had a trial run last fall when Lozano shared his curriculum with Multicultural Education and Counseling Through the Arts (MECA). The overwhelmingly positive response motivated Lozano to strike out on his own.

"If I had been exposed to this [as a child], I would have pursued engineering a lot earlier," Lozano said. "I would have graduated at the regular graduation age, 22 or 23, so I would have started my career path a lot earlier."

Lozano calls Vampire Squid Labs his "baby" despite the additional work. The high school dropout who became a NASA Johnson Space Center engineer hopes to spread interest in the field that has given him so much. "I feel lucky, and I want to share that and give others a similar opportunity," he said.

Learn more about Vampire Squid Labs at http://vampiresquidlabs.com.

ALUMNUS WINS HACKATHON WITH LIFE-SAVING INVENTION

Rocco De Grazia graduated in 2004 with a bachelor's degree in electrical engineering from the University of Houston Cullen College of Engineering. Now, 10 years later, he's still making waves in the tech community. Earlier this year, he earned a second place prize at the City of Houston's Hackathon, a 24-hour competition celebrating the technologies and innovations that benefit society.

The Hackathon is a competition held by the City of Houston wherein participants have only one full day to both begin and complete a technological innovation with an aim to better society. Most participants, De Grazia said, worked on software applications – he was one of the few participants working with actual hardware.

De Grazia's winning entry at the Hackathon was CarEye, a small solar-powered device that scans automobiles for the presence of humans in high-temperature conditions and alerts vehicle owners by phone if a human presence is detected inside the car. While a current average of 40 babies die annually from being left inadvertently in hot cars, the introduction of CarEye could virtually eradicate the issue completely.

While the Hackathon competition was held at the end of May, De Grazia said he came up with the idea for CarEye last winter. "I was reading in the Houston Chronicle … about a lady that unfortunately forgot her child in the car, and it was because of distraction, not because she was a bad parent or anything like that," he said. "It's a very basic problem, why isn't there anything on the market to fix it?"

When a colleague mentioned the Hackathon to De Grazia months later, he remembered the article and entered the competition with his idea for a solution. De Grazia works full time as a consultant at Wipro Technologies, but spends his off time dabbling in the "Internet of things," a concept that promotes attaching internet capabilities to everyday items in ways that improve their functionality. He approached the Hackathon with the mindset that he would set aside the 24 hours to focus solely on CarEye without the distractions of his other innovations, not realizing how well received his final product would be.

Since winning second place in the Hackathon (which included a meeting with Houston Mayor Annise Parker to pitch his idea), De Grazia said he and his business partner are working on new CarEye prototypes to present to investors. The initial device was completely constructed during the 24-hour competition, but he hopes that new prototypes will be smaller and more powerful, with different notification options like alerting local authorities if the vehicle owner doesn't respond to the notification.

While he doesn't have children himself, De Grazia has become passionate about the CarEye initiative and the lives it could save. "A solution has to [become mainstream]," he said. "It's too simple of a problem not to solve, and why not solve it?"

CULLEN COLLEGE SPEARHEADS $3.3M GRANT TO PROMOTE WOMEN IN STEM FIELDS

The University of Houston was awarded a $3.29 million grant over five years by the National Science Foundation's (NSF) ADVANCE program to increase the number and success of women faculty in the science, technology, engineering and mathematics (STEM) fields.

The focus of the ADVANCE program is to "increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce." This award will allow the university to establish a "Center for ADVANCING Faculty Success" to oversee the goal of increasing female STEM faculty recruitment, especially among women of color, as well as enhancing UH's infrastructure to make gender equity and diversity campus-wide priorities.

The Cullen College of Engineering spearheaded the grant proposal with support from the College of Technology, the College of Liberal Arts and Social Sciences, the College of Education and the College of Natural Sciences and Mathematics. Renu Khator, chancellor and president of the University of Houston, is the principal investigator on the grant.

Co-investigators include Joseph W. Tedesco, Elizabeth D. Rockwell Professor and Dean of the Cullen College of Engineering; Bonnie Dunbar, M.D. Anderson Professor of mechanical and biomedical engineering, director of the UH STEM Center and the aerospace engineering program; Dan Wells, interim dean of the College of Natural Sciences and Mathematics; and Holly Hutchins, associate professor of human development and consumer sciences in the College of Technology.

"The future of the engineering profession in the U.S. depends on recruiting more women and underrepresented minorities," Tedesco said. "In order to be successful, we need women and underrepresented minority role models in leadership positions throughout our STEM colleges. This grant will help UH to achieve that goal, and I'm extremely proud that the Cullen College of Engineering has taken a leadership role in this process."

The UH grant proposal included several goals in addition to attracting more women STEM faculty at senior, mid-career and junior levels. The center also hopes to increase the support and representation of women STEM faculty in administrative leadership positions at the department, college and university levels.

To achieve these goals, UH will establish mentorship programs between senior female STEM faculty members and their mid-career and junior counterparts. The ADVANCE Center will also launch diversity training and workshops for STEM chairs, deans and faculty members. Other programs to be implemented include leadership training for administrators, work-life integration activities for female employees and a "STEM in the Americas" speaker series.

Paula Myrick Short, senior vice chancellor for academic affairs for the UH system and provost of UH, will serve as the center's director. Lisa Robertson, executive director of external relations and strategic partnerships at the Cullen College, will serve as interim managing director.

In addition to creating an environment favorable to women STEM professionals, the proposal also establishes an ADVANCE Regional Network (ARN), linking Prairie View A&M University, Rice University, Texas A&M University and the University of Texas – Pan American with UH.

ARN will be the first-ever regional, multi-institutional ADVANCE network. Each of the ARN partners brings to the network a broad set of ADVANCE expertise that will be shared through mentoring programs, workshops, special events and webinars. ARN will provide a platform from which ADVANCE centers can reach out to other institutions to engage in dialogues about women faculty's experiences and help catalyze activities at those institutions to improve the success of women STEM faculty.

The period of performance for the NSF grant will run from Sept. 1, 2014 through Aug. 31, 2019.

To learn more about the UH ADVANCE Center, please visit: www.uh.edu/advance.

CULLEN COLLEGE PLAYING KEY ROLE IN OFFSHORE ENERGY SAFETY INSTITUTE

No one disputes that offshore energy development carries environmental risks. Through its involvement in the new Ocean Energy Safety Institute (OESI), the UH Cullen College of Engineering will play a key role in ensuring the safety of offshore energy production for years to come.

The institute is a partnership of the University of Houston, Texas A&M University and the University of Texas at Austin. The three schools won a competitive, five-year, $5 million grant from the Department of the Interior's Bureau of Safety and Environ-mental Enforcement (BSEE) to establish the institute. Its mission is vital: Serve as a platform for communications and research among government, academia and industry in the field of offshore energy.

The OESI, which was first proposed after the 2010 Deepwater Horizon oil spill, will provide recommendations and technical assistance to BSEE related to emerging technologies as well as the best and safest technologies that are currently available. In addition, it will develop and maintain an equipment failure monitoring system and train federal employees to enable them to remain current on state-of-the-art technology.

The institute will also promote collaboration among federal agencies, industry, standards organizations, academia and the National Academy of Sciences. Information on issues related to offshore research and best practices will be shared with industry, government and the public through Institute-held forums.

"The institute itself is going to act as a liaison between industry, regulators and the creators of the best available technologies in terms of safety and feasibility," said **Ramanan Krishnamoorti**, professor of petroleum engineering and chemical and biomolecular engineering at the college and Chief Energy Officer for the University of Houston.

The Cullen College is home to several offshore energy research efforts. UH's participation in the institute should help bring much-deserved attention to these projects, said Joseph W. Tedesco, Elizabeth D. Rockwell Dean and Professor of the Cullen College.

"Offshore resources are going to contribute significantly to energy production in the years to come. The Ocean Energy Safety Institute will play a key role in safely and efficiently developing these resources," said Tedesco. "I'm proud that our researchers are so prominently involved in this initiative and I look forward to seeing their advances adopted by companies in this sector."

UH ENGINEERING MAJORS RANKED 15TH IN U.S. FOR EARNING POTENTIAL

The University of Houston's Cullen College of Engineering was ranked among the top 20 schools in the country for graduating students with the highest salary potential by PayScale.com.

The 2013-2014 PayScale Potential Salary Report features the rankings of colleges by salary potential for graduates with degrees in nine specific major groupings, including humanities, engineering, social sciences and computer sciences. The University of Houston was ranked 15th for salary potential of engineering graduates. Other top 20 schools included Columbia University (#13) and MIT (#11).

PayScale.com is an online salary, benefits and compensation information company that offers users access to surveys determining what certain jobs might pay.

According to the PayScale report, UH engineering graduates earn an average yearly salary of $69,800 in their early careers and about $123,500 by mid-career.

Read the full report at www.payscale.com/college-salary-report/best-schools-by-majors/engineering.

INFOBYTES

ECE BY THE NUMBERS

$63,000
AVERAGE STARTING SALARY WITH B.S. IN ELECTRICAL ENGINEERING

#56
ECE PROGRAM IN THE U.S.
(AS RANKED BY THE NATIONAL RESEARCH COUNCIL)

$70,900
AVERAGE STARTING SALARY WITH B.S. IN COMPUTER ENGINEERING

#4
ECE PROGRAM IN TEXAS
(AS RANKED BY THE NATIONAL RESEARCH COUNCIL)

TOP 50
GREAT AFFORDABLE PROGRAM FOR COMPUTER SCIENCE AND ENGINEERING (GREAT VALUE COLLEGES, 2014)

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

145
FACULTY JOURNAL PUBLICATIONS IN 2013

$5.7M
IN ANNUAL RESEARCH EXPENDITURES

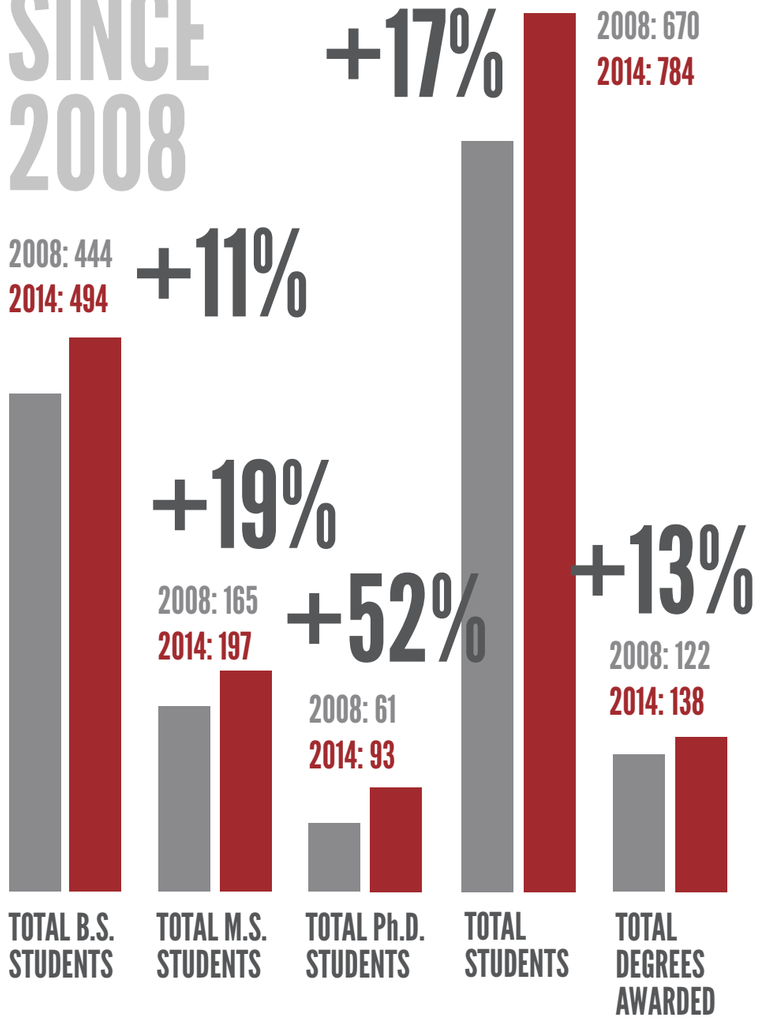
10% OF FACULTY MEMBERS ARE WOMEN

18% OF STUDENTS ARE WOMEN

17% OF STUDENTS ARE HISPANIC

40% OF STUDENTS ARE INTERNATIONAL

GROWTH SINCE 2008



POINTS OF PRIDE

1

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

2

The Princeton Review

Named one of Princeton Review's **"best value colleges"** (2012, 2013)

3

Located in **"America's coolest city"** and **"one of the best places for 20-some-things"** (Source: Forbes.com and Credit-Donkey, 2013)

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)

SOUNDBYTES:

PROFESSORS AND LEADERS TALK ECE AT UH

Fritz Claydon
Director, Honors Engineering Program
Professor, Electrical and Computer Engineering

TELL US MORE ABOUT THE HONORS ENGINEERING PROGRAM AT THE UH CULLEN COLLEGE OF ENGINEERING.

"The University of Houston's Honors Engineering Program immerses students in project-based learning in which they actively explore real-world problems and challenges and acquire a deeper knowledge of the relationship between their classroom lessons and the problems that await them as practicing engineers. Our Honors Engineering students are conducting cutting-edge research with real-world applications, and alumni of the Honors Engineering Program can be found in leadership positions throughout the Houston region and across the world."

DO ECE FRESHMAN RECEIVE ANY HANDS-ON TRAINING TO HELP INTRODUCE THEM TO THE FIELD OF ELECTRICAL AND COMPUTER ENGINEERING?

"First-year engineering students in ECE get down to business right away with hands-on projects in our two freshman courses. Before they finish their freshman year, they have built working analog circuits, explored digital electronics, and programmed a robot to navigate a maze!"

Len Trombetta
Director, ECE First Year Experience Program
Associate Professor, Electrical and Computer Engineering

WHAT IS THE SALARY EARNING POTENTIAL OF GRADUATES FROM THE ECE UNDERGRADUATE PROGRAM?

"The electrical and computer engineering undergraduate programs in the UH Cullen College of Engineering are very highly ranked, as measured by the mid-career salaries of our graduates. According to a recent report by PayScale.com, our graduates are earning a mid-career salary of about $123,500. This measure indicates that our rigorous programs produce excellent quality graduates, and that these alumni have achieved accordingly!"

Dave Shattuck
Associate Professor, Electrical and Computer Engineering

WHAT ARE SOME OF THE GREATEST STRENGTHS OF THE ELECTRICAL AND COMPUTER ENGINEERING GRADUATE PROGRAM AT THE UH CULLEN COLLEGE OF ENGINEERING?

"ECE graduate students in the UH Cullen College of Engineering are leading research projects with real-world impact in the Houston region and beyond. They receive hands-on guidance from faculty members and professionals who are world leaders in their field. Moreover, ECE graduate students take full advantage of our location in the city of Houston – the energy, medicine and space capital of the world – by collaborating on research projects with local energy firms, the Texas Medical Center and NASA, among many others."

Paul Ruchhoeft
Director, ECE Graduate Program
Associate Professor, Electrical and Computer Engineering

OUR FACULTY

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PROFESSORS

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THE FUTURE OF ELECTRICAL AND COMPUTER ENGINEERING

By Haluk Ogmen,
Professor of Electrical and Computer Engineering and Director of the Center for Neuro-Engineering and Cognitive Science

Since its modest start, focused on basic electrical phenomena, our field has experienced a phenomenal growth over the last century, producing inventions that shaped contemporary society. Telephones, televisions, computers, satellite communications, industrial robots, and the Internet are just a few examples of ubiquitous products of electrical and computer engineering.

Where is our field heading in the 21st century? The short answer would probably be everywhere imaginable.

Like atomic energy, the benefits of some developments come with deep implications for humanity, for they have the potential to wipe out our civilization. One such area is artificial intelligence. It is easy to see how smart machines can have significant benefits for our civilization; but their threat has also been a major concern, as illustrated by numerous Hollywood productions, including the classic "2001: A Space Odyssey." More fuel has been added to this fear recently by physicist Stephen Hawking, who commented that "the development of full artificial intelligence could spell the end of the human race."

Currently, we are far from full artificial intelligence because our understanding of how information is represented and processed by biological systems is rather limited. However, significant effort is devoted to this endeavor. IBM has recently developed a chip with 5.4 billion transistors and 256 million synapse-like structures to provide a computational platform that could mimic the operation of the brain.

Ambitious projects have been launched in Europe (the "Human Brain Project") and in the U.S. ("Brain Research Through Advancing Innovative Neurotechnologies"), and our field will play a critical role in the development of both the tools and the theories needed to make headway in this area.

Ethics have always been central to all engineering endeavors, and as we move forward in developing artificial intelligence, we must be reminded of the three laws of robotics that Isaac Asimov introduced in his 1942 short story Roundaround.

Furthermore, a functional understanding of the human brain can not only help us cure cognitive diseases, such as dementia, but can also pave the way to enhance our cognitive capabilities. Such "enhancements" need to be carried out always with ethics in mind so that their benefits are shared by all humankind.

MEET THE ECE INDUSTRIAL ADVISORY BOARD

A MESSAGE FROM ALAN GOODRUM, CHAIRMAN OF THE ECE INDUSTRIAL ADVISORY BOARD

The Advisory Board for the Electrical and Computer Engineering Department exists to help the department produce exceptional graduates who can immediately become productive engineers in industry and government. Our understanding of what those graduates will be required to do provides critical guidance for maintaining a quality engineering program.

Our Board meets regularly with the department faculty, administration and students to review not only today's curriculum but also the goals for the future. We help the faculty establish priorities in the curriculum so graduates are prepared with both deep technical knowledge and skills, and the communication and organizational skills that are required to solve complex, real-world problems and to function efficiently in a fast-moving industry.

We welcome the input and involvement of other interested practicing electrical and computer engineering professionals. If you see an opportunity to improve the ECE program at the University of Houston, or if you would like to be involved with the Board, feel free to contact me.

Alan Goodrum
Chairman, Industry Advisory Board
ECE Department, University of Houston
Fellow, Hewlett-Packard Company
alan.goodrum@hp.com

INDUSTRIAL ADVISORY BOARD MEMBERS

Thomas Sofka, Macro Enterprises
Douglas Verret, Texas Instruments
Kevin Key, Honeywell Corp.
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Daniel Erdeljac, Studio Works LLC
Tammy Savoie, Mitsubishi Corp.
Aurora Kennedy, Schlumberger Corp.
Keith Lancaster, Compiled Logic Corp.
Paloma de Arizon, CenterPoint Energy
Mark Laber, Toshiba Corp.
Shekhar Sharad, National Instruments Corp.
Dominik Pieniazek, Dashiell Corp.
Paul Rocha, CenterPoint Energy (emeritus)

ECE CONSORTIUMS

At most universities, businesses fund research projects through grants given to individual professors to explore a specific scientific problem. At the University of Houston, however, many professors have established research consortiums that invite local companies to become annual dues-paying consortium members. As members of the consortium, these companies meet regularly with the ECE professors and students to discuss current industry challenges. The membership fees paid by these companies go toward funding graduate students and postdoctoral researchers to take on research projects aimed at solving the challenges that companies are currently facing.

The consortium model at the UH Cullen College of Engineering is quickly gaining ground, as it offers immediate benefits to both the companies and the UH students involved in the consortium. The industry members have direct access not only to world-class researchers and cutting-edge technologies at the University of Houston campus, but also to the academic papers generated by the consortiums. Moreover, the ECE students involved in the consortiums receive real-world, hands-on training in their field, thereby increasing the chances of landing their dream job after college!

THE ELECTRIC POWER ANALYTICS CONSORTIUM (EPAC)

The Electric Power Analytics Consortium (EPAC) was established by associate professor Zhu Han in 2013 with funding from CenterPoint Energy and Direct Energy, two of the largest energy providers in the U.S. The mission of EPAC is to develop algorithms and mathematical models to make the best use of the data gathered from smart meters and other components of new smart electric power grids.

For CenterPoint Energy, EPAC is currently developing predictive damage assessment models to better prepare for hurricanes or major storms and to restore power more quickly after these severe weather events.

For Direct Energy, EPAC is analyzing customer energy usage throughout the Houston region in order to develop innovative tools, technologies and perhaps even dynamic pricing strategies that can help customers to save money on their energy bills while encouraging energy efficiency.

For more information on EPAC, please visit wireless.egr.uh.edu.

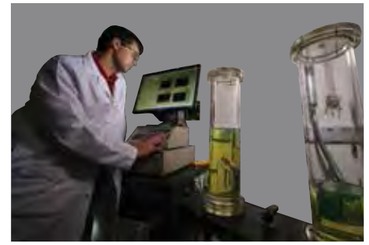
SYSTEMS RESEARCH AND EDUCATION CONSORTIUM (SREC)

The goal of the Systems Research and Education Consortium (SREC) is to facilitate industry and university collaborations to address the critical need of educating the next-generation of highly qualified engineers and researchers. Led by associate professor Yuhua Chen, SREC provides students with valuable hands-on training and enhanced ability to solve real-world research and development problems. SREC also provides a holistic approach to engineering education and offers instructions on topics such as time management, responsibility and accountability, intellectual property, project management and healthy living habits.

SREC is financially supported by industry members who pay an annual fee to support the consortium's research and education programs. Industry members provide guidance to SREC on the curriculum and types of training offered to its student members. The scope of research taken on by ECE students involved in SREC includes advanced communications systems, smart systems, cloud computing, network security, systems for medical applications, and embedded systems and systems with FPGAs.

For more information about SREC, please visit www.srl.ee.uh.edu/srec.

THE WELL LOGGING CONSORTIUM



The Well Logging Consortium was established in 1979 to investigate the electric properties of reservoir rocks over a wide range of frequencies. In addition, theoretical and experimental studies have been carried out to obtain a better understanding of electric tool response in complex borehole environments, such as dipping formations, thin invaded beds and anisotropic formations. All of these studies have the primary objective of improving interpretation of logs obtained with existing tools. Information is also being generated on the design of possible new tools, on the limitations of existing tools, and logging response in complex borehole environments. The research program is supported by a consortium of oil and service companies. The WLL operates the API Nuclear Logging Calibration Facility and has constructed, under a joint API-Industry funding arrangement, a set of Potassium - Uranium - Thorium standard pits. These pits are located on the campus of the University of Houston.

For more information about the Well Logging Consortium, please visit welllogging.egr.uh.edu.

NSF/IUCRC ON ELECTROMAGNETIC COMPATIBILITY

Established in 2009 with a five-year, $600,000 grant from the National Science Foundation as well as $300,000 in added annual support from industry, the NSF/IUCRC Center for Electromagnetic Compatibility is devoted to reducing electromagnetic interference in electronic devices. Together, researchers involved in the consortium work with its industry members to assess the design of everything from wireless enabled laptops to pacemakers, increasing their reliability and reducing susceptibility to interference.

For more information about the Center for Electromagnetic Compatibility, please visit http://174.143.170.127/iucrc/publicFactSheetServlet?centerId=43.

BP AWARDS $85K TO STUDENT SUCCESS PROGRAMS

Thanks to an $85,000 grant from BP, the Cullen College's PROMES (Program for Mastery in Engineering Studies) Program has the funds to continue its many outreach and student success activities through the summer of 2014.

According to PROMES Program director Kathy Zerda, PROMES relies on grant funding and corporate support to provide engineering outreach to K-12 students as well as academic enrichment and personal development to undergraduate students in the Cullen College. "We are fortunate to have a number of dedicated alumni and corporate sponsors who believe in this programming and who see firsthand the impact of PROMES, especially as relates to students from groups typically underrepresented in engineering, such as women and minorities."

The grant earmarks $10,000 to support PROMES' "Maximizing Your Power Weekend," an annual orientation for freshman and new transfer students entering into the PROMES community. The two-day event includes inspirational keynote speakers, professional development workshops hosted by industry engineers, and a full-day seminar on the Guaranteed 4.0 Learning System. Over 300 PROMES students and guests attend "Power Weekend" each year. The average cumulative end-of-year G.P.A. of the first-year PROMES students who attended 'Maximize Your Power Weekend' in 2012 was 3.01, compared to 2.66 for those students who did not attend this event.

BP's donation also included $25,000 for the STEP Forward Camp, a week-long engineering camp for rising high school 12th graders. Students who participate in this camp are often from underserved communities in the Houston area.

Many camp participants go on to study engineering, Zerda said. In fact, about 12 to 15 STEP Forward alumni are currently enrolled in the Cullen College, making the camps valuable recruiting tools.

GE OIL & GAS GIVES COLLEGE $100K FOR SCHOLARSHIPS

GE Oil & Gas will donate $100,000 to the University of Houston Cullen College of Engineering for undergraduate student scholarships.

The gift will support students in the college's mechanical engineering department. For five academic years starting in the fall of 2013, two undergraduates will each receive a one-year scholarship valued at $10,000, along with the title of GE Oil & Gas Scholar. The scholarships can be renewed, provided that the recipients meet specific academic benchmarks.

These students will receive more than financial support, though. As GE Oil & Gas Scholars, they will also get an early look at the world of professional engineering. They will be invited to visit GE Oil & Gas facilities in the Houston area, where they can meet with company executives and members of its engineering team. The winners will also have the opportunity to work with the company on research.

According to Pradeep Sharma, mechanical engineering department chairman, this donation is a boon for the department in more ways than one.

"The relationships we have with the professional engineering world are extremely important to the college. This gift is going to provide support to some truly outstanding students while also strengthening those relationships, giving us deeper insight into the challenges businesses face in terms of employee skills as well as technical and scientific obstacles," Sharma explained. "We're extremely grateful to GE Oil & Gas for this generous donation and the impact it will have on our department."

ROBOTICS TEAM THRIVES WITH SUPPORT FROM SCHLUMBERGER

As an electrical engineering manager at Schlumberger, Jim Mayes places a high premium on the ability to hire engineering graduates with real-world, hands-on experience. So, each year since 2006, Schlumberger has been the UH Robotics Teams' number one supporter, providing anywhere between $5,000 and $15,000 to the team annually.

Thanks to the support Schlumberger has provided to the team, UH Robotics has steadily grown larger and more successful each year. The team, which used to only be available to IEEE students, is now open to any students who wish to participate.

"These students are actually building and programming autonomous robots from the ground up," explained John Glover, professor of electrical and computer engineering and advisor to the UH Robotics Team.

Under Glover's mentorship, the robotics team at UH has taken home trophies from many IEEE Region 5 Robotics Competitions since 2002, even winning first place in two of them. And thanks to Schlumberger's support for the team, the cost of materials and travel are covered each year. Glover says this allows him to focus on two larger goals for the UH Robotics Team: expanding and continuing to be successful.

"When the University of Houston team shows up at the IEEE Robotics Competition each year, everyone there knows we're going to do well," Glover said. "That is in no small part due to the incredible support we've received from Schlumberger over the years. It has allowed us to focus our energy on improving our skills as a team each year rather than raising money."

Mayes stressed that Schlumberger's support for the team is in no way a one-way street. "Schlumberger directly benefits from supporting the UH Robotics Team. We love to hire UH graduates – they are very hands-on and ready for work in industry right out of the gate. They are self-starters who have already designed things on their own."

JOE CHARLSON RETIREMENT PARTY

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