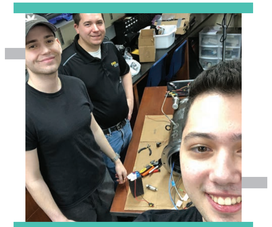
STUDENTS/ALUMNI



(From left) James Forsberg, Jonathan Lundquist and Erwin Karincic. Photo courtesy of team.

Securing submarine communications

Underwater communications are difficult because the electromagnetic waves used to transfer data don't travel well in water. To solve this problem, seniors **Ciarra Cartwright Elliott, James Forsberg, Erwin Karincic** and **Jonathan Lundquist** designed a dissolving transmission system for submarine communications.

The system's transmission sphere floats to the water's surface, transmits data, then dissolves. The students created a proprietary dissolving material for the device and have filed a patent application. Because the sphere is not tethered to the vessel — and dissolves after doing its job — there is reduced risk of a submarine's location being discovered. This project took top honors at the virtual Capstone Design Expo.

GROWTH

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 state-of-the-art 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."

Erdem Topsakal, Ph.D.

Professor and Chair

Department of Electrical and Computer Engineering

FROM THE CHAIR

VCU's Department of Electrical and Computer Engineering is advancing sophisticated technologies to build communities and enhance quality of life.

We have a passion for inventing new devices and systems that connect people with information and resources to improve their homes, transportation and cities. We're also partnering across the disciplines to find ways to make communities healthier and better fed.

As leader of the Central Virginia node of the Commonwealth Cyber Initiative, we're helping make Virginia a national and global leader in cybersecurity and cyber physical systems.

We take pride in our nationally recognized faculty, impressive students and family atmosphere.

37 ACTIVE RESEARCH GRANTS IN 2019-20

32 INVENTION DISCLOSURES SINCE 2018

AREAS OF RESEARCH

Micro-/nano-electronics and photonics

Power, energy and controls

Signal processing and communications

Computer architecture and cyber physical systems

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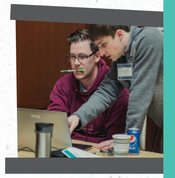

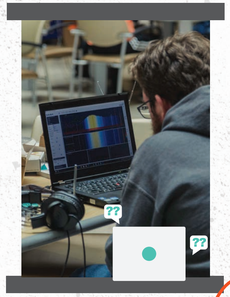

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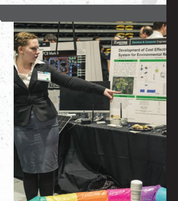

VCU College of Engineering

ELECTRICAL & COMPUTER ENGINEERING

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2019 - 2020 Annual Review

NEWS/RESEARCH

Simulations show electromagnetics at work

Electromagnetics is a challenging topic — even for students who gravitate to electrical engineering. To make electromagnetics concepts easier for students to understand, **Nathaniel Kinsey, Ph.D.**, assistant professor of electrical and computer engineering, designed a teaching tool that was featured in the December 2019 issue of IEEE Spectrum.

"Through things like Wi-Fi and cell phone towers, electromagnetic fields are all around us but we can't see them, feel them or interact with them," Kinsey said. As a result, he said, these phenomena can seem like "some sort of black magic wrapped in an enormity of complex math equations. It's easy to get stuck in the math and miss the picture of the physics behind what's happening."

To restore that missing picture, Kinsey designed interactive, computer-based simulations that display electromagnetic problems as colorful, 3D images. These simulations, built with COMSOL Multiphysics software, allow students to rotate and scale the electromagnetic fields with which they are working. They can change parameters and, voilà, electromagnetic fields can be seen on screen and interacted with like water, smoke or wind.

Improving multi-source data fusion

Ruixin Niu, Ph.D., associate professor of electrical and computer engineering, is optimizing sensor management in distributed networks, which drive many systems including telecommunications, traffic monitoring and robotic vision. Sensors in these networks have different modalities, so it's difficult to link data using physical models. Niu's lab is applying sophisticated signal processing/machine learning techniques to fuse information from sensors with different modalities. His method combines traditional tracking algorithms with deep learning artificial neural networks for object detection and estimation.

NEWS/RESEARCH

Securing critical energy infrastructures

Sherif Abdelwahed, Ph.D., professor in the Department of Electrical and Computer Engineering, is helping safeguard industrial control systems with supervisory control and data acquisition (SCADA) systems in critical energy infrastructures, which are prime targets for cyber attacks. He is building a model-based approach to develop a quantitative, automated methodology to assess and manage security risks of both the overall industrial control system and its SCADA subsystems. Abdelwahed's method will integrate proactive and reactive security mechanisms to automate risk assessment and management.

Central Virginia

VCU leads Central Virginia's cyber network node

VCU took the lead in creating the Central Virginia node of the Commonwealth Cyber Initiative (CCI), a statewide network of higher education institutions and businesses advancing cyber-related research, education and engagement. The Central Virginia node is the largest in the state, comprising VCU, the University of Virginia, Virginia State University, Longwood University, Virginia Union University and three community colleges. **Erdem Topsakal, Ph.D.,** professor and chair of VCU's Department of Electrical and Computer Engineering, is director of the Central Virginia node.

STUDENTS

Undergraduate receives Goldwater Scholarship

Undergraduate **Anastasios Karles** received a Goldwater Scholarship for the 2019-2020 academic year. The award, supported by the Barry Goldwater Scholarship and Excellence in Education Foundation, is considered the preeminent undergraduate scholarship of its type in mathematics, the natural sciences and engineering.

Karles was among 496 winners selected from a pool of more than 5,000 sophomores and juniors across the U.S. His faculty adviser is **Carl Elks, Ph.D.**, assistant professor in the Department of Electrical and Computer Engineering.

"This award was possible because of the incredible opportunities the VCU College of Engineering provided me, first as a high school student through the Dean's Early Research Initiative, and later as an undergraduate through the Vertically Integrated Projects program," Karles said. "Dr. Erdem Topsakal and Dr. Elks have been incredible mentors whose guidance inspired me to immerse myself in my research and continue to pursue new frontiers in engineering."

Photo courtesy of Anastasios Karles

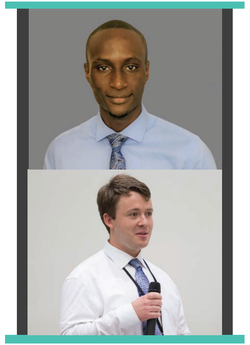
Intern's work identifying malaria antibodies impresses researchers

Administrators at the Naval Medical Research Center in Silver Spring, Maryland, were so impressed with summer intern **Tania Dobrescu**, an undergraduate majoring in electrical and computer engineering, that they invited her back to work in the same lab for a second year. Malaria research has been her primary focus throughout her internships. "Dobrescu has been remarkably brilliant in discussions on all topics every week during the weekly student lunch seminar. She asks probing, thoughtful questions of each speaker that reflect a keen scientific mind and broad exposure to many different topics," said Sofia Casares, Ph.D., senior scientist in the Infectious Diseases Directorate, and Dobrescu's mentor.

Photo courtesy of NMRC

STUDENTS

Meet VCU's 2019 SMART Scholars



Two computer engineering undergraduates were VCU's 2019-2020 recipients of the Science, Math and Research for Transformation (SMART) scholarship, an award established by the U.S. Department of Defense to support the country's top science and engineering students.

As SMART Scholars, **Papa Beye** and **Michael Kimbrough** receive full tuition, $25,000 annual stipends, summer research internships and post-graduation civilian employment with DoD agencies.

Beye, who has interned with the Naval Surface Warfare Center in Dahlgren, Virginia, plans to make his career with the U.S. Navy after graduation. "I didn't know if there was a position (in the Navy) that went with my skills. Once I saw the possibilities in autonomous systems, I said, 'That's right up my alley.'"

Kimbrough has interned with the NASA Langley Research Center and Dominion Energy and thinks his future may include the military and industry sectors. The SMART scholarship, he said, inspires him to finish strong at VCU Engineering. "It's a vote of confidence, and I want to live up to it," he said.

Photos courtesy of Papa Beye and Michael Kimbrough

Undergraduate student studies abroad — virtually

Undergraduate **Colleen Foley** was selected to study abroad at University College Cork, a constituent university of the National University of Ireland, in spring 2020. When she had to leave Ireland in mid-March because of the worldwide outbreak of COVID-19, Foley completed her studies in electromagnetics, integrated circuits, electronic devices and economic production and costs by working remotely with University College Cork scholars.

Photo courtesy of Colleen Foley