Chemical & Biomolecular Engineering
Newsletter Spring 2023

TRANSPORT

ENGINEERED FOR
WHAT'S NEXT.

Cullen College of Engineering
UNIVERSITY OF **HOUSTON**

Letter from the Chair

Dear Colleagues,

I am delighted to share some of the recent research highlights and accomplishments of our faculty and students. From developing new methods to diagnose and monitor lupus nephritis on your smartphone, enhancing at-home COVID tests with glow-in-the dark materials and addressing renewable energy challenges with computers, there is no shortage of exciting research projects in the William A. Brookshire Department of Chemical and Biomolecular Engineering. I invite you to take a moment and look through the following items, and if any strike your interest, do not hesitate to reach out to me personally.

Warm Regards,

Triantafillos J. (Lakis) Mountziaris
William A. Brookshire Department Chair and Professor
William A. Brookshire Dept. of Chemical & Biomolecular Engineering
University of Houston

UH ChBE **BY THE NUMBERS**

FACULTY *(FALL 2022)*

1 NATIONAL ACADEMY OF ENGINEERING MEMBER

2 NATIONAL ACADEMY OF INVENTORS FELLOWS

3 NATIONAL ACADEMY OF INVENTORS SENIOR MEMBERS

ENROLLMENT *(FALL 2022)*

444 UNDERGRADUATE STUDENTS

135 GRADUATE STUDENTS

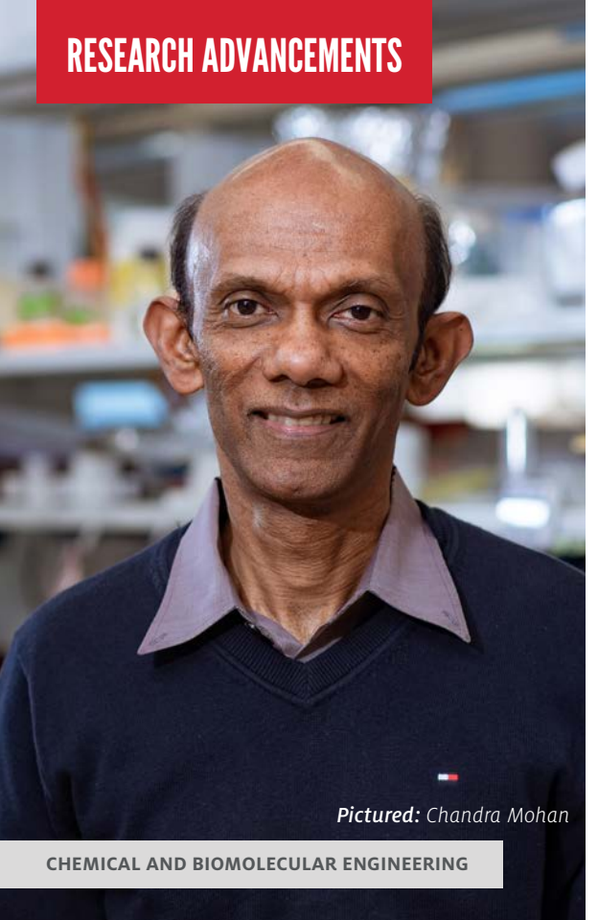
LEARN MORE ABOUT ChBE PROGRAMS:
www.chee.uh.edu

DEGREES AWARDED
(FALL 2022)

75 B.S.

13 M.S.

22 PH.D.



Pictured: *Chandra Mohan*

CHEMICAL AND BIOMOLECULAR ENGINEERING

EARLY DIAGNOSIS AND MONITORING OF LUPUS NEPHRITIS- **ON YOUR SMARTPHONE**

According to the Centers for Disease Control and Prevention, about 204,295 Americans have systemic lupus erythematosus, an autoimmune disease leading to chronic inflammation in multiple organs, including the kidneys. Nephritis flares are hard to recognize because their symptoms often masquerade as something else. A sufferer might think they have a cold or the flu or are just tired.

University of Houston researchers **Chandra Mohan**, Hugh Roy and Lillie Cranz Cullen Endowed Professor of biomedical engineering and **Richard Willson**, Huffington-Woestemeyer Professor of chemical and biomolecular engineering and professor of biochemical and biophysical sciences are reporting the success of their new method for the early diagnosis and monitoring of lupus nephritis – at home. If you've taken an at-home COVID-19 or pregnancy test, then you've taken what is scientifically called a lateral flow assay (LFA) test, a diagnostic tool widely used because of its rapid results, low cost and ease of operation. The team applied that same technology to assessing lupus nephritis, or inflammation of the kidneys, one of the most severe complications for patients with systemic lupus erythematosus (SLE, or lupus).

The home test – with results read on a smartphone – is meant to eventually replace the gold standard for diagnosis of active lupus nephritis, an invasive kidney biopsy, with its attendant morbidity which cannot be serially repeated.

Pictured: Richard Willson

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Pictured: *Jeffrey Rimer with research students.*

DOLPHIN RESEARCH LEADS TO NEW METHOD TO POSSIBLY **IMPROVE** PHARMACEUTICALS

Jeffrey Rimer, Abraham E. Dukler Professor of Chemical Engineering at the Cullen College of Engineering, is known globally for his seminal breakthroughs using innovative methods to control crystals to help treat malaria and kidney stones. He is reporting a new method to control the growth of ammonium urate crystals, the substance known to cause kidney stones in dolphins.

Rimer has been riding the wave of dolphin research for a while, previously reporting on crystals associated with dolphin kidney stones made of ammonium urate, rarely found in humans. “We found that a small fraction of urate existing as a minor tautomer can control the rate at which crystals grow to the point they can completely block crystallization,” Rimer said. “It was the most unexpected and remarkable thing to find that as you increase the concentration of urate, all of a sudden the rate of crystallization drops to almost zero and crystals do not grow in that region.”

Rimer thinks it may be possible to mimic those results by diet control to get the concentration in the kidney in that range, so then the possibility exists that crystal growth would be inhibited, and medicine would be unnecessary.

ENHANCING AT-HOME COVID TESTS WITH

GLOW-IN-THE-DARK MATERIALS

Researchers at the University of Houston are using glow-in-the-dark materials to enhance and improve rapid COVID-19 home tests. If you've taken an at-home COVID-19 or pregnancy test, then you've taken what is scientifically called a lateral flow assay (LFA) test, a diagnostic tool widely used because of its rapid results, low cost and ease of operation. When you read test results, you see colored lines.

"We are making those lines glow-in-the-dark so that they are more detectable, so the sensitivity of the test is better," said **Richard Willson**, Huffington-Woestemeyer professor of Chemical and biomolecular engineering and professor of biochemical and biophysical sciences, who previously created a COVID smartphone-based app and test kit based on the technology underlying home pregnancy tests.

The first idea for glow-in-the-dark technology sprang from a star pasted on the ceiling of Willson's young daughter's bedroom. One night while he was putting her to sleep, he peered at the glow-in-the-dark star and his mind began to wander, applying its principles to science. Within days Willson and his team of students and postdocs was creating a test with glowing nanoparticles made of phosphors, which would make the particles even more detectable and the tests more accurate. So truly, the sky – and stars – are the limit.

Pictured: *Glow-In-The-Dark Stars*

FACULTY

ACCOLADES

DR. TRIANTAFILLOS J. MOUNTZIARIS

Triantafillos J. Mountziaris was recently elected to Senior Member status of the National Academy of Inventors (NAI) in recognition of his outstanding achievements in innovation that are making an impact around the world. Dr. Mountziaris serves as a professor and chair of the William A. Brookshire Department of Chemical and Biomolecular Engineering. He also is a Fellow of the American Association for the Advancement of Science and the American Institute of Chemical Engineers. Dr. Mountziaris has developed and patented novel methods for scalable synthesis of quantum dots which are tiny crystals of semiconductors useful in a variety of applications, including ultra-high-definition color displays and multiplexed optical biosensors. His team also discovered and patented a new class of quantum-dot based biological sensors that can speed processes in drug discovery applications

JACINTA CONRAD

Jacinta Conrad was recently elected as a Fellow of the American Physical Society (APS) in recognition of her outstanding achievements and contributions in the application of physics to science and technology. Conrad is the Cullen College Frank M. Tiller Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering. She is the 15th faculty member from the University of Houston to be elected as a Fellow of the American Physical Society (APS). Conrad also serves as the Chair of the Division of Soft Matter (DSOFT). She is a member of the Topical Group on Statistical & Nonlinear Physics (GSNP), the DPOLY for polymers, the DFD for fluids and DBIO–biophysics.

JERROD A. HENDERSON

Jerrod A. Henderson, a faculty member of the William A. Brookshire Department of Chemical and Biomolecular Engineering and the co-founder of the St. Elmo Brady STEM Academy, was named an Associate Editor position for the Journal of Women and Minorities in Science and Engineering. Dr. Henderson as served as a reviewer for the journal and contributed as recently as January 2022.

STUDENT

SUCCESS

SHAYNE SENSENBACH

Shayne Sensenbach, a doctoral student in the William A. Brookshire Department of Chemical and Biomolecular Engineeirng, was recently elected to the Department of Defense's Science, Mathematics and Research for Transformation (SMART) scholarship program. As part of being chosen for the SMART program, Shayne will get the opportunity to complete two internships with the Department of Defense and receive stipends for his tuition and research efforts. After graduation, Shayne will take a full-time position with his sponsoring DoD agency.

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 spear-heading research that has a real, direct impact in the Houston region and beyond.

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