

2021 - 2022 ANNUAL REVIEW

VCU Engineering

UNCOMMON ENGINEERING

BIOMEDICAL ENGINEERING



VCU

College of Engineering

BIOMEDICAL ENGINEERING (BME)



Lovell Abraham investigates Alcian Blue Orange G femur fracture cells.

Chemistry major researches how bones change in outer space



VCU Engineering's biomedical engineering graduate program is ranked among the best graduate schools, according to the 2023 rankings by *U.S. News & World Report*.

In **Lovell Abraham's** first biomedical engineering class, BME professor and chair **Henry Donahue, Ph.D.**, encouraged students to get involved in research. Abraham didn't hesitate and began working in Donahue's lab, winning awards for his contributions to a NASA-funded project studying the effect of microgravity on bone fracture healing.

"We're interested in why astronauts and the elderly lose bone. Bone loss that occurs with space travel is similar to age-related bone loss, which affects millions of people,"

Donahue said. "Insights into disuse-induced bone loss will possibly lead to new therapeutics for age-related bone loss.

Abraham is looking at a particular cell mechanism called gap junctional communication, where cells talk to one another. He's asking whether inhibiting these gap junctions actually protects against disuse-induced bone loss. Postdoctoral research fellow **Evan Buettmann, Ph.D.**, is leading Abraham in a project looking at how bone fractures heal after the bone has been exposed to disuse.

BIOMEDICAL INNOVATIONS TO ADVANCE PATIENT HEALTH

Researcher seeks to understand how groups of cells determine how and where they are going



BME assistant professor **Priscilla Hwang, Ph.D.**, received a Faculty Early Development (CAREER) Award from the National

Science Foundation (NSF) for her research on how cells in the body cluster together and migrate as a group.

This process, called collective migration, is behind the healthy development of many tissues. When wounds heal, for example, cells often gather together and migrate as a “sheet” to help close the wound. But this is not always a good thing. Cancer cells can migrate from the original tumor and travel as a group to form new tumors in the body. This is called metastasis.

Hwang is investigating leader cells, which move to the front and guide the migration of groups of cells. She will study how leader cells polarize to the front of the cell cluster to determine whether leader cells are mechanically connected, and how mechanical forces between leader cells initiate and sustain collective migration. This can provide insight to therapies targeting abnormalities or disease progression that occurs when these migrations go awry.

VCU multidisciplinary researchers seek to improve early detection of aortic diseases



BME assistant professor **John Wilson, M.D., Ph.D.**, and **Uyen Truong, M.D.**, collaborated to test novel imaging methods for assessing a patient’s risk of life-threatening aortic dissection, a condition in which a tear can weaken and possibly rupture the aorta.

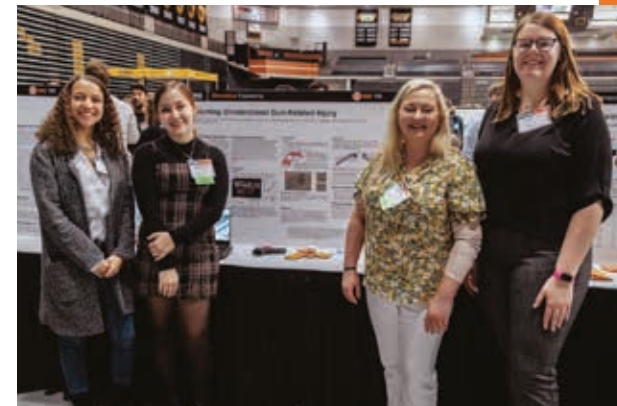
Wilson researches non-invasive MRI approaches to quantify aortic wall strain, which is “a measure of deformation of how the aorta changes in shape as the blood passes through it. We use that information to provide new data that might help clinicians make decisions on how to best diagnose and potentially treat aortic diseases like aneurysms and dissections,” he said.

In their joint study of at-risk patients, they are focusing on patients with Marfan syndrome or hypertension. Marfan syndrome is an inherited disorder in which connective tissue, such as that in the aortic wall, can be weakened. Hypertension is also a risk factor for aortic dissections.

Students create prototype of a childproof handgun safety mechanism

From 2015 to 2020, there were at least 2,070 unintentional shootings by children, according to Everytown for Gun Safety. These incidents motivated Capstone team BME106 to choose a senior Capstone Design project related to gun injuries.

BME106 set out to find an engineering solution for two handgun problems: provide ready access to an adult while also preventing a young child from firing it.



Zore X Core is the product BME106 developed, a gun lock with a mechanism that blocks the firing pin from meeting the ammunition and prevents the slide from fully closing. It allows for the lock to stay attached to the firearm and transition automatically to remove the firing pin block.

To prevent children younger than 10 years of age from unlocking the device, the team intends to use mechanical switches or pressure sensors that react only to an adequate amount of force – an amount of force larger than a young child could muster.



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