

GROWTH



Makerspace for large-scale projects opens

The college unveiled its new Maker Garage on Sept. 19, 2019. Faculty, students and members of the VCU Engineering Dean's Society toured VCU Engineering's makerspace for large-scale engineering and high-performance transportation projects. Situated in a former auto shop, the old-meets-new facility has metalworking and woodworking equipment, a state-of-the-art waterjet cutter and multiple student work areas.

New Engineering Research Building topped off

The college marked a milestone in the construction of its new \$93 million, 133,000-square-foot Engineering Research Building with a topping-off ceremony Oct. 15, 2019. Approximately 150 spectators cheered as a final beam — signed by students, faculty and members of the community — was hoisted into the air and placed atop the building, which is set to open in late 2020.

Barbara D. Boyan, Ph.D., the Alice T. and William H. Goodwin, Jr. Dean of the college, said that the future of engineering was built into the design of the advanced research hub.

"This building speaks to the future," she said. "It's full of modern concepts, with a first-floor makerspace, labs for the way computer science is going to be, and for advanced, collaborative engineering."



Gary C. Tepper, Ph.D.

Professor and Chair
Department of Mechanical and Nuclear Engineering

FROM THE CHAIR

VCU's largest engineering department, the Department of Mechanical and Nuclear Engineering, is a research and education leader.

Our award-winning faculty are making their mark on the field with high-impact, transformative research, and through their mentorship of the next generation of engineers. We are among the nation's stand-out nuclear engineering programs and offer its only dual doctorate in mechanical and nuclear engineering. In fact, last spring our graduate nuclear program was ranked number 18 in the nation by U.S. News and World Report. And we are designing breakthrough technologies for transportation, health care and manufacturing.

We are proud of our accomplishments, and excited about our future.

85 ACTIVE RESEARCH GRANTS

\$6.2 MILLION IN RESEARCH EXPENDITURES IN 2019-2020

AREAS OF RESEARCH

- Materials
- Mechanics
- Nuclear engineering
- Thermal fluid systems

47 INVENTION DISCLOSURES SINCE 2016



VCU College of Engineering

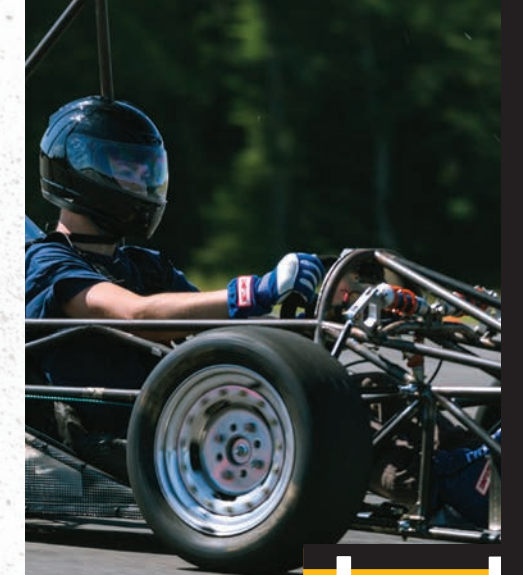
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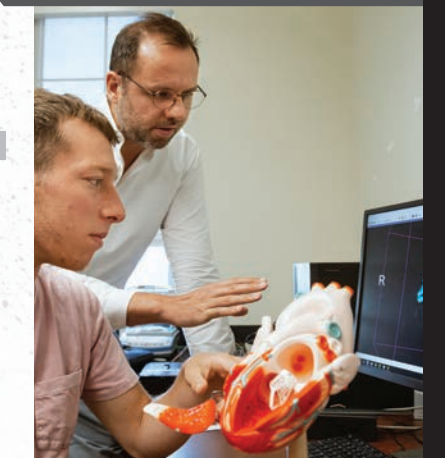
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VCU College of Engineering



2019 - 2020 Annual Review

VCU Engineering
Engineers Make It Real.

MECHANICAL & NUCLEAR ENGINEERING

NEWS/RESEARCH

A filter that kills airborne pathogens

Heating, ventilation and air conditioning (HVAC) systems are designed to improve indoor air quality. Their filters, however, often accumulate bacteria, many of which are infectious pathogens. When released into the filtered air, these pathogens form bioaerosols that can transmit diseases.

Wei-Ning Wang, Ph.D., associate professor of mechanical and nuclear engineering, is developing a cost-efficient antimicrobial HVAC filter that kills airborne pathogens. The filter is made by inducing growth of iron oxide nanowires on iron mesh. When these nanowires receive a low direct voltage, they produce oxidants capable of killing most pathogens. The electrical fields at the tips of these nanowires produce joule heating and electroporation effects to further deactivate pathogens. This innovation received a 2019 Commonwealth Research Commercialization Fund Award.



Photo courtesy of Wei-Ning Wang, Ph.D.

Analysis for accident tolerant fuels

To advance nuclear power safety, **Jessika Rojas, Ph.D.**, assistant professor of mechanical and nuclear engineering, is working with the U.S. Department of Energy on testing protocols for accident tolerant fuels (ATF), which can tolerate severe loss of active cooling in the reactor core for a considerably longer period of time than other fuel systems. Rojas is using advanced materials examination techniques to characterize ATF cladding surfaces. The results will enhance models for ATF surface chemistry and thermal performance.



NEWS/RESEARCH

In-vitro correlations for personalized aerosol therapy

Laleh Golshahi, Ph.D., assistant professor of mechanical and nuclear engineering, received the 2019 International Society for Aerosols in Medicine Young Investigator Award. She specializes in aerosol science for respiratory support, diagnosis and inhalation therapy, with a focus on pediatric patients. Her research addresses particle deposition in children and infants. Because this research cannot be easily done in vivo, in-vivo data on aerosol deposition in children's airways are limited. Golshahi's work to correlate in-vitro and in-vivo pediatric aerosol therapy research has resulted in important contributions to the multidisciplinary area of aerosol medicine and pulmonary drug delivery.

Golshahi has authored more than 30 peer-reviewed publications, including an Aerosol Research Letter featuring the first description of a child mouth-throat model for standardized testing of aerosol medicine delivery devices. Her work has received multiple honors including the VCU Presidential Research Quest Award in 2017.



Novel nanomagnets for memory storage

Jayasimha Atulasimha, Ph.D., Qimonda Professor in the Department of Mechanical and Nuclear Engineering, and doctoral candidate **Dhritiman Bhattacharya** are conducting research that can lead to novel nanomagnetic components for memory storage. By applying voltage to a ferromagnetic layer, they can make the magnetic direction cease to point "up" or "down" and instead spiral into an intermediate flower-like state. This process facilitates more precise switching between the "up" and "down" states.



STUDENTS/ALUMNI

Roy G. Post Foundation Scholarship winner

Dimitris Killinger (B.S.'15), a Ph.D. candidate in the Department of Mechanical and Nuclear Engineering, has received a Roy G. Post Foundation Scholarship for 2020. He is one of eight graduate-level recipients selected internationally for this award, which recognizes students with outstanding research achievements in safe management of nuclear materials.

Killinger's research focuses on developing new methods to improve nuclear waste characterization and accountability. He is one of relatively few doctoral students in the field working on coupling laser-based and electrochemical techniques with materials science and characterization to decrease the cost of processing used nuclear fuel. When perfected, this approach will bring about a more sustainable fuel cycle, one of the strategic goals of the U.S. Department of Energy.



Applied Spectroscopy Best Paper Award

Ammon Williams (Ph.D.'16) received the award for best paper published in Applied Spectroscopy in 2018 on the topic of Laser Induced Breakdown Spectroscopy. Williams is a graduate of VCU's dual mechanical and nuclear engineering doctoral program. The award was presented in a special ceremony at the Society for Applied Spectroscopy's national meeting in October 2019.

Williams is now a staff scientist at the Idaho National Laboratory. His paper is titled "Laser-Induced Breakdown Spectroscopy Measurement of Uranium in Molten Salt." **Supathorn Phongikaroon, Ph.D.**, associate professor of nuclear engineering and director of nuclear engineering programs at VCU, is co-author.

Photo courtesy of Ammon Williams, Ph.D.

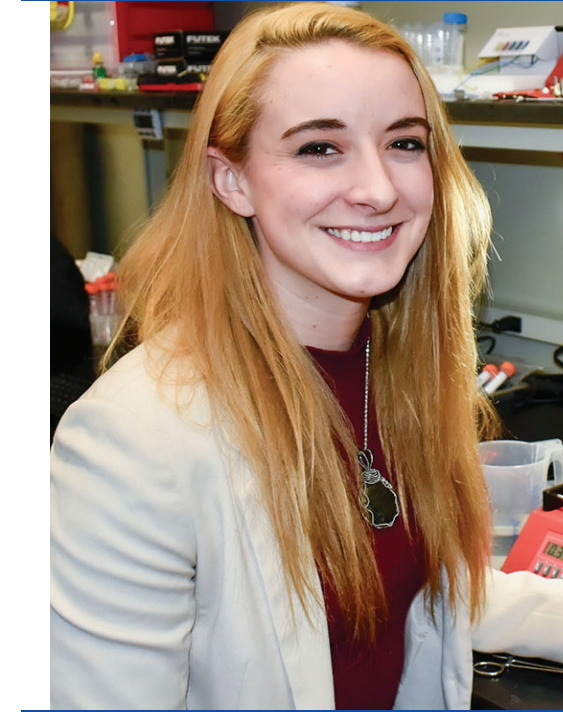


STUDENTS/ALUMNI

Like 'a gym for cells'

Sarah Saunders (B.S.'17), a doctoral student in the Department of Mechanical and Nuclear Engineering, received an American Heart Association Predoctoral Fellowship to study the effects of mechanical forces on the development of engineered tissue. Her adviser is **Joao S. Soares, Ph.D.**, assistant professor of mechanical engineering.

The two-year award will fund Saunders' investigations into how mechanically training engineered tissues during incubation can improve the performance of these tissues when they are implanted as grafts. The researchers describe the process as "a gym for cells" that will advance efforts to engineer living blood vessels for clinical applications.



Alum honored by Rochester Institute of Technology for research contributions

Mohamed Samaha (Ph.D.'12), who earned his doctorate in mechanical engineering from VCU in 2012, was recognized by the Rochester Institute of Technology (RIT) for outstanding research contributions. He is associate professor and graduate program adviser for mechanical engineering at RIT's campus in Dubai. He was the faculty member from RIT's Dubai campus selected to receive this honor for 2020.

Samaha's research focuses on experimental, numerical and theoretical approaches to thermofluids, with applications in active and passive flow control for saving energy. He credits **Mohamed Gad-el-Hak, Ph.D.**, professor emeritus in VCU's Department of Mechanical and Nuclear Engineering, with inspiring him to excel.

Photo courtesy of Mohamed Samaha, Ph.D.

