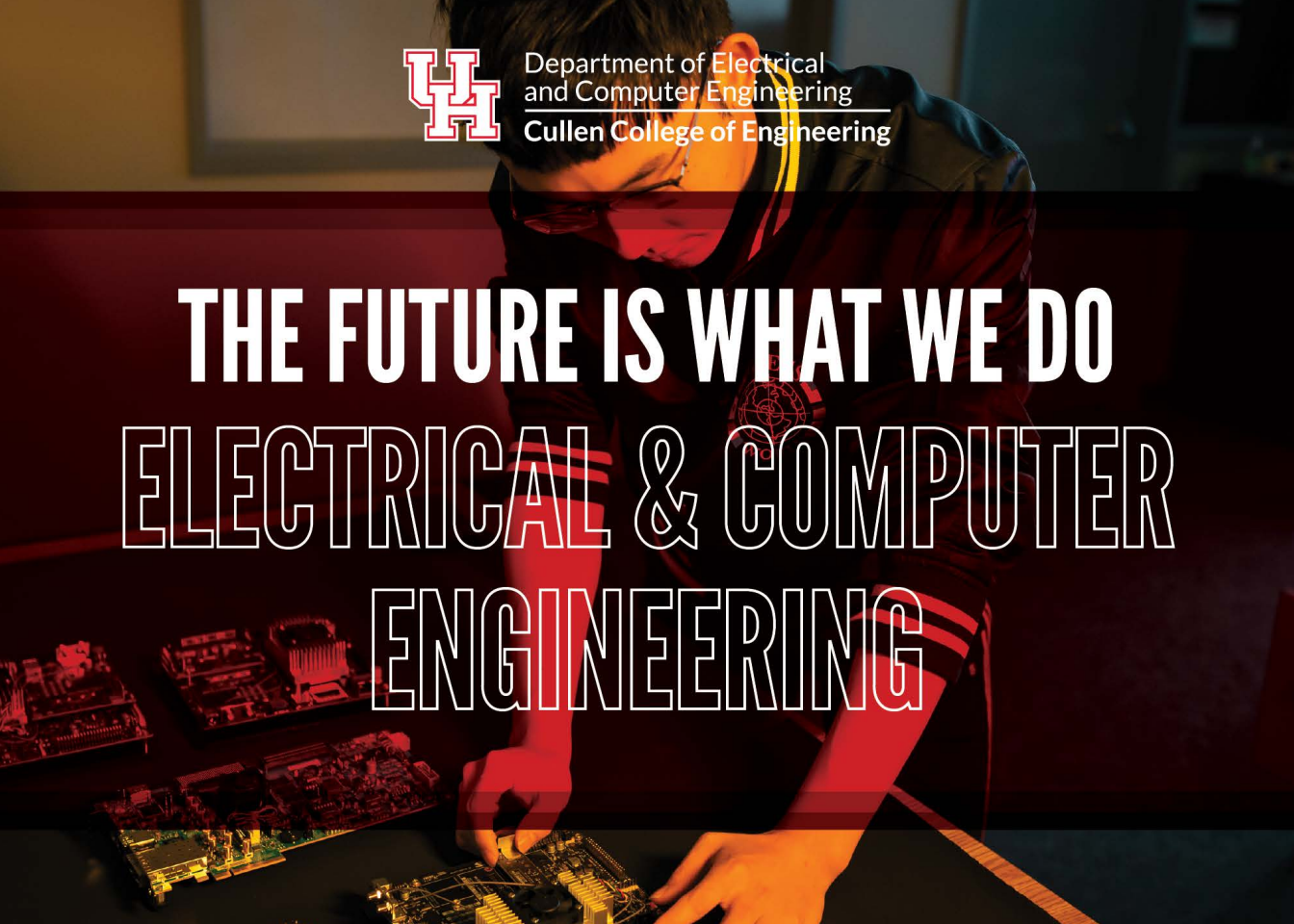
Department of Electrical
and Computer Engineering
Cullen College of Engineering
THE FUTURE IS WHAT WE DO
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WEI-CHUAN SHIH HOPING TO DETECT LUNG CANCER FROM A FEW DROPS OF BLOOD, THANKS TO CPRIT GRANT

A new $900,000 grant from the Cancer Prevention & Research Institute (CPRIT) to **Wei-Chuan Shih**, professor of electrical and computer engineering, will support efforts to develop a next-generation blood test aimed at improving lung cancer detection.

The technology uses a biochip-based platform to directly detect and analyze tumor-secreted exosomes from a tiny blood sample, potentially enabling more precise and less invasive cancer diagnostics.

In cancer detection, analyzing exosomes, which contain DNA and RNA, among other things, can provide direct insight into the state and identity of a cancerous cell. But current technologies for such detection are lacking, often unable to isolate or detect exosomes with precision, instead relying on inconsistent processing methods and large blood samples, limiting the level of detail they can provide about a patient's cancer.

"Current analysis of circulating tumor exosomes (CTE) can only generate an overly simplistic binary outcome and lacks sufficient dynamic range," Shih said. "Our proposal builds a biochip and automated detection technique that pushes the envelope of CTE assay by eliminating isolation and purification and directly counts and profiles exosomes from 20 microliters of blood plasma."

The grant, "Purification- and Isolation-free eXosomE profiLing (PIXEL) for lung cancer detection," was awarded on May 20. It pushes active funding for cancer research by UH professors to more than $11 million.

Wei-CHuan Shih
Professor, Electrical and Computer Engineering

JI CHEN WARNS OF NERVE STIMULATION DURING MRI

A University of Houston engineering professor is warning that implanted cuff electrodes — widely used in therapy for epilepsy, depression and inflammatory disorders — could trigger unintended nerve stimulation for patients undergoing an MRI scan.

The implanted electrodes, which stimulate the vagus nerve, are metallic and positioned near the nerve bundle, so their presence in an MRI environment raises concerns about nerve stimulation due to fast-switching gradient coils and radio frequency coil-induced heating near nerve fibers.

The study, led by **Ji Chen**, professor of electrical and computer engineering at UH, used detailed computer simulations to examine how MRI fields interact with the cuff electrodes.

"We found that patients with implantable devices may experience unintended nerve stimulation during MRI, which could cause discomfort or pain," Chen said. "This suggests that current MRI safety guidelines may not fully account for implanted nerve cuffs, and that more refined guidelines and careful safety considerations are needed." Chen reported his findings in the journal *Magnetic Resonance in Medicine*.

The results indicate that the presence of the cuff electrode significantly reduces the activation threshold, or minimum electrical level needed to trigger a nerve response, under gradient field exposure, while RF-induced heating further decreases the threshold for stimulations with short pulse durations.

"For RF-induced heating safety assessment, multiple human body models, more imaging landmarks, more implantation pathways, and different polarizations should all be considered," he said.

Chen's team is developing methods and new designs to mitigate these risks in future cuff electrodes.

Ji Chen
Professor, Department of Electrical and Computer Engineering

NEW AI MODEL FROM XINGPENG LI PREDICTS BATTERY DECAY TO MAKE RENEWABLE ENERGY MORE RELIABLE

University of Houston Researchers Develop AI Model That Predicts Battery Aging, Preventing Grid Failures

As the global demand for reliable electricity grows, University of Houston researchers are deploying artificial intelligence to solve a critical vulnerability in the power grid: the unpredictable aging and decay of large-scale batteries.

The latest research from Xingpeng Li, associate professor in the Electrical and Computer Engineering Department at the Cullen College of Engineering, aims to make power grid batteries more efficient as solar and wind power expand.

These sources increasingly depend on battery energy storage systems to balance swings in energy supply, which is stored when energy is high and released when output drops. The problem is batteries degrade over time, reducing their performance and efficiency, which makes it difficult for grid operators to know when to use them.

"The growing use of alternative energy and battery storage in bulk power systems and small-scale microgrid systems, where solar and wind fluctuations make reliable scheduling more challenging," Li said. "A key motivation was that batteries degrade over time that may affect the system performance especially in later years when battery capacity reduced greatly, so we developed a smarter way to include battery aging in energy planning without making the optimization too slow."

Xingpeng Li
Associate Professor, Department of Electrical and Computer Engineering

BRAIN CENTER FINDS EXPOSURE TO NATURE ASSOCIATED WITH REDUCTIONS IN NEGATIVE EMOTIONS

University of Houston Researchers Develop AI Model That Predicts Battery Aging, Preventing Grid Failures

You probably heard it from your mom a thousand times — fresh air and sunshine; it's the cure for most anything. Now scientists at the University of Houston concur, measuring the impact of mother's advice on mother nature to find that exposure to nature is associated with reductions in negative emotions.

"Findings from this systematic review support the notion that nature exposure is a critical determinant of brain health and therefore brain capital. Thus, promoting and maintaining healthy environments is critical to promote and grow the world's brain capital," said renowned brain scientist **Jose Luis Contreras-Vidal**, Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Electrical and Computer Engineering and director, NSF IUCRC BRAIN Center (Building Reliable Advances and Innovation in Neurotechnology). He led a team of researchers through a systematic review and meta-analysis of the impact of nature on wellness.

The team examined the results from 2,101 participants in 33 studies combining neuroimaging and psychological assessments during exposure to real, virtual or imagined natural environments. EEG was the most widely used neuroimaging modality across the studies reviewed.

"Healthy populations showed a more balanced psychological response, with nature exposure being associated with both increases in positive emotions and reductions in negative emotions," reports Contreras-Vidal in the International Journal of Environmental Research and Public Health. "Growing interest in how nature influences the brain has driven research toward understanding its neurophysiological impact. This interest has recognized that genetics alone cannot account for health risk factors and that environmental exposures play a substantial role in shaping brain health."

Jose Luis Contreras-Vidal
Professor, Electrical and Computer Engineering,
Director, NSF IUCRC BRAIN Center

FOUR CULLEN PROFESSORS NAMED SENIOR MEMBERS OF NATIONAL ACADEMY OF INVENTORS

Seven University of Houston faculty members, including four from the Cullen College of Engineering, have been named Senior Members of the National Academy of Inventors — the most of any single Texas institution this year.

The class is proof of how UH's leadership is reinforcing and supporting research-driven innovation with real-world impact. UH now has 46 Senior Members in the NAI.

"This recognition affirms what we see every day at the University of Houston — bold, collaborative innovation focused on improving lives," said **Ramanan Krishnamoorti**, vice president of energy at UH. "Having seven faculty members named Senior Members reflects our momentum and a culture where discovery moves beyond the lab into solutions that strengthen communities and drive economic growth."

NAI Senior Members are faculty, scientists and administrators who have demonstrated innovation with the potential for meaningful societal impact, along with success in patents, licensing and commercialization, and a commitment to mentoring future inventors.

The four honorees from the Cullen College of Engineering are:

Haleh Ardebili, the Kamel Salama Endowed Professor of Mechanical & Aerospace Engineering and assistant vice president for Entrepreneurship and Startup Ecosystem at UH.

Vemuri Balakotaiah, the Hugh Roy and Lillie Cranz Cullen Distinguished University Chair and professor of chemical and biomolecular engineering.

Jose Contreras-Vidal, the Hugh Roy and Lillie Cranz Cullen Distinguished Professor in electrical and computer engineering and director of UH's NSF neurotechnology research center.

Jae-Hyun Ryou, professor of mechanical and aerospace engineering.

HIEN VAN NGUYEN WINS OUTSTANDING PAPER AWARD FOR AI THAT DECODES RADIOLOGISTS' BEHAVIOR FROM EYE MOVEMENTS

Hien Van Nguyen, an associate professor in the Department of Electrical and Computer Engineering, served as the lead for an NIH-funded research project. His paper, *"Interpreting Radiologist's Intention from Eye Movements in Chest X-ray Diagnosis,"* was recognized as an Outstanding Paper in Content Theme at the 33rd Association for Computing Machinery (ACM) International Conference on Multimedia, a major conference.

ACM Multimedia is dedicated to advancing research and applications across diverse multimedia fields. The conference brings together leading minds from academia and industry to explore cutting-edge developments in areas such as virtual and augmented reality, AI, video, and social data.

"My first thoughts were gratitude for the entire team and our clinical collaborators, because this project sits at the intersection of radiology and AI. It really only works when everyone contributes their expertise. I also felt excited that the community sees value in moving beyond 'AI that mimics experts' and toward AI that helps us understand expert decision-making."

The goal of the team's research is to teach AI to understand what a radiologist is looking for moment by moment, based on eye movements while reading a chest X-ray.

Their method, RadGazeIntent, takes a sequence of gaze fixations along with the X-ray image and predicts which clinical finding the radiologist is likely focusing on at each moment, along with confidence scores.

"As an analogy, imagine watching someone searching for issues in a complex scan," Nguyen said. "Their eyes reveal whether they're doing a routine sweep, double-checking something suspicious, or focusing hard on one spot. We're building tools that can interpret that 'search strategy' rather than only copying the final answer."

Hien Van Nguyen
Associate Professor, Department of Electrical and Computer Engineering

HAO HUANG SERVES AS KEYNOTE SPEAKER FOR AI X ENERGY SUMMIT

Hao Huang, a distinguished adjunct professor in the Electrical & Computer Engineering Department and member of the National Academy of Engineering, served as a keynote speaker for the 2026 AI x Energy Summit.

Taking place at the San Diego State University campus in March, the two-day event united researchers, developers, engineers and industry leaders in AI, power electronics and energy.

"I was honored to receive the Top Influences in AI Energy Award at the summit, and I was particularly encouraged that my presentation resonated with participants, reflecting a growing interest in next-generation deep learning approaches within the field," Huang said.

Huang's presentation, "Maximize the Potential of Transformer-Based Deep Learning in Power / Energy Engineering," described how transformer-based deep learning has reshaped modern AI and become the dominant architectural paradigm. The work presents a practical pathway for transitioning power and energy engineering workflows to transformer-based solutions.

Huang is the retired Technology Chief of GE Aerospace — Electrical Power since 2020. In this role, he shaped technical directions, innovation strategies and product roadmaps while pioneering advances in aircraft electrical power. With 37 years of experience in power systems, generation, starting, electronics, controls, and electric vehicle drives, he holds 80 U.S. patents and about 300 international patents.

In addition to being an NAE Member, he is also an IEEE Fellow, NAI Fellow and SAE Fellow. Earning his Ph.D. in Electrical Engineering from the University of Colorado Boulder in 1987, he received the 2019 IEEE Transportation Technologies Award "for contributions to aircraft electrification." He joined the University of Houston in 2021.

Hao Huang
Distinguished adjunct professor,
Department of Electrical and Computer Engineering

KAUSHIK RAJASHEKARA ELECTED AS INTERNATIONAL FELLOW OF CANADIAN ACADEMY OF ENGINEERING

Kaushik Rajashekara, Hugh Roy and Lillie Cranz Cullen Distinguished University Professor and a member of the National Academy of Engineering, has been elected as an international fellow of the Canadian Academy of Engineering (CAE).

Rajashekara is one of six international fellows selected for the 2026 cohort, and 56 fellows overall in the class. The class was revealed at the CAE's annual general meeting in May.

CAE is the national institution through which individuals, who have made outstanding contributions to engineering in Canada, provide strategic advice on matters of critical importance to Canada and to Canadians. Rajashekara is also an international Fellow of Indian and Japanese Academies of Engineering, and recipient of the 2022 Global Energy Prize.

According to a press release from the organization, "Rajashekara is internationally recognized for his pioneering contributions to transportation electrification for improving energy efficiency and reducing emissions. He has made transformative contributions to propulsion, power generation, architectures, and control systems for electric, hybrid, and fuel-cell vehicles, as well as hybrid aircraft and flying cars."

Rajashekara joined the faculty at Cullen in 2016. He is well-known for his prowess in the fields of electrical cars and aviation, as well as the international collaborations he has had in academia and industry. Rajashekara joined General Motors / Delphi in 1989 and rose to Global Chief Scientist and Technical Fellow, leading international engineering teams in the development of electric machines, power electronics, and propulsion systems for electric, hybrid, and fuel cell vehicles.

From 2006 to 2012, he served as Chief Technologist at Rolls-Royce Corporation working on More Electric and Hybrid Electric Aircraft Systems, leading electrified propulsion development for commercial and defense aerospace applications.

Kaushik Rajashekara
Distinguished University Professor,
Department of Electrical and Computer Engineering

JI CHEN RECEIVES IEEE AWARD FOR OUTSTANDING PERFORMANCE

Professor and Chair of the Electrical and Computer Engineering Department **Ji Chen**, Fellow IEEE, Fellow AIMBE, was recently selected by the EMC Society to receive the 2026 Richard Stoddart Award for Outstanding Performance. This IEEE award recognizes "the outstanding performance of an EMC Society member in contributing to the advancement of EMC technology or in contributing to the solution of a socio-technological problem."

"The impact of Professor Ji Chen's work is transformative across engineering scholarship, clinical care, industry practice, and regulatory science," states the award summary. "His methodologies constitute essential electromagnetic compatibility (EMC) and MRI safety infrastructure used globally by regulators, clinicians, and medical device manufacturers to ensure that active and passive implantable medical devices can be safely exposed to MRI."

Chen's nomination, based on his "seminal contributions to electromagnetic compatibility (EMC) and MRI safety engineering that bridge fundamental electromagnetic theory, regulatory science, and deployable engineering systems," received support from many fellow professionals well-versed in MRI technologies.

From an industry and regulatory implementation perspective, Urs Wigger, Senior Director of R&D at Johnson & Johnson MedTech, described Chen's central leadership role in large-scale global regulatory remediation efforts, including the "comprehensive evaluation of MRI safety across extensive implant portfolios under both FDA and Medical Device Regulation (MDR) frameworks."

Ji Chen
Professor, Department of Electrical and Computer Engineering

ADRI ROYSAM RECEIVES 2026 ECEDHA AWARD FOR LEADERSHIP AND SERVICE

The Electrical and Computer Engineering Department Heads Association (ECEDHA) recognized their 2026 award recipients earlier this spring, and among them was Hugh Roy and Lillie Cranz Cullen University Professor **Badri Roysam**, Fellow IEEE, Fellow AIMBE, who served as the Cullen College of Engineering's Electrical and Computer Engineering (ECE) Department Chair from 2010 to 2024.

Roysam was awarded the Robert M. Janowiak Outstanding Leadership & Service Award, which recognizes "a sustained record of leadership and service to ECEDHA and to electrical and computer engineering" as a discipline. Having been engaged with ECEDHA as both a member and a Board Member for over a decade, he has served the association in "a variety of roles." He cites serving as editor of the monthly ECEDHA newsletter, The Source, as his "most remembered contribution."

"I was amazed at how many colleagues remembered and appreciated my editorials," Roysam said.

"ECEDHA is truly unique among professional organizations," he said. "[Members] all face very similar situations in our work as department Chairs, and we have much to learn from each other. ECEDHA brings us together in engaging ways."

Renowned in the field of multi-dimensional image informatics, Roysam's research occurs "at the confluence of multi-dimensional signal processing, machine learning, big-data bioinformatics, high-performance computing and biomedicine." He has been named as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) for pioneering contributions to image analysis algorithms for biological microscopy.

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KEYSIGHT PROVIDES HARDWARE, SOFTWARE LICENSE GIFT FOR ECE, CIRCUITS COURSES

A significant donation of software licenses and physical hardware from Keysight — a leader in design, emulation and test environments for engineers — has strengthened the bonds between industry and the Cullen College of Engineering, with the Electrical and Computer Engineering Department serving as the primary recipient.

The gift includes the donation of hardware for undergraduate circuits courses, along with 52 software licenses. An additional donation of 100 licenses is expected in the near future.

A ribbon-cutting ceremony was held in March at the Undergraduate Electronic Labs in Engineering Building 2 to unveil the new equipment. This was followed by a seminar in Melcher Hall, featuring talks and demonstrations by several faculty members, as well as a round table discussion, “Bridging Industry and Academia.”

Douglas Baney, the Corporate Director of Education for Keysight, attended the ceremony, along with several stakeholders from the Cullen College of Engineering, including Ji Chen, Professor and Chair of the Electrical and Computer Engineering Department; Jagannatha “JR” Rao, Cullen Associate Professor of Mechanical & Aerospace Engineering and Senior Associate Dean for Undergraduate Programs and Distance Learning; and Badri Roysam, Hugh Roy and Lillie Cranz Cullen University Professor, who initiated the effort with Professor Len Trombetta.

Representing UH Advancement were Lili Cavazos, formerly Assistant Director at UH Engineering Development Office and now Assistant Director of Development at Bauer, and Alex Moreno, Senior Director at UH Engineering Advancement Office.

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The University of Houston Cullen College of Engineering addresses key challenges in energy, healthcare, infrastructure, and the environment by conducting cutting-edge research and graduating hundreds of world class engineers each year. With research expenditures topping $40 million and increasing each year, we continue to follow our tradition of excellence in spearheading research that has a real, direct impact in the Houston region and beyond.

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