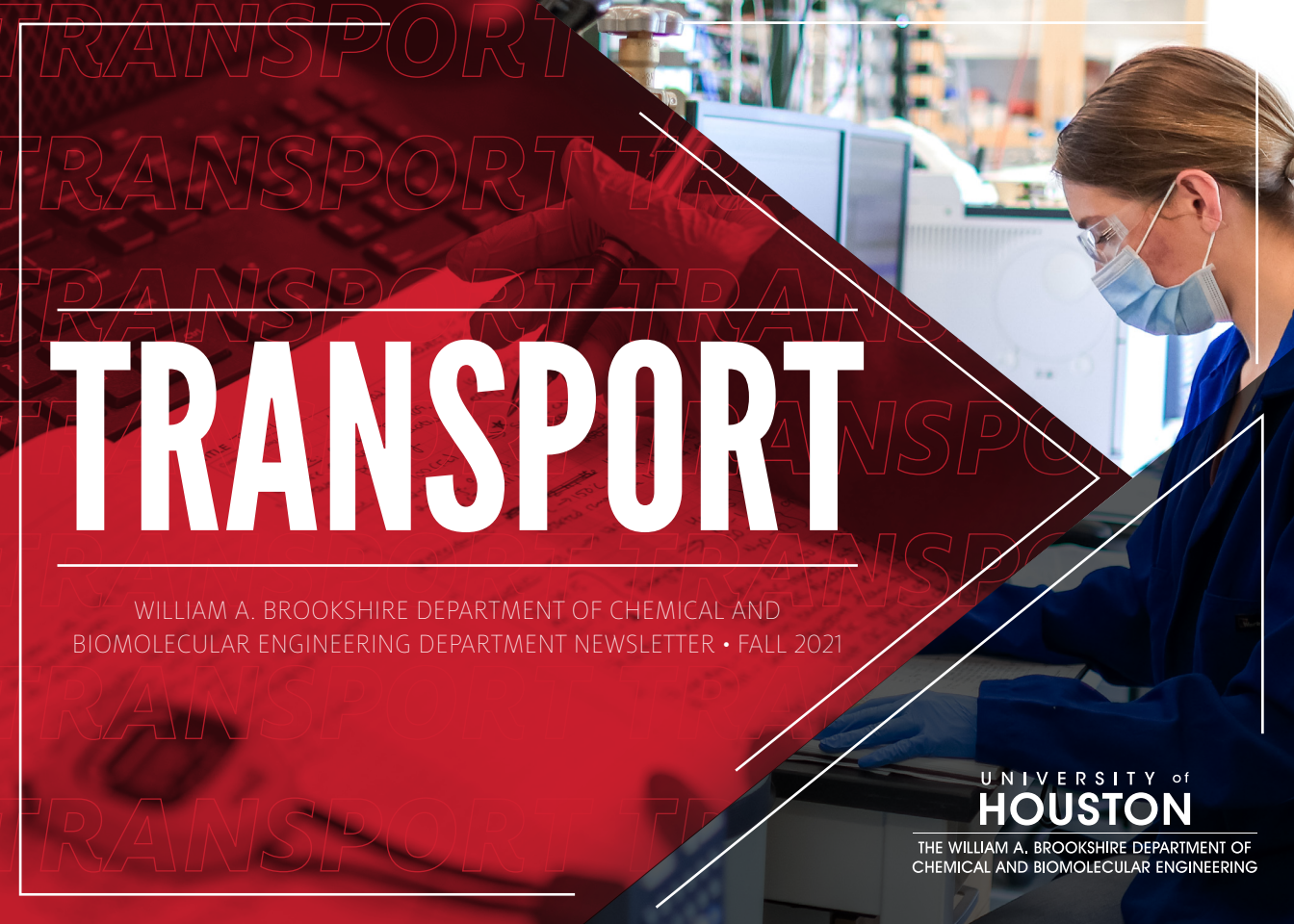


TRANSPORT

WILLIAM A. BROOKSHIRE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING DEPARTMENT NEWSLETTER • FALL 2021

UNIVERSITY of HOUSTON

THE WILLIAM A. BROOKSHIRE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING

Letter from the Chair

Dear Colleagues,

Greetings from Houston! While we continue to closely monitor the effects of COVID-19 in the greater Houston area and beyond, we have resumed in-person functionality at the University of Houston campus by taking necessary precautions to limit the spread of the virus. Despite the challenges we faced over the last year, the University of Houston has continued to excel, including enrollment levels reaching record numbers and an increase of 40% in research grants. This publication highlights some of the recent achievements of faculty and students from the William A. Brookshire Department of Chemical and Biomolecular Engineering that is leading this effort. If you would like to know more about any of these projects, or wish to collaborate with our faculty, I invite you to contact me directly. Please stay safe and be well.

Warm Regards,

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

CHBE DEPARTMENT NAMED AN
ACS BRIDGE SITE

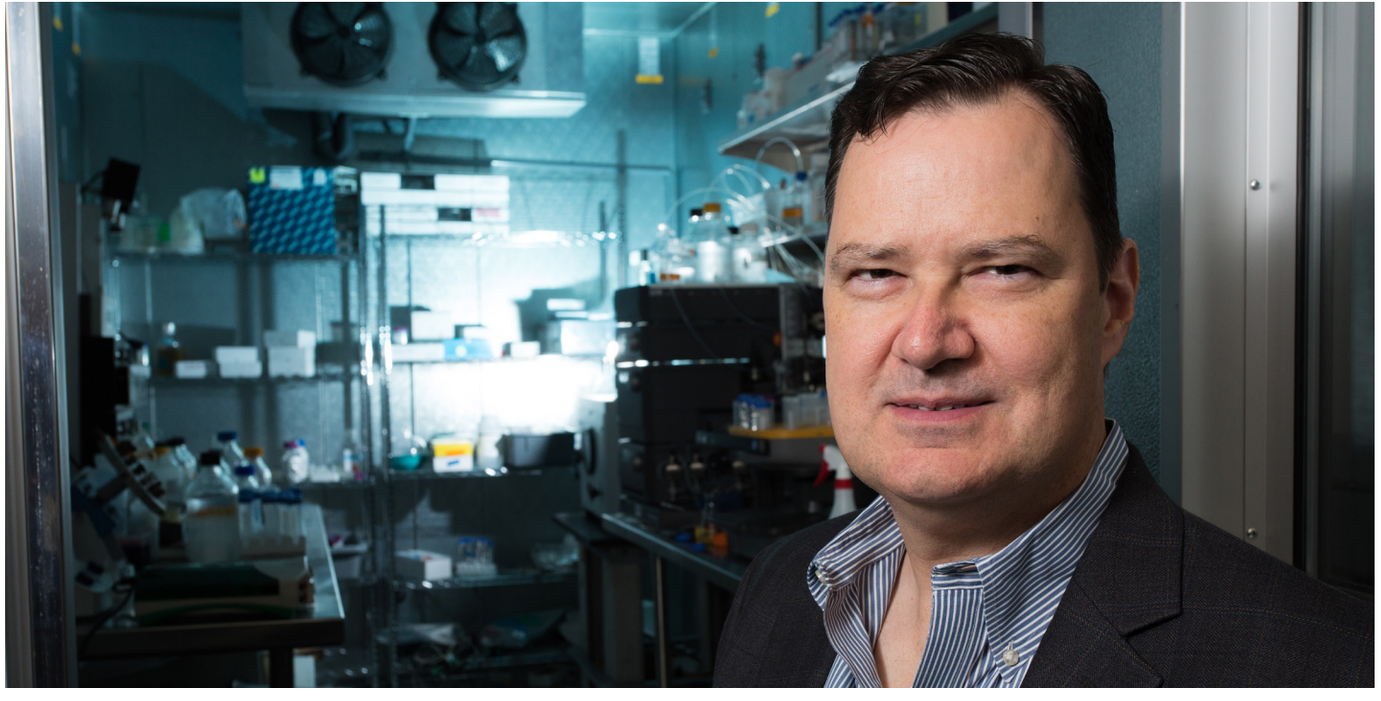
The William A. Brookshire Department of Chemical and Biomolecular Engineering was recently named by the American Chemical Society (ACS) as an ACS Bridge Site. The American Chemical Society Bridge Program (ACS-BP) is an effort to increase the number of chemical science Ph.D.s awarded to underrepresented minority students. Only one other chemical engineering department in the country holds this distinction, Georgia Tech. The ACS Bridge Project's mission is to strengthen the chemical sciences in the United States by increasing the number of students from underrepresented groups who receive doctoral degrees. The William A. Brookshire Department was chosen for its extensive commitment to both excellence in research and inclusiveness.

CULLEN ALUMS, PROFESSOR'S

SMARTPHONE-BASED COVID-19 TEST HITS MARKET

In 2020, just as the SARS-CoV-2 coronavirus caused a pandemic of respiratory illness called COVID-19, two chemical engineers and alumni of the University of Houston decided to pivot the product strategy of Luminostics, the company they began forming while in the UH lab of **Richard Willson**, Huffington-Woestemeyer Professor of Chemical and Biomolecular Engineering and Professor of Biochemical and Biophysical Sciences. Based on technology developed in the Willson lab, Luminostics aims to empower consumers with rapid self-diagnostics.

By May 2021, having gotten Emergency Use Authorization from the FDA, Luminostics' founders **Andrew Paterson**

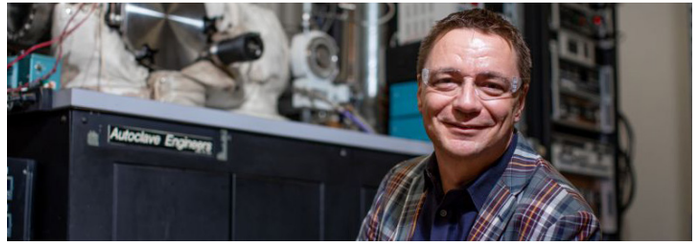


and **Bala Raja** had distributed their Clip COVID Rapid Antigen Test across the United States.

The Clip COVID test, a revolutionary test based on a smartphone-coupled analyzer, uses a nasal swab, a smart phone, and glow-in-the-dark nanoparticles to detect SARS-CoV-2 infection within 30 minutes

EXAMINING THE ONE-TWO PUNCH OF MALARIA DRUGS

The first-line treatment for malaria, caused by the P. Falciparum parasite, is artemisinin-based combination therapy, which provides a one-two punch. The drug artemisinin (derived from the Asian Artemisia annua or sweet wormwood) is combined with a quinoline-based compound. Artemisinin weakens the parasite by oxidizing it; the quinoline drug kills it. But the two drugs do not always cooperate, as they can also be antagonistic. Now UH researchers are studying the interactions between artemisinin and the drugs with which they are combined to fight malaria. **Peter Vekilov**, Moores Professor of Chemical and Biomolecular Engineering at the University of Houston, received $1.2 million from the National Institutes of Health, in partnership with Johns Hopkins University, to study the interactions of the drugs. Working with Vekilov is **Jeff Rimer**, Abraham E. Dukler Professor of Chemical and Biomolecular Engineering at UH.



BRINGING CHEMICAL PRODUCTION AND MANUFACTURING TOGETHER

Lars Grabow, Dan Luss Professor of Chemical and Biomolecular Engineering at the University of Houston and principal investigator, received a $2,091,874 award from the U.S. Department of Energy to resolve a major industry pain point by engineering a dynamic process using small reactors near geographically distributed carbon fiber plants that would effectively bring feedstock acrylonitrile production onsite. Grabow will work in tandem with team members from Idaho National Laboratory, the University of Virginia, Pacific Northwest National Laboratory and KX2 Development. The multifaceted benefits of this project would provide a myriad of solutions to several pain points in the carbon fiber market industry, ultimately leading to a cheaper, safer product for the average consumer.

CANCER 'GUARDIAN' BREAKS BAD

WITH ONE SWITCH, UH, RICE RESEARCHERS SHOW

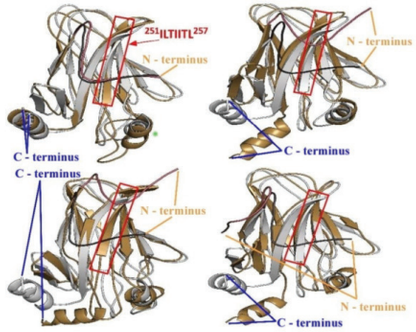
The ubiquitous p53 protein in its natural state, sometimes called "the guardian of the genome," is a front-line protector against cancer. But the mutant form appears in 50 percent or more of human cancers and actively blocks cancer suppressors.

Researchers led by **Peter Vekilov** and his group at the University of Houston and Anatoly Kolomeisky at Rice University have discovered the same mutant protein can aggregate into clusters. These in turn nucleate the formation of amyloid fibrils, a prime suspect in cancers as well as neurological diseases like Alzheimer's.

The p53 mechanism described in a paper published in the the *Proceedings of the National Academy of Sciences* may be similar to those that form functional and pathological solids like tubules, filaments, sickle cell polymers, amyloids and crystals, Vekilov said.

Researchers at UH combined 3D confocal images of breast cancer cells taken in the lab of **Navin Varadarajan**, MD Anderson Professor of Chemical and Biomolecular Engineering at the University of Houston, with light scattering and optical microscopy of solutions of the purified protein carried out in the Vekilov lab.

UH graduate student **David Yang** is lead author of the paper. Co-authors are Rice graduate student Alena Klindziuk and alumnus Aram Davtyan; UH graduate student Arash Saeedi and alumni Mohsen Fathi and Mohammad Safari; and Michelle Barton, a former professor at the University of Texas MD Anderson Cancer Center now at Oregon Health & Science University.

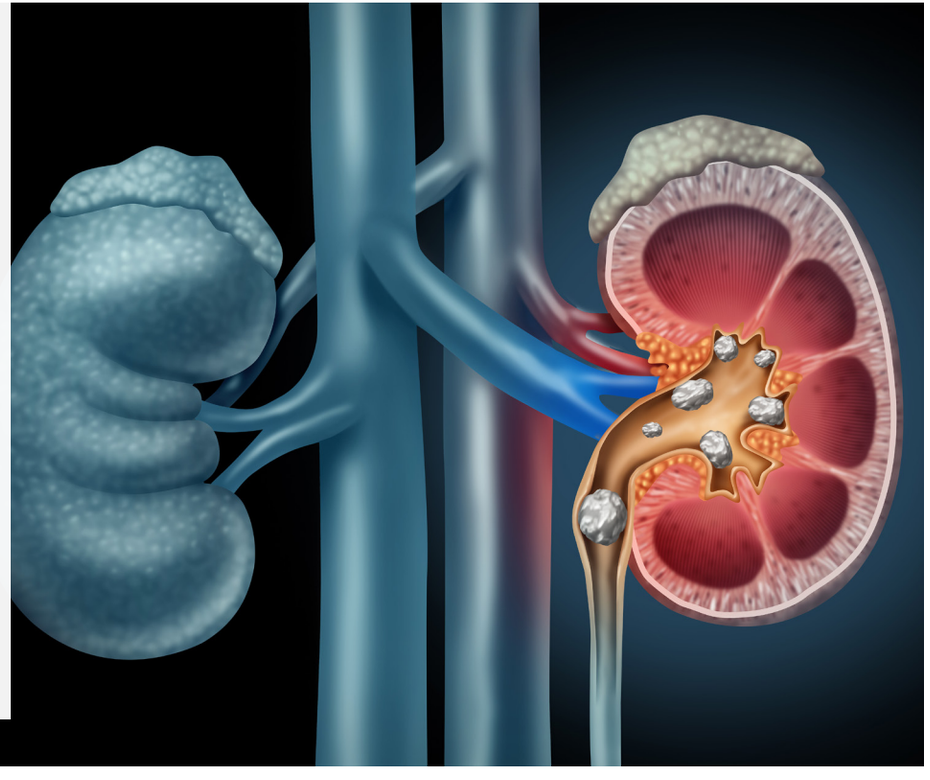


A model produced by scientists at Rice University shows the conformational changes caused by a mutation in the cancer-fighting p53 protein. At top left, the red box highlights the aggregation-prone sequence protected by the N-terminus tail in wild-type p53 but exposed by the mutation of a single amino acid. The strongest deviation happens in the domain at the green asterisk. The other three models show "open" conformations at the C-terminus caused by the mutation. (Credit: Kolomeisky Research Group/Rice.)

DOES ZINC INHIBIT OR PROMOTE GROWTH OF KIDNEY STONES? WELL, BOTH.

A funny thing happened on the way to discovering how zinc impacts kidney stones - two different theories emerged, each contradicting the other. One: Zinc stops the growth of the calcium oxalate monohydrate (COM) crystals that make up the stones; and two: It alters the surfaces of crystals which encourages further growth. Now it can be told – both theories are correct as reported in the American Chemical Society journal *Crystal Growth & Design* by **Jeffrey Rimer**, Abraham E. Dukler Professor of Chemical and Biomolecular Engineering at the University of Houston, and co-workers who conducted the first study to offer some resolution to the differing hypotheses.

In this study, Rimer and his team used a combination of in vitro experiments and computational modeling to decode the effects of zinc on COM crystal growth. The findings on the dual role of zinc on COM was confirmed by atomic force microscopy measurements showing a unique ability of zinc ions to alter the termination of crystal surfaces. The team compared the impact of zinc on COM, with similar ions like magnesium. The paper's first author is Bryan G. Alamani, a former doctoral student of Rimer's and now a professor at University of the Philippines Diliman. Rimer also partnered with Julian Gale, Curtin University, Perth, Western Australia.



IMPROVED CATALYST MAY TRANSLATE TO PETROCHEMICAL PRODUCTION GAINS

Jeffrey Rimer, Abraham E. Dukler Professor at the University of Houston Cullen College of Engineering and Javier Garcia-Martinez, Professor of Inorganic Chemistry at the University of Alicante, have uncovered a seeding method that simplifies the synthesis process and results in spontaneous pillaring of zeolites. The work is published in *Advanced Materials*. The process results in higher aluminum concentration in the zeolite and a unique crystal structure to facilitate chemical reactions with reduced carbon build up.

Next steps for this project include scaling up the process to show whether this improved zeolite catalyst can replicate its performance on industry scale. This research also functions as a springboard for further exploring the implications of seeding to produce other zeolites with unique structures and exceptional performance in commercial applications.

FACULTY ACCOLADES

Rimer Selected as Associate Editor for ACS' Crystal Growth and Design

Cullen College of Engineering professor **Jeffrey Rimer**, Ph.D., was selected as the newest Associate Editor for *Crystal Growth & Design*, a monthly peer-reviewed journal published by the American Chemical Society. *Crystal Growth & Design* is one of the most prestigious journals in the field, with nearly 31,000 citations in 2019. According to a statement on the journal's scope, its aim is to stimulate cross fertilization of knowledge among scientists and engineers working in the fields of crystal growth, crystal engineering, and the industrial application of crystalline materials and molecular assemblies.

Bhowmick earns Innovation Award from Polymer Processing Society

Anil Bhowmick, Ph.D., a Research Professor in the William A. Brookshire Department of Chemical & Biomolecular Engineering at the Cullen College of Engineering, is the recipient of the 2021 James L. White Innovation Award from the Polymer Processing Society. The award is given yearly by the society, and honors outstanding researchers or inventors from academia and industry, either as individuals or as a group, in the area of polymer processing and related fields. The award is for an innovative development in the field of polymer processing technologies with recent commercial impact. It aims to recognize originality, innovation and creativity among researchers or inventors in the science and technology of processing polymers and polymeric products.

Willson Wins Alan S. Michaels Award from ACS BIOT

A career pinnacle, University of Houston professor **Richard Willson** was named a recipient of the Alan S. Michaels Award in the Recovery of Biological Products for 2021 from the American Chemical Society Biochemical Technology Division. The award is given only every other year, worldwide, and there have been only eight winners before him. The award is named to honor the legendary MIT Professor Alan S. Michaels, a pioneer who also has a lecture series in his honor at MIT. He was a pioneer in the application of chemical engineering principles to bioengineering.

FACULTY ACCOLADES

Conrad Elected as Fellow in Society of Rheology

Jacinta C. Conrad, Ph.D., Frank M. Tiller Professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering, was elected a Fellow of the Society of Rheology. The Society of Rheology is composed of physicists, chemists, biologists, engineers and mathematicians interested in advancing and applying rheology, which is defined as the science of deformation and flow of matter. The Fellow status recognizes a history of distinguished scientific achievement, a significant technological accomplishment, and/or outstanding scholarship in the field of Rheology. The number of Fellows is capped at 5 percent of the society's membership.

Vekilov Named 17th Recipient of AACG Award

Peter Vekilov, Ph.D., John and Rebecca Moores Professor, is the 17th recipient of the American Association for Crystal Growth (AACG) Award. The Award recognizes outstanding research contributions to the field of crystal growth and epitaxy. Vekilov first joined the AACG in 1993, when he came to the United States. His doctoral and post-doctoral advisors were both in the organization. For the past 15 years, he has been a member of the executive committee, and the chairman of the organizing committees for two of the national conferences.

STUDENT SUCCESS

ChBE Student earns ACS Development Award

Her work as an undergraduate computational researcher, as well as a strong support system inside and outside of the University of Houston system, allowed senior **Rosa Miraldina Futy** to excel in her studies, which includes being selected for an American Chemical Society Bridge Career & Professional Development Award. The award is open to undergraduate students interested in the Chemical Sciences and that are from groups traditionally underrepresented in the field. As part of winning the award, Futy also gave a poster presentation during the ACS Spring 2021 meeting in April on methane activation on Platinum Group Metal (PGM) catalysts.

UH Graduate Student Jacklyn N. Hall gains National Recognition for Catalysis Research

Jacklyn N. Hall, a graduate student and research assistant, has been conducting research in catalysis – or expediting a chemical reaction using a catalyst – which recently garnered her the recognition of the Department of Energy (DoE) Office of Science, for participation in the highly exclusive Science Graduate Student Research (SCGSR) program. Hall is one of 78 students selected nationwide to participate in the program, with an opportunity to work with researchers from the Argonne National Laboratory outside of Chicago, Illinois. Her research specifically involves the conversion of the greenhouse gas methane to methanol, a useful petrochemical.

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