



Biomedical Engineering
Newsletter Spring 2022



INNOVATION IN HEALTHCARE



**ENGINEERED FOR
WHAT'S NEXT.**

CULLEN
COLLEGE OF ENGINEERING
UNIVERSITY of HOUSTON

Letter from the Chair



Dear Colleagues,

In this latest edition of Innovation in Healthcare, we share some exciting developments and research breakthroughs to recently come out of the University of Houston's Cullen College of Engineering's biomedical engineering department. Despite being a relatively new department, founded in 2010, we have accomplished a great deal over the last 12 years and have recruited a renowned faculty roster, including multiple society Fellows and 2 NSF CAREER Award winners. The world is changing, and the needs of the medical community are ever evolving. And UH BME, proud partners of the UH medical school and the Texas Medical Center, will be there to answer the call. I hope you enjoy reading through this small sampling of our work, and if any of these projects strike your interest, do not hesitate to reach out. We are always looking for collaborators to further our research.

Warm Regards,

Metin Akay, Ph.D.

Founding Chair, John S Dunn Endowed Chair Professor
Department of Biomedical Engineering
Cullen College of Engineering
University of Houston

UH BME BY THE NUMBERS



PH.D. POST-GRADUATE JOB PLACEMENT

*NUMBERS BASED ON FALL 2021

DEGREES AWARDED (FALL 2021)



53 B.S.



19 M.S.



9 Ph.D.



ENROLLMENT (FALL 2021)

283 UNDERGRADUATE STUDENTS

122 GRADUATE STUDENTS



FACULTY:

NAE: **1**
IEEE FELLOW: **1**
SPIE FELLOW: **1**
AIMBE FELLOWS: **3**
AAAS FELLOWS: **2**

NSF CAREER: **2**
BMES FELLOW: **1**
IOP FELLOW: **1**
IAMBE FELLOW: **1**
ACS FELLOW: **1**

TOP 1% HIGHLY CITED RESEARCHERS: **2**
HONORIS CAUSA DOCTORATE: **1**
OSA FELLOW: **1**
AICE FELLOW: **1**

JINSOOK ROH EARNS



FROM THE NATIONAL SCIENCE FOUNDATION

FOR STROKE REHAB
RESEARCH



When it comes to rehabilitation efforts following a stroke, **Jinsook Roh** of the Cullen College of Engineering stresses that one simply can't address the effects of the incident – a more holistic approach, looking at why and how a patient's movement has changed, for example, is needed, as well as objective measurement criteria. Roh wants to develop a rehabilitation model that is tailored to individual patients, and that measures the cause of neural impairment, instead of fixing just the consequences of that impairment.

The approach has led to Roh's first National Science Foundation grant, and a CAREER award. "Neuromuscular Coordination (NeuroCoord)-Guided Human-Machine Interaction for Quantifying and Improving Motor Function after Stroke" was chosen for \$544,539 in funding by the NSF on Jan. 11, 2022.

Roh, an assistant professor of biomedical engineering, noted that her research has evolved over time, from an initial interest in physics to the characteristics of movement in creatures. She earned her doctorate from the Massachusetts Institute of Technology (MIT) and her B.S. from Ewha Womans University in Seoul, South Korea. After earning her doctorate, Roh worked as a postdoctoral research fellow at Northwestern University, before being hired as an assistant

professor of kinesiology by Temple University. She joined the University of Houston in 2018. ⚙️



Pictured Above: Jinsook Roh conducts research in the lab with the help of a student.

Read NSF Grant Overview Online:

Award Abstract # 2145321

Neuromuscular Coordination (NeuroCoord)-Guided Human-Machine Interaction for Quantifying and Improving Motor Function after Stroke



NATIONAL SCIENCE FOUNDATION:

www.nsf.gov

SIPHONING THE **FUEL** **FOR INFLAMMATION**

The College of Pharmacy's Bin Guo, associate professor of pharmaceuticals, and Gomika Udugamasooriya, associate professor of medicinal chemistry, in collaboration with **Chandra Mohan**, Hugh Roy and Lillie Cranz Cullen Endowed Professor in the Department of Biomedical Engineering, are pursuing how their work with cancer compounds could help in the treatment of rheumatoid arthritis thanks to a \$400,000 Innovative Research Award from the Rheumatology Research Foundation.

The researchers said they expect to observe significant anti-arthritic activity with the peptoid compound IFRA3Q1 and its optimized derivatives, which they say are likely to show improved activity in suppressing inflammation and arthritis. Specifically, the compound inhibits the cytokine protein known as interleukin-15 (IL-15), which induces the proliferation of T cells and natural killer cells who play key roles in inflammation. ⚙️



Pictured: Chandra Mohan

communications biology

Read Journal Publication Online:

Platinized graphene fiber electrodes uncover direct spleen-vagus communication



NATURE JOURNAL OF COMMUNICATIONS BIOLOGY:

www.nature.com/articles/s42003-021-02628-7

Pictured: Mario Romero-Ortega



UNDERSTANDING HOW THE **NERVOUS** **SYSTEM CONTROLS ORGANS**

An international team of researchers, led by University of Houston Cullen Endowed Professor of Biomedical Engineering **Mario Romero-Ortega**, has progressed electroceutical research for treatment of diseases including rheumatoid arthritis, colitis and sepsis. Romero-Ortega partnered with the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong in Australia.

The field of electroceuticals, where electrical stimulation is used to modify biological functions, has the potential to treat medical conditions with minimal invasion and side effects.

Published in the *Nature Journal of Communications Biology*, the work builds on previous studies when the team introduced the sutrode to the world just over a year ago. This graphene-based electrode is an electrical stimulation device that could replace the use of pharmaceuticals to treat a range of medical conditions. The sutrode, created using the fabrication technique known as fiber wet spinning, combines the electrical properties of an electrode with the mechanical properties of a suture. ⚙️

BIOMED, ECE, MCGOVERN COLLABORATION

LEADS TO NEW EPILEPSY RESEARCH

A recently published paper from a team of researchers and students from multiple departments at the Cullen College of Engineering and the McGovern Medical School at UTHealth proposes a way to provide real-time, continuous tracking for the 50 million people living with potential seizures from epilepsy world-wide.

While a drug regimen can control many symptoms of epilepsy, according to the paper's authors more than 90 percent of people with the disorder will still experience seizures. With real-time monitoring, a closed-loop system can be developed – making sure a person is only given treatment at the most effective times, to prevent or to cut off seizures.

The research was truly a collaborative effort between multiple departments at the college and outside of it, as the paper has nine listed authors, eight of which are at UH, and builds upon the previous work of students **Mohammad Badri Ahmadi** and **Alex Craik**. Ahmadi is a doctoral student of Jo-

seph T. Francis, Ph.D., professor of Biomedical Engineering.

The paper, "A Mixed Filtering Approach for Real-Time Seizure State Tracking Using Multi-Channel Electroencephalography Data," authored by **Rose T. Faghieh**, Ph.D., and doctoral students **Alexander Steele** and **Sankalp Parekh**, was published in September in Volume 29 of *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. ⚙️

IEEE Xplore®

Read Journal Publication Online:

A Mixed Filtering Approach for Real-Time Seizure State Tracking Using Multi-Channel Electroencephalography Data



IEEE Xplore
ieeexplore.ieee.org/abstract/document/9541179



METIN AKAY



Metin Akay, Ph.D., the founding chairman and the John S. Dunn Endowed Professor of Biomedical Engineering, was elected chairman of the governing council for the International Academy of Medical and Biological Engineering (IAMBE). The organization consists of more than 200 fellows who are recognized for their exceptional contributions to biomedical engineering.



“I am highly dedicated to increasing the global public awareness of how biomedical engineers impact healthcare innovations in collaboration with scientists, physicians, healthcare professionals, and industry leaders”

- Metin Akay



Additionally, Metin received an Honoris Causa degree from the Silesian University of Technology in Poland in October 2021. ⚙️

FACULTY

ACCOLADES

MINI DAS



The Society of Photo-optical Instrumentation Engineers (SPIE) has named University of Houston associate professor of physics and biomedical engineering **Mini Das**, as a Fellow. Fifty-eight SPIE members were named Fellows in 2022, joining more than 1,600 society Fellows worldwide.



"SPIE brings together a great mix of scientists and engineers who work on interdisciplinary research areas. An international platform like this is critical to solve difficult problems and advance optics, photonics and imaging science and technology. It has been an incredible opportunity to learn from and brainstorm with like-minded colleagues."

- Mini Das



Das has also been named a Scialog Fellow and a UH ADVANCE Fellow, both honors for her research in biological and medical imaging. ⚙️

STUDENT SUCCESS

SARAH HAKAM NAMED OUTSTANDING SENIOR

Growing up, **Sarah Hakam** knew she wanted to go to medical school, but she also knew that she didn't want to go via the conventional route, by pursuing a biology or chemistry major. She has flourished as a Biomedical Engineering student, and as a result, has earned the college's Outstanding Senior award for the academic year. After earning her degree at UH, Hakam will be continuing her studies at Texas A&M College of Medicine. She has been accepted into a dual degree program there, to pursue her medical doctorate and a Master's in Interdisciplinary Engineering at the same time. Ideally, she would like to stay in the area once she enters the professional world, but beyond wanting to be a surgeon, her goals are ever-changing. ⚙️

Pictured: Sarah Hakam



BIOMEDICAL ENGINEERING

HYUNDAI WOMEN IN STEM SCHOLARSHIP

QUYNH NGUYEN WINS SCHOLARSHIP FROM HYUNDAI MOTOR AMERICA

Quynh Nguyen, a biomedical engineering senior and undergraduate research assistant, was recently recognized with a 2021 Hyundai Women in STEM Scholarship. According to Hyundai, "The scholarship helps close the gender gap in engineering, mobility and autonomous driving fields by awarding female students interested in pursuing an education and career in those disciplines." Nguyen was one of five individuals recognized with the award, which comes with a \$10,000 scholarship. Nguyen currently conducts research for biomedical engineering associate professor, Yingchun Zhang's, neuroimaging lab. ⚙️

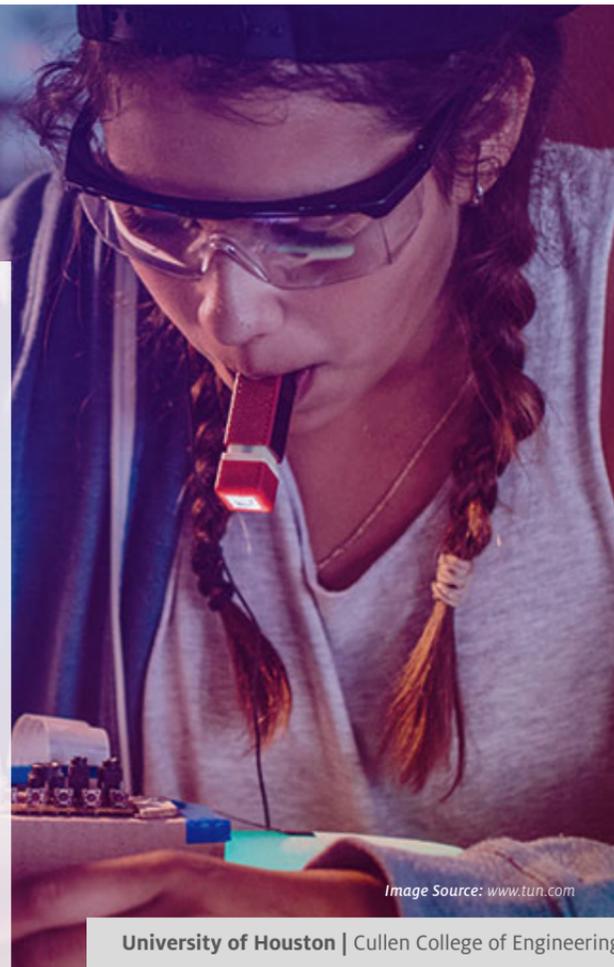


Image Source: www.tun.com

University of Houston | Cullen College of Engineering



Pictured: Elizabeth Perry

TRANSITIONING FROM **INTERNSHIP** **TO INDUSTRY**

After completing an experience and expertise-building internship this summer, junior Biomedical Engineering student **Elizabeth Perry** is excited about the opportunity to build on that momentum with her studies at the Cullen College of Engineering this year and next.

She received the offer for the internship at Boston Scientific, a medical device manufacturing and research company with more than \$9 billion in yearly revenue, on a virtual call while she was attending the Black Engineering of the Year Awards STEM Conference in February 2021.

Perry completed the internship from May 2021 through August 2021, working an 8-5 schedule throughout. Perry worked to develop a Graphical User Interface [GUI] through MATLAB for image processing for the company's Research and Development Department. She also developed test methods and tested the performances of various endoscopes at the company.

Given how positive her internship experience was overall, Perry hopes to pursue a career in industry after she graduates in May 2023. ⚙️

ALUMNI ACHIEVEMENTS

NICHOLAS DIAS RECEIVES NIH FUNDING FOR CHRONIC **PELVIC PAIN RESEARCH**

A graduate from the Cullen College of Engineering has received a first round of funding from the National Institutes of Health FastTrack program for research into chronic pelvic pain management, with close to \$2 million potentially available as the research continues.

Nicholas Dias, Ph.D., is a research scientist working for HillMed, Inc., a Houston-based medical research firm. Dias also graduated from the University of Houston with a B.S. in 2015 and a doctorate in 2020, both in Biomedical Engineering.

His proposal, “An Novel Medical System for Quantitative Diagnosis and Personalized Precision Botulinum Neurotoxin Injection in Chronic Pelvic Pain Management,” was chosen for \$251,964 in Phase 1 funding, for one year. As long as milestones are hit for Phase 1, an additional \$1.7 million for three years of funding will be released. Dias said his research at the firm centers on diagnosing and treating pelvic floor dysfunctions that complicate chronic pelvic pain (CPP). ⚙️

BIOMEDICAL ENGINEERING



Read Proposal Online:

An Novel Medical System for Quantitative Diagnosis and Personalized Precision Botulinum Neurotoxin Injection in Chronic Pelvic Pain Management



Pictured: Nicholas Dias

University of Houston | Cullen College of Engineering

The University of Houston

Cullen College of Engineering

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 worldclass 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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