


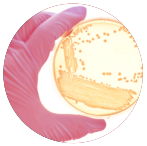




RESEARCH

TRANSPORT

MILESTONES

AT THE WILLIAM A. BROOKSHIRE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING

UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING
Department of Chemical & Biomolecular Engineering

Letter from the Chair

Dear Colleagues,

I hope that this message finds you safe and in good health. Despite the challenges presented by the novel coronavirus, our department has been hard at work in our continued pursuit of excellence in academia and research. I invite you to read through the following research breakthroughs, academic success stories and newly funded projects.

If you would like to learn more about how to support a project or collaborate with our department, do not hesitate to let me know.

Warm Regards,

Mike Harold
Cullen Engineering Professor and Department Chair
William A. Brookshire Dept. of Chemical & Biomolecular Engineering
University of Houston
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UH ChBE **BY THE NUMBERS**

#36
BEST CHEMICAL ENGINEERING PROGRAM IN THE U.S.
**Source: US News & World Report*

TOP 20
CHEMICAL DOCTORAL PROGRAM IN THE U.S.
**Source: National Research Council*

22:1 UNIVERSITY-WIDE STUDENT TO FACULTY RATIO

446 UNDERGRADUATE STUDENTS

128 GRADUATE STUDENTS

574 TOTAL STUDENTS IN DEPARTMENT

**Student Totals are from Fall 2019 & Spring 2020*

35M+ IN RESEARCH EXPENDITURES AT THE CULLEN COLLEGE OF ENGINEERING

80% OF UH ENGINEERING UNDERGRADUATES ARE EMPLOYED WITHIN 1 YEAR OF GRADUATION

55 RESEARCH LABS, CENTERS, INSTITUTES & INDUSTRY CONSORTIUMS

CULLEN COLLEGE

ChBE DEPARTMENT HAS BEEN RENAMED

CHEMICAL AND BIOMOLECULAR ENGINEERING

The UH ChBE department has been renamed as the

WILLIAM A. BROOKSHIRE DEPARTMENT OF CHEMICAL & BIOMOLECULAR ENGINEERING

Dr. William A. Brookshire graduated from UH in 1957 with a bachelor's degree in chemical engineering and later co-founded S&B Engineers and Constructors. Though he passed away in 2017, his continued philanthropic impact on the educational excellence of UH faculty, students and researchers is significant. Endowments fuel the momentum of the academic mission in perpetuity, helping the Cullen College of Engineering excel as an internationally recognized hub of research activity in the fields of chemical and biomolecular engineering.

STEM LEADER JOINS UH CHBE

Jerrod A. Henderson recently joined the William A. Brookshire Department of Chemical and Biomolecular Engineering as an instructional associate professor. Dr. Jerrod A. Henderson ("Dr. J") is the Director of the Program for Mastery in Engineering Studies and an instructional associate professor in the Cullen College of Engineering. As the co-founder or St. Elmo Brady STEM Academy, his work focuses on the development of out-of-school STEM interventions for K-12 students, the implementation of innovative strategies in engineering classrooms, and student engagement.

Henderson is PI on two NSF funded projects and Co-PI on another which all focus on the engagement of underrepresented (UR) students in engineering. For his work he has been recognized as an Inspiring Leader in STEM by Insight into Diversity Magazine (2017), a Young Alumni Achievement Award by University of Illinois (2019); and the Science Spectrum Trailblazer Award, at the 34th Black Engineer of the Year Awards (BEYA) STEM Conference (2020).

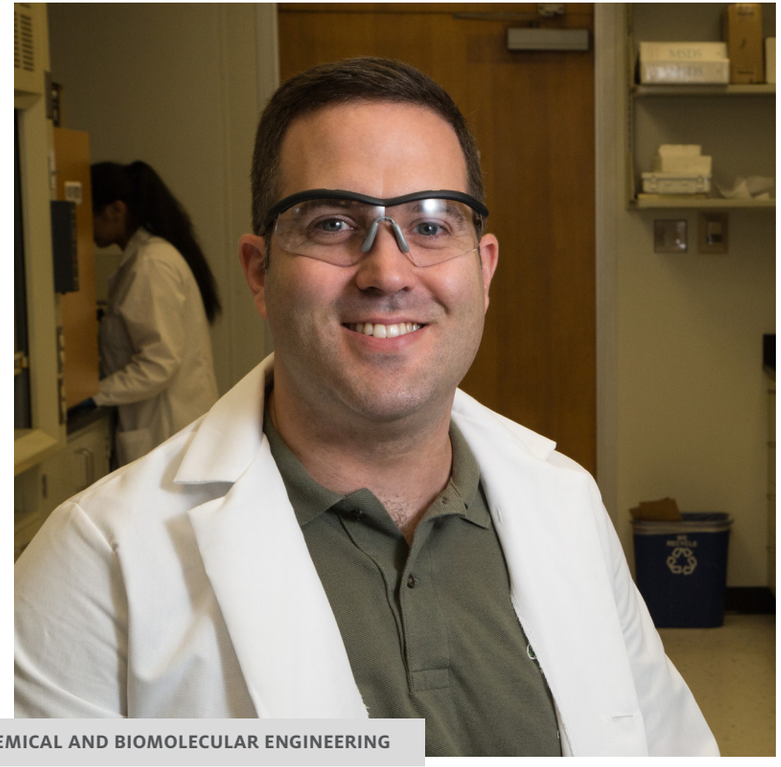
THE FOLLOWING FACULTY MEMBERS RECENTLY RECEIVED PROMOTIONS FOR THEIR CONTINUED DEDICATION TO ACADEMIC AND RESEARCH EXCELLENCE:

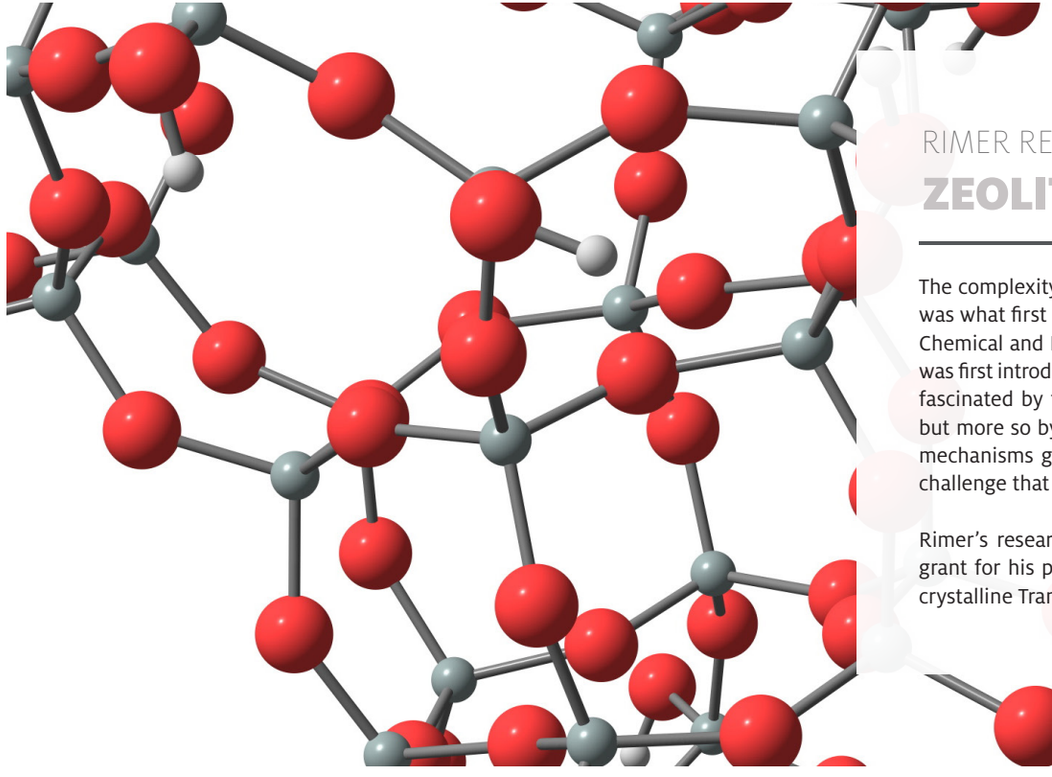
Jeremy Palmer was promoted to the position of associate professor. His title is now Ernest J and Barbara M Henley Associate Professor of Chemical and Biomolecular Engineering. Some of his research areas include materials by design, soft and complex media, and glasses and metastable liquids.

Lars Grabow was promoted to professor status. His title is now Dan Luss Professor of Chemical and Biomolecular Engineering. Grabow's research group uses computational methods to understand and predict chemical processes that occur on solid-gas and solid-liquid interfaces. In particular, the work focuses on heterogeneously catalyzed reactions relevant for energy production, energy storage, photocatalysis, pollution mitigation and the production of useful chemicals.

Navin Varadarajan was promoted to professor status. His title is now M.D. Anderson Professor of Chemical and Biomolecular Engineering. His lab is developing high-throughput screens designed to characterize a wide range of biological functions ranging from the properties of proteins in single cells to antigen mediated cellular cytotoxicity. The development of these assays are intended to serve as versatile platforms for the systemic investigation of B cells and antibodies in autoimmune diseases, and characterization of T cell responses in cancer and engineering therapeutic enzymes and antibodies.

To learn more about Faculty Expertise at the William A. Brookshire Department of Chemical and Biomolecular Engineering, please visit: *http://www.chee.uh.edu/research/faculty*





RIMER RECEIVES **NSF GRANT FOR ZEOLITE WORK**

The complexity and mystery of zeolites – porous aluminosilicate crystals – was what first attracted **Jeffrey Rimer**, the Abraham E. Dukler Professor of Chemical and Biomolecular Engineering, to his current field of research. "I was first introduced to zeolites during my Ph.D. studies, and I quickly become fascinated by these porous materials, partly because of their complexity, but more so by the fact that very little was known about the fundamental mechanisms governing zeolite crystallization," he said. "This presented a challenge that to this day continues to motivate research in my group."

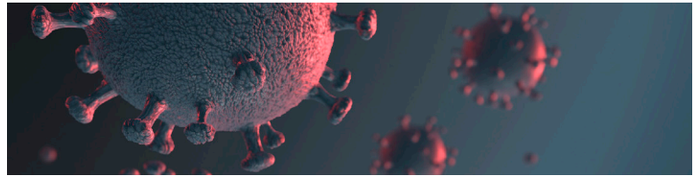
Rimer's research group will be aided in its search with a $446,364 NSF grant for his proposed project, "Designing New Methods to Exploit Inter-crystalline Transformations in Zeolite Synthesis."

RAPID TESTS FOR COVID-19

AND OTHER DISEASES

The development of point-of-care tests – and as of late, for COVID-19 – has been the primary focus of **Katerina Kourentzi**, Research Associate Professor of Chemical and Biomolecular Engineering in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the University of Houston's Cullen College of Engineering.

"I was introduced to the fascinating and intellectually-stimulating nano-world of biomolecular recognition, and the science behind antibody-antigen interactions, during my graduate studies under Professor **Richard C. Willson**," she said. "Beyond their natural role in the immune system, antibodies can be made ex-vivo [by chemical engineers] to be used as therapeutics but also as precise tools in diagnostics to target a specific antigen or pathogen." Kourentzi wants to put these antibodies to work to diagnose disease. "My goal is to develop novel antibody-based diagnostic technologies and enable early disease detection," she said. "As an engineer, I am very interested in using science and technology to solve society's problems and help people live better."



SHOWING PROMISE: UH RESEARCHER EXPLORES

CARE OPTIONS FOR COVID-19

Navin Varadarajan, M.D. Anderson Associate Professor of Chemical and Biomolecular Engineering is testing inhalation vaccines. Think FluMist for COVID-19. "For airborne pathogens, the nasal mucosa is the first point of defense that needs to be breached," said Varadarajan. "Mucosal immunity and vaccines are fundamentally important for a wide range of pathogens including influenza, severe acute respiratory syndrome coronavirus (SARS-CoV) and the current SARS-CoV-2." Still, he said, nasopharyngeal immunity is understudied. Varadarajan is using the spike protein, which helps the virus enter the target cell, and is the major target for neutralizing antibodies as it binds to the cellular receptor called angiotensin converting enzyme-2 (ACE2) for virus entry. He prefers using proteins because of their ability to induce strong immune responses, flexibility and scalability, and absence of infectious particles.

RESEARCHERS TAKE A CUE FROM NATURE

TO CREATE BULLETPROOF COATINGS

Shrimp, lobsters and mushrooms may not seem like great tools for the battlefield, but chemical engineers from the University of Houston are using chitin – a derivative of glucose found in the cellular walls of arthropods and fungi – and 3D printing techniques to produce high-impact multilayered coatings that can protect soldiers against bullets, lasers, toxic gas and other dangers.

Although corn is better known as a sustainable, bio-based material, chitin offers promise as a commonly available material that could be processed and used in some products that now require petroleum-based plastics.

Alamgir Karim, Dow Chair Professor of chemical and biomolecular engineering, is leading the project funded by a $660,000 grant from the U.S. Department of Defense, to develop tough, durable and antimicrobial multilayer films capable of resisting an impact from projectiles or lasers while simultaneously absorbing toxic gas. **Megan Robertson**, associate professor of chemical and biomolecular engineering, is serving as a co-principal investigator.

TARGETING

CHRONIC INFECTIONS AND DEADLY BACTERIA

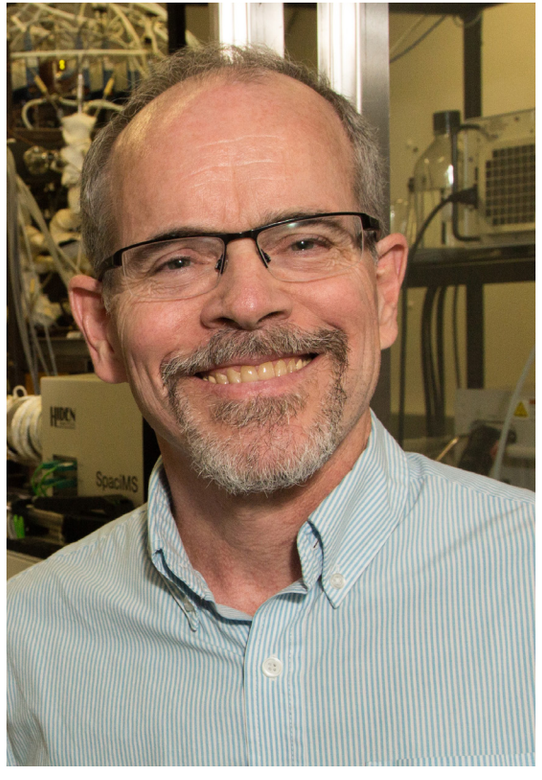
A University of Houston engineering professor is examining the life cycle of stubborn, drug-resistant persister cells in recurrent infections to find a way to destroy them. Persister cells are non-growing cell subpopulations observed in many pathogenic bacteria and they certainly live up to their name – they persist, and are not fazed by current medications. Scientists believe they cause the recurrence of chronic health issues like airway infections in cystic fibrosis patients, urinary tract infections and tuberculosis.

"If we know how persister cells are formed, we can target their formation mechanisms to eliminate these dangerous cell types," said **Mehmet Orman**, assistant professor of chemical and biomolecular engineering, who is using a $1.9 million grant from the National Institute of Allergy and Infectious Diseases to explore persister cells.

$2M NSF DISTRIBUTED CHEMICAL MANUFACTURING PROJECT

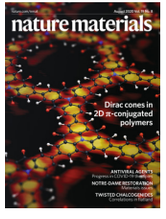
A partnership between researchers at the University of Virginia and the University of Houston has continued to flourish, and expanded to another professor at the Worcester Polytechnic Institute, after the National Science Foundation chose their Emerging Frontiers in Research and Innovation (EFRI) proposal – the development of dynamically operated, smaller scale reactors that can process distributed feedstock – for a $2 million award.

Dr. Lars C. Grabow, Dan Luss Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering at the Cullen College of Engineering, is a co-PI on the project and will lead a team of researchers at the University of Houston. He identified **Dr. Michael P. Harold** and **Dr. Praveen Bollini**, also of the William A. Brookshire Department of Chemical and Biomolecular Engineering, as two colleagues that will be taking part in the research with him.



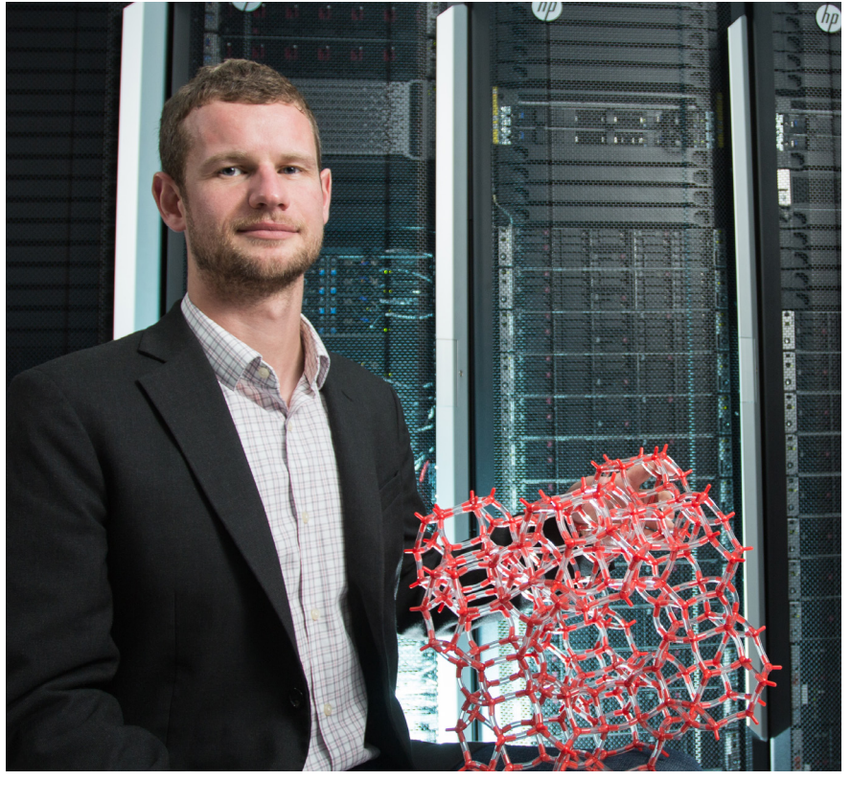
University of Houston | Cullen College of Engineering

BREAKING MOLECULAR TRAFFIC JAMS WITH FINNED NANOPOROUS MATERIALS



Thousands of chemical processes used by the energy industry and for other applications rely on the high speed of catalytic reactions, but molecules frequently are hindered by molecular traffic jams that slow them down. Now an entirely new class of porous catalysts has been invented, using unique fins to speed up the chemistry by allowing molecules to skip the lines that limit the reaction. This discovery was published in *Nature Materials*, the leading journal of materials science.

The breakthrough focused on reducing barriers for molecules accessing the interior pores of catalysts, called zeolites – aluminosilicates with pores smaller than a nanometer. Zeolites are widely used in commercial processes as solid catalysts for the production of gasoline and value-added chemicals and other products. UH ChBE researchers **Jeffrey Rimer** and **Jeremy Palmer** are contributing members in the ongoing the study.



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 world-class engineers each year. With research expenditures topping $35 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.

UNIVERSITY of HOUSTON | ENGINEERING

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Research MILESTONES