



BLUEPRINT

CIVIL AND ENVIRONMENTAL ENGINEERING
DEPARTMENT NEWSLETTER • FALL 2021

UNIVERSITY of
HOUSTON

CULLEN COLLEGE of ENGINEERING
Department of Civil & Environmental Engineering

Letter from the Chair



Dear Colleagues,

While we continue to closely monitor the effects of COVID-19 in the greater Houston area and beyond, we have now resumed full-in person functionality at the University of Houston campus. Despite the challenges from 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 specific achievements of the Cullen College's civil and environmental engineering department from the last six months. If you would like to know more about any of these projects, or wish to collaborate, I invite you to contact me directly.

Warm Regards,

Roberto Ballarini, Ph.D., P.E.

Thomas and Laura Hsu Professor and Department Chair
Civil and Environmental Engineering
Cullen College of Engineering
University of Houston



DEVIN SHAFFER, PH.D.

ASSISTANT PROFESSOR OF CIVIL AND ENVIRONMENTAL
ENGINEERING AT THE UNIVERSITY OF HOUSTON
CULLEN COLLEGE OF ENGINEERING

WINNER OF THE



FROM THE NATIONAL SCIENCE
FOUNDATION (NSF)



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CEE'S SHAFFER EARNS **NSF CAREER AWARD**

Devin L. Shaffer, Ph.D., an Assistant Professor in the Civil and Environmental Engineering Department, is the latest member of the Cullen College's faculty to receive a National Science Foundation CAREER award.

NSF CAREER awards provide financial support for five years for the research of promising junior faculty. Shaffer received \$538,686 in funding for his proposal, "Two-Dimensional Covalent Organic Framework (2D COF) Membranes: A New Platform for Liquid Separations," which will run through June 2026. Shaffer's research is focused on membrane separations for liquids. In the lab, his research group designs new membrane materials and test membrane separation processes for applications like purifying drinking water, recycling wastewater from oil and gas production, and filtering impurities from organic liquids. The CAREER project will engineer membranes from covalent organic frameworks (COFs), which are polymers with ordered porous structures. The researchers will then fabricate ultrathin COF membranes with tunable pore properties and apply them to different liquid separation challenges in the energy, environmental and health fields. ⚙️

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CEE WELCOMES FOUR NEW FACULTY

**Pietro Milillo**

Pietro Milillo, assistant professor. Milillo worked as a scientist and postdoctoral fellow for the NASA Jet Propulsion Laboratory in Pasadena, California, before being hired by UH. His thesis was on the synergistic use of synthetic aperture radar (SAR) constellations for studying natural and anthropogenic phenomena.

**Behrooz Ferdowsi**

Behrooz Ferdowsi, assistant professor. Ferdowsi previously worked as an associate research scholar in the Department of Geosciences at Princeton, following a position as the Harry H. Hess Postdoctoral Fellow from 2017-2019. His area of study is constitutive laws for rock friction, and revisiting the physical basis for an existing empirical constitutive modeling framework for frictional behavior of rocks and other Earth materials, known as the “rate-and state-dependent friction” framework.

**Mim Rahimi**

Mim Rahimi, assistant professor. Rahimi was a postdoctoral associate in the Department of Chemical Engineering at MIT from 2018 to 2021. He completed his doctorate at Penn State in 2017. His research focuses on developing electrochemical processes to help industries become more energy-efficient and to capture CO₂ from either point sources or air.

**Mahdi Safa**

Mahdi Safa, senior lecturer. Safa served as an assistant professor of Construction Management at Sam Houston State for the past three years. He also taught at Lamar University for three years. ⚙️

BELARBI CONTINUES FIGHT AGAINST CORROSION

IN BRIDGES WITH NCHRP AWARD

Abdeldjelil “DJ” Belarbi, Ph.D., Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Civil and Environmental Engineering, received approval and \$600,000 in funding from the National Cooperative Highway Research Program for his proposal, “Stainless Steel Strands for Prestressed Concrete Bridge Elements,” in July 2020. NCHRP is part of the National Academies of Sciences, Engineering and Medicine.

Although his current research under the awarded grant is fairly new, Belarbi noted that it continues his work from previous research, which has now progressed from “science to direct implementation.” Additionally, it is projected to run through March 2023.

Assisting Belarbi on the project is postdoctoral fellow Damian Stefaniuk and Ph.D. student Khalad Elsayed, with postdoctoral fellow Lara Zerbe having assisted in the planning stages before taking an engineering position at Thorton Tomasetti. ⚙️





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UNDERSTANDING OF THE **RULES OF LIFE**

Debora Rodrigues and **Stacey Louie**, both researchers in the UH Department of Civil and Environmental Engineering, were awarded \$1.5M from the National Science Foundation (NSF) for their project titled “The impact of the fungal microbiome in metal tolerance and soil biogeochemical transformations.”

The award funding will began in September and will continue through August 2026. According to the project summary, “Understanding of the rules of life pertaining to the role of the environment in the interactions between the host and its microbiome, and in return, the role of the host-microbiome in environmental transformations, is essential to understanding ecosystem functions, including biogeochemical cycling and environmental detoxification.” For this work, the fungal microbiome will be used as the model system.

Rodrigues and Louie will investigate several filamentous fungi across different functional and phylogenetic groups, and their interactions with endobacteria and exobacteria (facultative and obligatory). ⚙️

LIFE EXPECTANCY LOWER FOR THOSE LIVING NEAR SUPERFUND SITES

Living near a hazardous waste or Superfund site could cut your life short by about a year, reported **Hanadi S. Rifai**, John and Rebecca Moores Professor of Civil and Environmental Engineering at the University of Houston. The study, published in *Nature Communications* and based on evaluation of 65,226 census tracts from the 2018 Census, is the first nationwide review of all hazardous waste sites and not just the 1,300 sites on the national priority list managed by the federal government.

The analysis shows a decrease of more than two months in life expectancy for those living near a Superfund site. When coupled with high disadvantage



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of sociodemographic factors like age, sex, marital status and income, the decrease could be nearly 15 months, according to the analysis. Prior studies confirmed that those living near hazardous waste sites generally have greater sociodemographic disadvantage and, as a result, poorer health. The average life expectancy in the U.S. is 78.7 years, and millions of children have been raised within less than a one-mile radius from a federally designated Superfund site.

Joining Rifai on this project are Amin Kiaghadi, University of Houston and Clint N. Dawson, University of Texas at Austin. ⚙️

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.



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