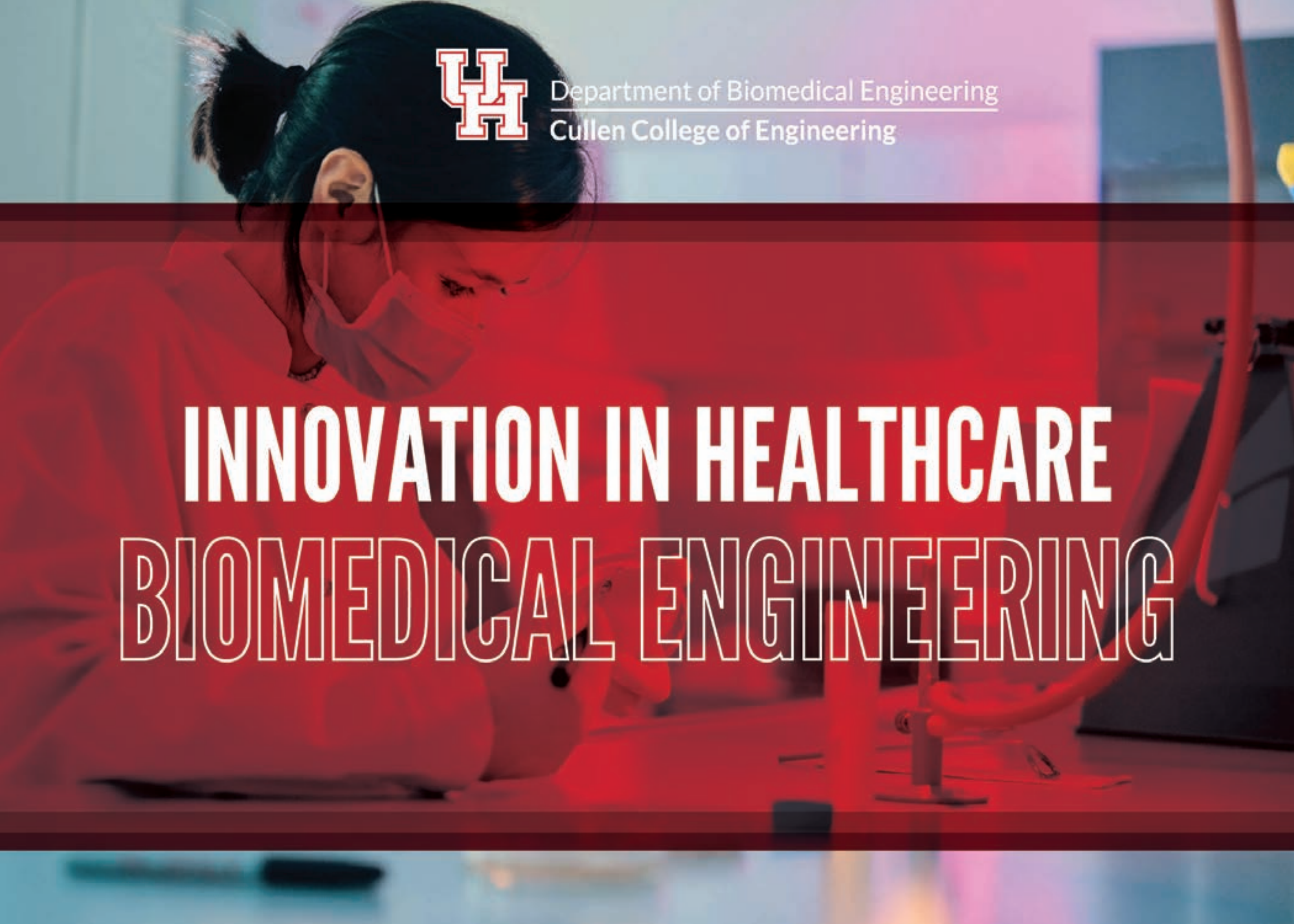


Department of Biomedical Engineering
Cullen College of Engineering

INNOVATION IN HEALTHCARE

BIOMEDICAL ENGINEERING

CULLEN AWARDED $3M TO LAUNCH CANCER BIOMARKER FACILITY FOR IMMUNOTHERAPY RESEARCH

HOUSTON — As part of a $93 million grant package, the Cancer Prevention and Research Institute of Texas, known for funding groundbreaking projects, has awarded the University of Houston $3 million to set up a Cancer Immunotherapy Biomarker Core. This state-of-the-art facility will offer researchers in Texas the most comprehensive targeted proteomic cancer biomarker screens currently feasible, particularly in the field of cancer biology and immunotherapy.

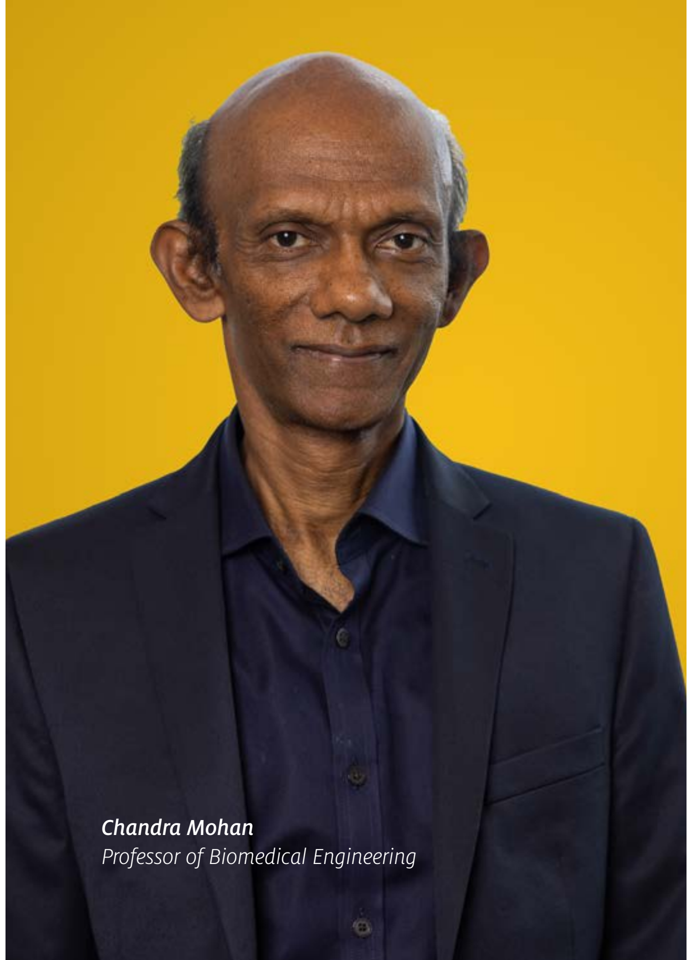
UH CIBC will be the first such facility in Texas to offer targeted proteomics, which is the technology that makes it possible to study thousands of proteins at once and will offer its services at a minimized cost partly subsidized by CPRIT funding.

“Identifying better biomarkers for cancer will accelerate early diagnosis and better prognostication of cancer, better monitoring of disease progression and treatment response possibly leading to the identification of better medications for treating cancer,” said **Chandra Mohan**, Hugh Roy and Lillie Cranz Cullen Endowed Professor of Biomedical Engineering and project director. “All of these will lead to reduced cancer associated morbidity and mortality.”

Rather than targeting cancer cells directly, immunotherapy treats cancer by training the immune system to find and attack the cancer cells.

“Cancer immunotherapy is experiencing a meteoric rise, and this new chapter in oncology demands a new array of biomarkers, including blood and tissue biomarkers that predict who might respond best to immunotherapy, and biomarkers that help researchers identify the best targets for immunotherapy,” Mohan said.

To meet these needs the CIBC will offer four unique platforms that include a 11,000- plex targeted proteomic screen that allows 11,000 specific proteins to be screened in any single body fluid sample, representing the largest proteomic coverage possible, as well as 21,000-plex protein array platform that allows scientists to assess the specificity of autoantibodies/ligands against the entire human proteome.



Chandra Mohan
Professor of Biomedical Engineering

Weiyi Peng
Associate Professor of Biology and Biochemistry

WU LEADS TEAM ADVANCING EARLY DETECTION OF OVARIAN CANCER

Tianfu Wu, an associate professor of biomedical engineering, is leading a team to find early markers for ovarian cancer via large scale screening.

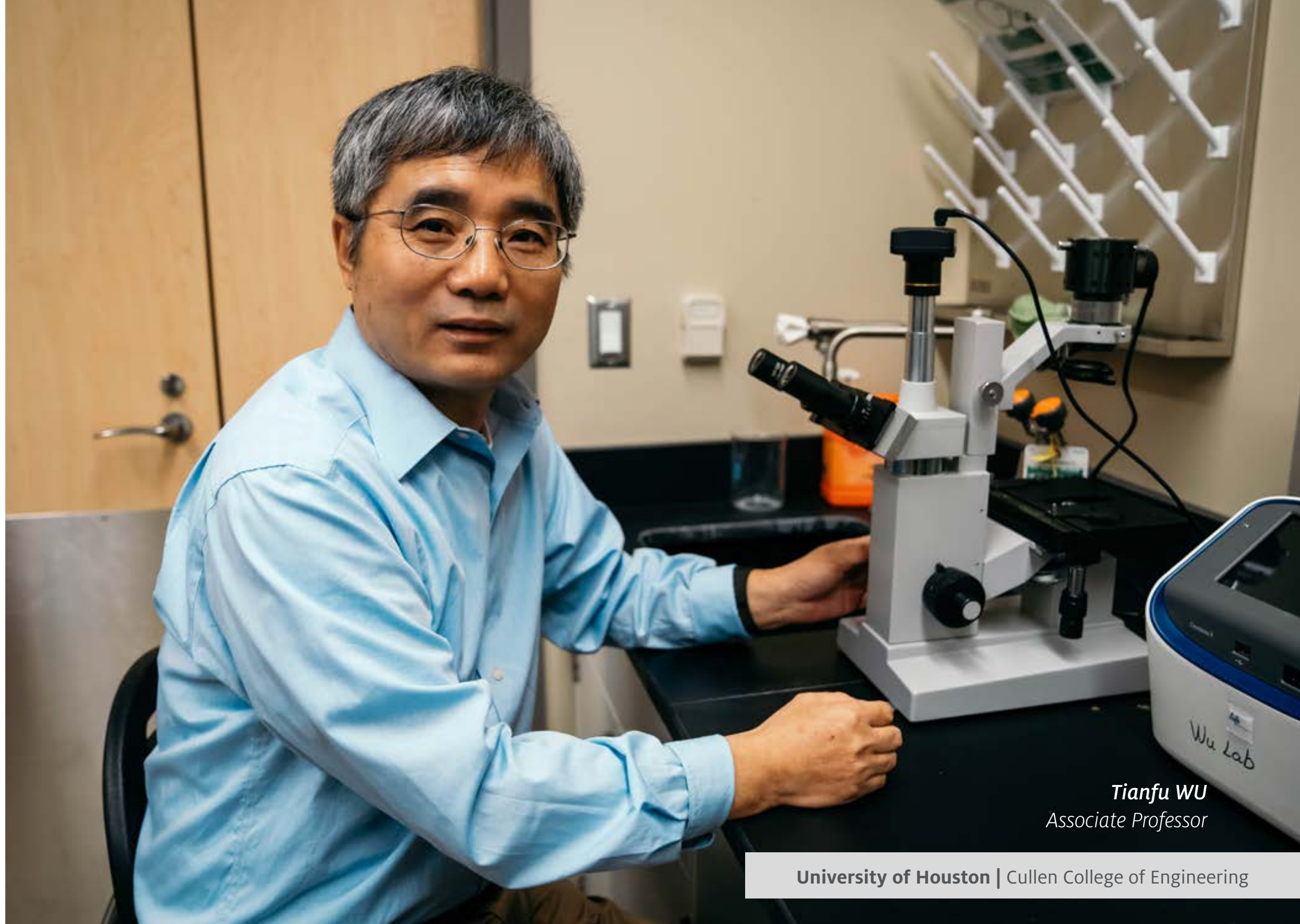
With a $1.2M grant from the Department of Defense, Tianfu Wu, associate professor of biomedical engineering, will lead a team of researchers, partnering with those from MD Anderson Cancer Center, in finding early markers for ovarian cancer.

Ovarian cancer is a deadly threat because it is difficult to detect early. Most women (70 to 75 percent) are diagnosed once the cancer has already spread, and their chances of survival are below 32 percent. Computational models estimate that detecting ovarian cancer earlier could reduce mortality by 10 to 30 percent.

Currently doctors screen for ovarian cancer by measuring the rising amount of a protein called Cancer Antigen 125, or CA125, produced by ovarian cancer cells, to detect 70 percent of early-stage cases, but still additional biomarkers are needed to improve sensitivity and to detect cases missed by CA125.

"Advancing early detection methodologies is essential to improving patient prognosis and survival outcomes," Wu said. "The technological challenges in the early detection of ovarian cancer are multifaceted, primarily due to limited sensitivity of currently available biomarkers and the absence of highly accurate biomarkers that can detect the disease well before clinical diagnosis."

So, Wu and team have set out to find better biomarkers, starting first with autoantibodies which target the tumor suppressor gene often mutated in cancers and can be an early indicator of ovarian cancer development.



Tianfu WU
Associate Professor

UH RESEARCHERS AWARDED $3.6M TO EXAMINE RETINAL DISEASES, BLINDNESS

A team of endowed professors and vision researchers at the University of Houston's Cullen College of Engineering has been awarded more than $3.6 million by the National Eye Institute to investigate a gene in the eye, crucial for normal vision, but when mutated causes retinal diseases that lead to blindness.

When working properly, the gene — called peripherin 2 — provides instructions for making a protein essential for shaping the outer segment of photoreceptor cells in the retina, the light sensitive structure responsible for capturing visual information. Photoreceptor cells are crucial because they convert light into electric signals that the brain interprets as images.

But when mutated, the PRPH2 gene, with more than 300 variants, can cause a spectrum of retinal disease, ranging from retinitis pigmentosa to cone and macula-predominant disorders like pattern dystrophy, cone-rod dystrophy and several forms of macular degeneration.

With it all, the underlying mechanisms of PRPH2 are not well understood.

“We want to understand how defects with the PRPH2 gene lead to eye diseases. Our main objective is to uncover the mechanisms underlying PRPH2-associated pathology, with a focus on its roles in rods and cones, the two types of photoreceptor cells in the retina," said **Muna Naash**, the John S. Dunn Endowed Professor of Biomedical Engineering.

Her research partner is **Muayyad Al-Ubaidi**, John & Rebecca Moores Professor of Biomedical Engineering.

“We will also examine how these cells are built and organized, and how proteins are transported to their outer segments,” said Naash..

“Despite considerable scientific advancement, there are still no clinically viable therapeutic options for PRPH2 retinal diseases,” Al-Ubaidi said. “Gaining a thorough grasp of the mechanisms associated with PRPH2 diseases is crucial for designing effective therapies.”

Left to right: *Muna Naash and Muayyad Al-Ubaidi*

WU CREATES NEW DRUG DELIVERY SYSTEM TO TREAT LUPUS

With a $1 million Impact Award from the U.S. Department of Defense, **Tianfu Wu**, a University of Houston biomedical engineer, is developing a method to send medication directly to the spleen where certain immune cells cause the disease known as lupus, or Systemic Lupus Erythematosus.

Lupus is a debilitating autoimmune disease characterized by uncontrolled disease activity, frequent flares, long-term immunosuppression, increasing infection rates, cumulative organ damage and decreased quality of life.

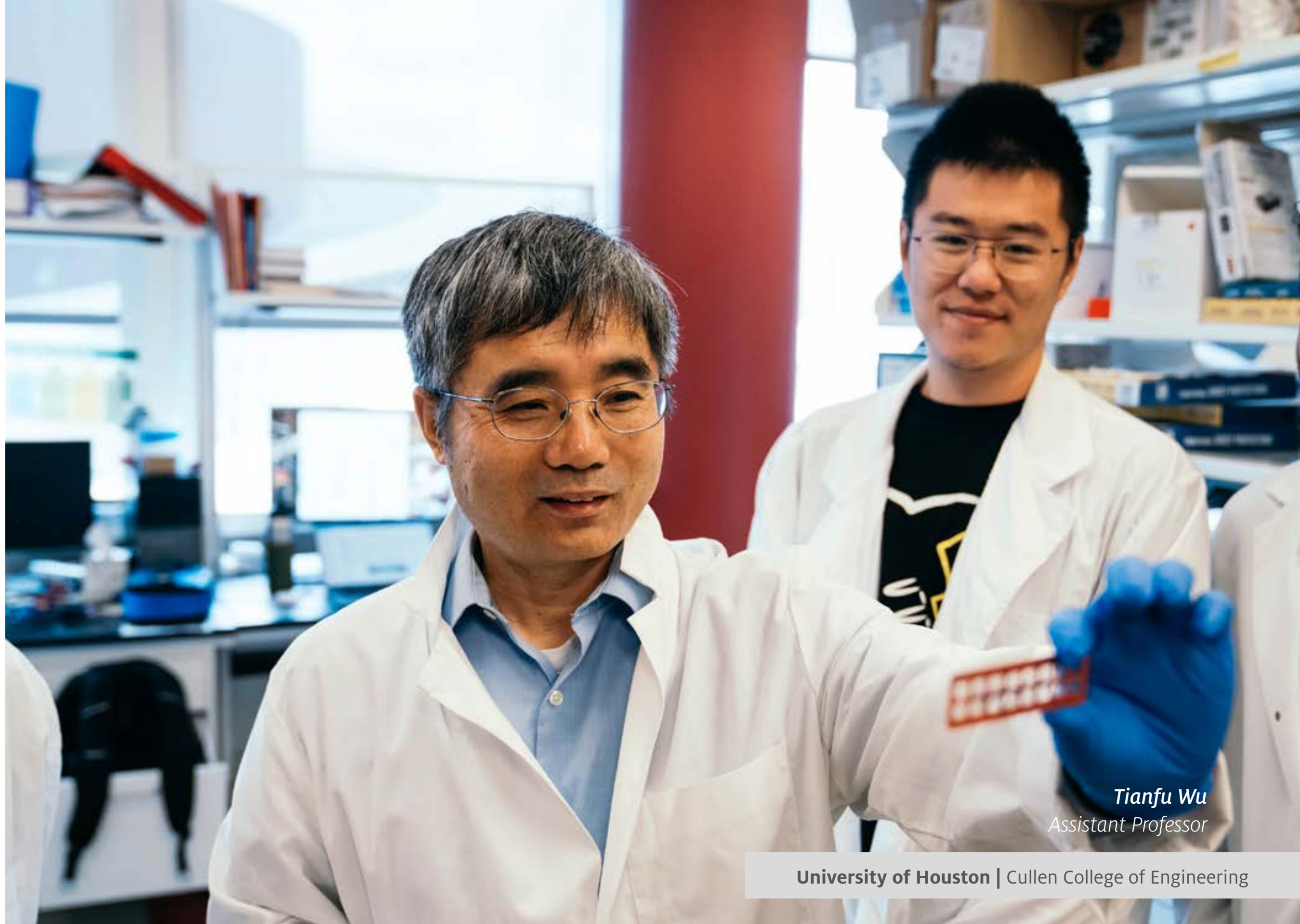
The spleen has often been called the security guard of the bloodstream, filtering out old or damaged blood cells while housing millions of white blood cells, or lymphocytes, that carry out immune system functions. It is because the spleen harbors these cells it plays a critical role in how lupus develops.

“The current therapeutic landscape for lupus is often marred by systemic side effects and relatively limited efficacy. To address these challenges, we are proposing a spleen-specific selective organ targeting lipid nanoparticle drug delivery system to modulate immune responses and mitigate symptoms with minimal side effects,” said Wu, an associate professor in the Biomedical Engineering Department at the Cullen College of Engineering.

Wu’s system will use tiny fat-based particles, or lipid nanoparticles, modified with mannose, a simple sugar, to carry medicine directly to the spleen and to target B cells, plasmacytoid dendritic cells and macrophages, which are critical immune cells thought to drive the disease. The use of mannose facilitates the binding to mannose receptors, ensuring precise delivery to these splenic immune cells.

“New drug delivery systems are urgently needed to provide more effective treatment options that fine-tune or modulate the immune system rather than employing systemic immunosuppression or B-cell depletion,” Wu said. “Systemic immunosuppression can lead to severe side effects and increase the risk of infections, while systemic B-cell depletion may wipe out beneficial B cells, leading to unfavorable complications.”

This work may mark the first instance of a spleen-specific targeting system being designed, developed and applied in lupus models.



Tianfu Wu
Assistant Professor

LI EARNS NIH TRAILBLAZER AWARD FOR SPINAL CORD INJURY REHAB

An assistant professor at the Cullen College of Engineering has received $629,000 in funding to conduct research into helping patients recover after spinal cord injuries.

Zhengwei Li is an assistant professor and Presidential Frontier Faculty Fellow in the Biomedical Engineering Department, with a joint appointment in the Tilman J. Fertitta Family College of Medicine. His proposal, "Wireless, Closed-Loop System to Restore Urological Dysfunction after Spinal Cord Injury," was selected for funding by the National Institute of Biomedical Imaging and Bioengineering, which is under the umbrella of the National Institutes of Health.

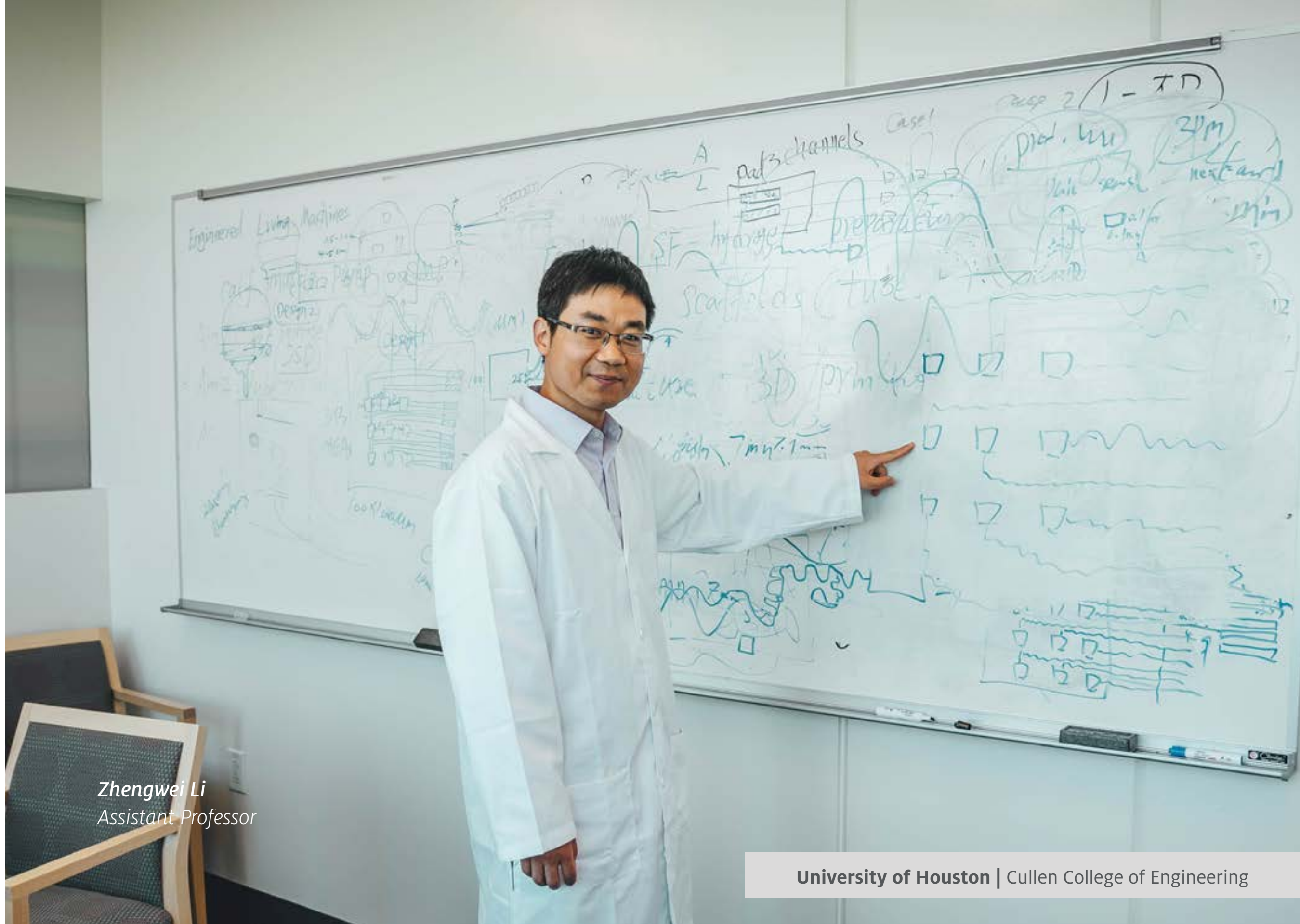
The Trailblazer R21 Award supports new and early-stage investigators pursuing research programs that are of high interest to the National Institute of Biomedical Imaging and Bioengineering, at the interface of life sciences with engineering and the physical sciences.

According to the project summary, more than 70 percent of people that suffer a severe, high-level spinal cord injury will develop serious bladder and urological complications. Current treatments are limited and the complications rates can be significant using stent implantations or other surgical procedures.

The goal of Li's research is to develop a novel wireless implantable bioelectronic system capable of supporting an AI algorithm for autonomous, closed-loop neuromodulation of these issues.

Li noted that if successful, the technology platform could be easily adapted to address a range of application possibilities beyond those associated with the bladder, and have a significant impact in field of rehabilitation and regeneration.

This prestigious NIH trailblazer award underscores Li's leadership in bioelectronics research and reflects national recognition of his work at the intersection of engineering and medicine. The project is expected to pave the way for transformative, minimally invasive solutions to complex neuro-urological disorders.



Zhengwei Li
Assistant Professor

PAPER FROM LARIN, SINGH EXAMINES GROWTH OF NON-INVASIVE MECHANICAL IMAGING TECHNIQUE

A new review paper published in Nature Reviews Methods Primers from the research group of **Kirill Larin**, Cullen Endowed Chair and Professor of Biomedical Engineering, highlights several key advantages and limitations of optical coherence elastography (OCE), as well as likely future advances and opportunities in OCE. At UH, Larin worked with Manmohan Singh — Research Assistant Professor of Biomedical Engineering — on the review. Additional authors are Matt S. Hepburn and Brendan F. Kennedy, both of the Department of Electrical, Electronic and Computer Engineering in the School of Engineering at the University of Western Australia.

OCE is a non-invasive imaging technique that uses light to image the mechanical properties of tissues. In "Optical coherence elastography," the authors talk about the developments for the technique over the past two decades, as well as the key advantages and limitations of OCE.

"OCE has undergone a significant transition in the past few years. Previously, OCE research was focused on novel applications and technical developments. Now, OCE has matured to clinical relevance, and a handful of important clinical studies have emerged showing that it can be used to detect disease and understand the importance that mechanics plays in disease," Singh said.

"When we were approached by the Nature publishing group about this OCE Primer, we immediately knew we had to collaborate on it with Dr. Kennedy and Dr. Hepburn. They have been instrumental in OCE's development and transition to the clinic, which is evidenced by their immense progress, particularly for detecting breast cancer margins."

The partnership between Singh and Larin has also been fruitful through the years, and Singh has flourished at UH as well. He earned his B.S. and Ph.D. from Cullen, and he worked as a postdoctoral fellow at the college before starting as a research assistant professor in December 2021. He earned a University of Houston President's Circle Award in 2025, and a 50 in 5 Award — recognizing research excellence and gains — in 2024.

Kirill Larin
Professor

Manmohan Singh
Assistant Professor

BME GRAD STUDENT MUSINA RECEIVES AHA FELLOWSHIP AWARD

Guzel Musina, a Ph.D. student in the Department of Biomedical Engineering, has been awarded a predoctoral fellowship by the American Heart Association (AHA) for her project, “Novel optogenetics tool for the mouse embryonic cardiodynamic research.”

In this project, Musina’s main goal is “to develop a new optical tool for manipulating cardiodynamics in mouse embryos.”

“This involves creating and applying advanced optogenetic techniques to study the intricate processes within embryonic cardiac tissues. By focusing on innovative optical imaging, optogenetic control, and novel image processing methods in genetic mouse models, my aim is to improve our understanding of congenital heart defects and potentially contribute to better management of these defects,” she said.

“From my childhood, the lectures of my father — a high school teacher who himself was filled with wonder in physics and mathematics — kindled a fascination in me for the unseen forces that govern our world,” Musina continued. “This foundational curiosity evolved into a focused interest in optics and photonics during my college years.

“My educational journey, starting at Bauman Moscow State Technical University (BMSTU), in Moscow, and continuing through my PhD studies at the University of Houston, has been pivotal in shaping my career. At BMSTU, I gained a strong foundation in optics and photonics, enhanced by hands-on research in Kirill Zaytsev’s lab,” she said.

“These experiences honed my research skills and sparked my interest in biophotonics. Continuing my studies at the University of Houston, I joined professor of integrative physiology Dr. Irina Larina’s research group at Baylor College of Medicine and discovered the field of optogenetics under her guidance. This combination of rigorous academic training and cutting-edge research placed me in the fields of optogenetics and biophotonics more broadly.”

Guzel Musina

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