VIRGINIA COMMONWEALTH UNIVERSITY

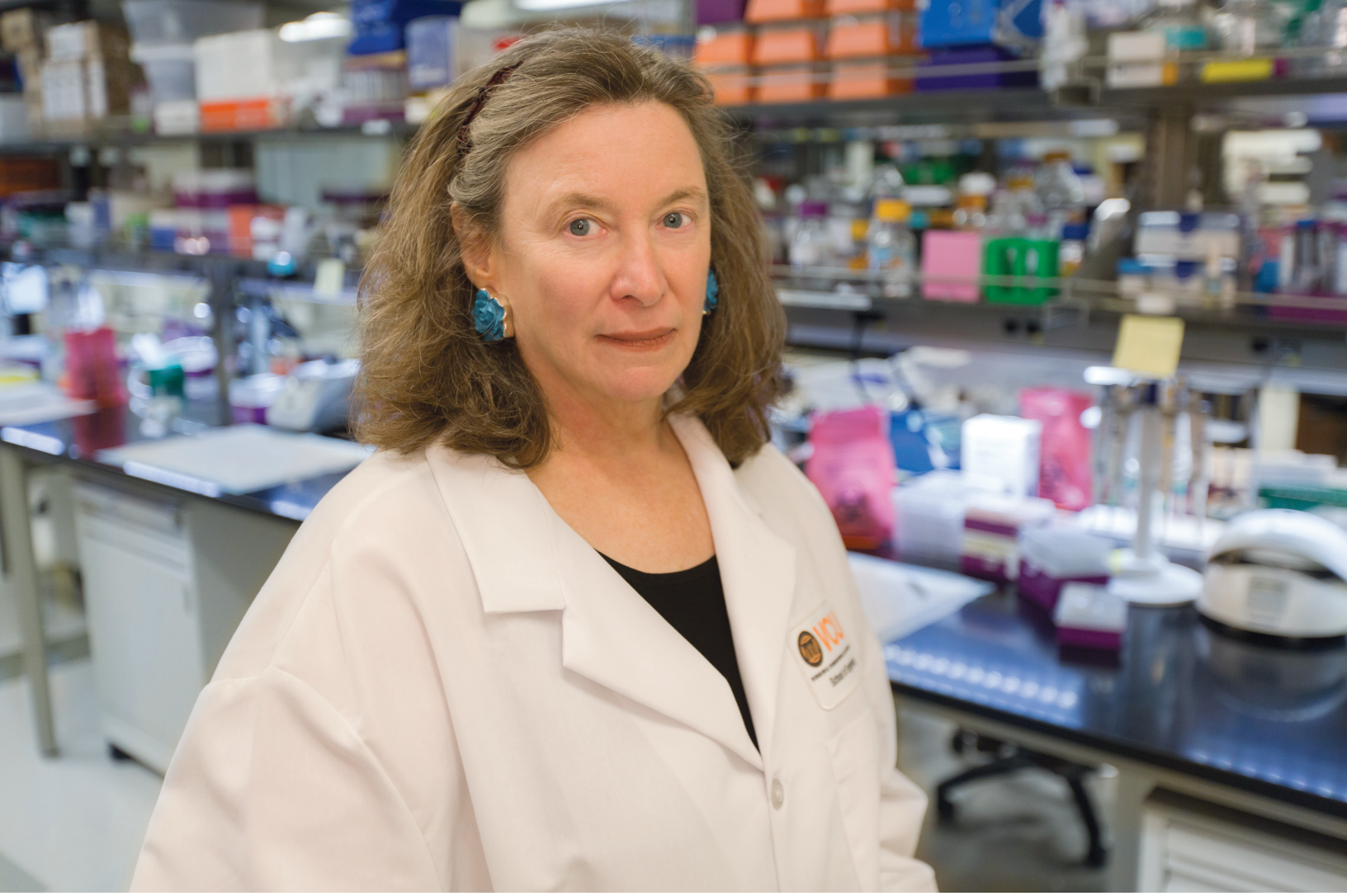
Make it real.

VCU School of Engineering

ANNUAL REVIEW

Volume 8 | 2015

SUSTAINING MOMENTUM



FROM THE DEAN

When I joined Virginia Commonwealth University in 2013, my mind was set on positive change. Every day VCU's School of Engineering continues to grow in the pursuit of our strategic plan. These goals —

- Building upon our legacy of student-centered learning to prepare the leaders of tomorrow
- Expanding full-time faculty
- Increasing our funded research to make a difference in our community and humankind
- Achieving a top 50 ranking among U.S. schools of engineering
- And expanding our innovative graduate programs

— are now in motion.

"In these pages you will learn about our dedication to cross-disciplinary education and student-centered learning. You'll see the pride we have for our collaborative culture, real-world perspective of engineering and stewardship of resources."

The interest and passion I see in our community of students, faculty, and fellow Rams signals that we are well on our way to greatness.

In the past 24 months, we have:

- Increased enrollment to 1,915 undergraduate and graduate level students in 2014
- Recruited 22 new faculty in 2014
- More than doubled our awarded grant funding
- Introduced a certificate in Cybersecurity
- Instituted research programs such as the Dean's Undergraduate Research Initiative
- Initiated the Dean's Early Research Initiative to promote STEM fields to young learners

Leadership provided from our faculty and staff as well as top research efforts from our colleagues, their laboratories and facilities distinguish VCU as a place of sustainable momentum. We are ever advancing, ever diversifying and continuously realizing our ambitions.

In these pages we are highlighting our dedication to cross-disciplinary education and student-centered learning. You'll see the pride we have for our collaborative culture, real-world perspective of engineering and stewardship of resources. We've come far in our short 18 years as the youngest school on either the university's Monroe Park campus or the VCU Medical Center.

And we invite you to explore VCU Engineering. Thank you for your interest. Our future is now. Our momentum can't be stopped. Go, Rams!

Barbara D. Boyan, Ph.D.
Alice T. and William H. Goodwin, Jr. Chair
in Biomedical Engineering
Dean, VCU School of Engineering

Contents

MEET OUR ASSOCIATE DEANS

Lewis Franklin Bost, M.B.A., I.D.S.A., executive associate dean
L. Franklin Bost joined VCU in 2013 from the Georgia Institute of Technology where he was professor of the practice and executive director of the master of biomedical innovation and development program in the Wallace H. Coulter Department of Biomedical Engineering. Bost is president and chief executive officer of Spheringenics Inc., an early stage company focusing on stem cell therapies.

- M.B.A., University of North Carolina
- Bachelor of Product Design, North Carolina State University

Ram B. Gupta, Ph.D., associate dean for research
Ram Gupta, Ph.D., joined VCU in 2014 from the National Science Foundation where he served as director of energy for sustainability. From 1995-2014, he was a professor of chemical engineering at Auburn University. His recent books include *Hydrogen Fuel: Production, Transport, and Storage and Gasoline, Diesel* and *Ethanol Biofuels from Grasses and Plants.*

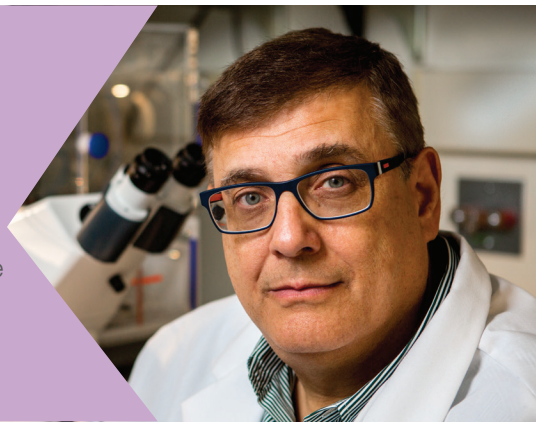
- Ph.D., chemical engineering, University of Texas, Austin
- M.S., chemical engineering, University of Calgary
- B.E., chemical engineering, Indian Institute of Technology

Afroditi V. Filippas, Ph.D., associate dean of undergraduate studies
Associate professor in the Electrical and Computer Engineering department, Afroditi Filippas plays a critical role in the development of supportive undergraduate programs. Her work assures students' collaborative success from project concept to completion and includes community partnerships and the development of real-world scenarios.

- Diploma, electrical engineering, University of Patras
- M.S.E., electrical engineering, University of Texas
- Ph.D., electrical engineering, University of Texas

Zvi Schwartz, Ph.D., D.M.D., associate dean
Zvi Schwartz is a professor in the Biomedical Engineering department whose research includes periodontal diseases, hormones and growth factors on endochondral bone regulation and the influence of different implant materials on bone formation.

- D.M.D., dentistry, The Hebrew University, Hadassah Faculty of Dental Medicine
- Graduate training, periodontics, The Hebrew University, Hadassah Faculty of Dental Medicine
- Ph.D., experimental pathology, The Hebrew University, Hadassah Faculty of Dental Medicine



Our mission

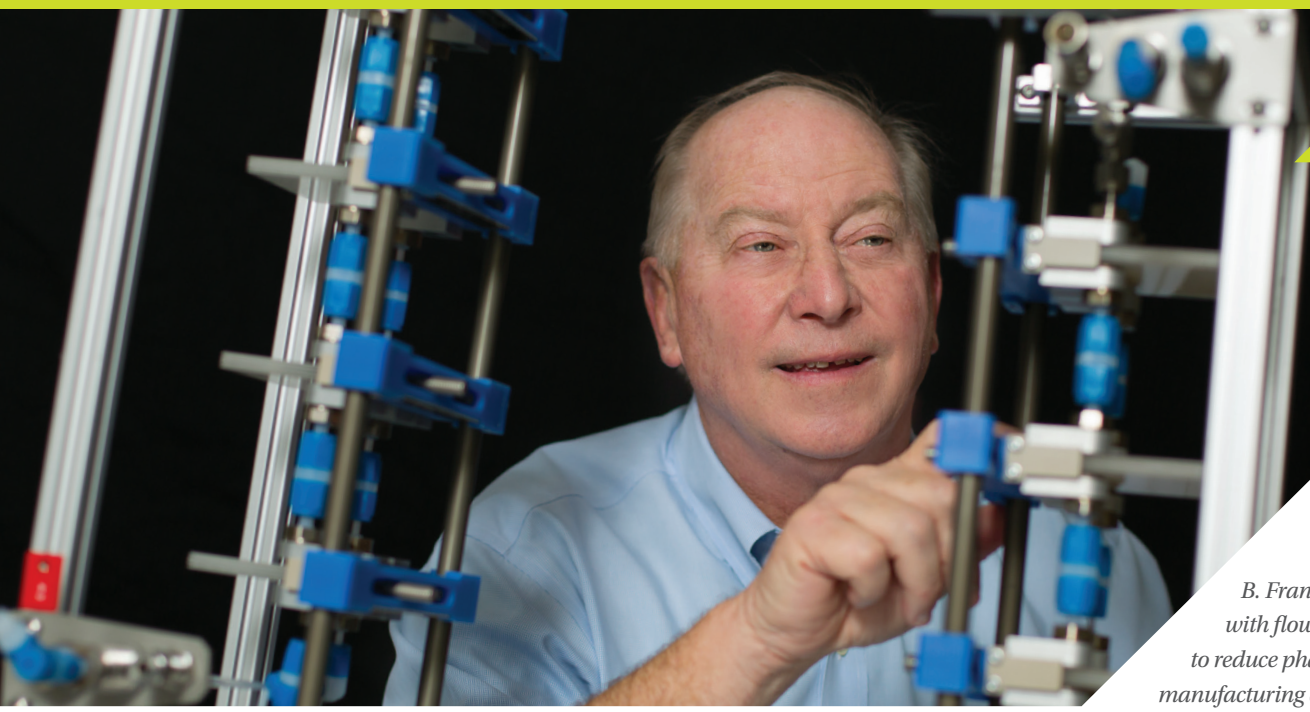
Through teaching and research, the VCU School of Engineering creates knowledge and transforms ideas in engineering and the life sciences into technologies that enhance regional and global prosperity. We prepare our students for leadership and entrepreneurship through collaborative and interdisciplinary partnerships.

Our vision

To establish the VCU School of Engineering as a preeminent school in education, research and technological development at the intersection of engineering, business, medicine and the life sciences.

Streamlining

access to AIDS drugs for ALL



B. Frank Gupton, Ph.D., with flow reactor technology to reduce pharmaceutical manufacturing cost.

In May 2014, the Bill & Melinda Gates Foundation allocated a $4.4 million grant to Virginia Commonwealth University, supporting the School in its effort to supply developing countries with affordable access to AIDS drugs.

VCU, the lead university in a collaborative healthcare effort known as the Medicine for All Initiative, is the sole recipient of the grant. Additional specialists involved in the project include the University of Washington (UW), Florida State University (FSU) and Massachusetts Institute of Technology (MIT).

B. Frank Gupton, Ph.D., research professor and chair of the Department of Chemical and Life Science Engineering at VCU, is leading the interdisciplinary team focused on cost improvements for the drug nevirapine. The World Health Organization considers nevirapine a first-line therapy for the treatment of AIDS.

Due to his extensive experience in pharmaceutical process development, Gupton serves as principal investigator for the effort. The Gates Foundation has given support to the project in order to employ new synthetic and manufacturing methods for global healthcare.

The mission heralds dramatic change in pharmaceutical manufacturing technology while increasing access to life-saving medicines worldwide.

"Since we have achieved our first deliverable, we have initiated discussions to evaluate other AIDS drug candidates using the strategy we employed for nevirapine," said Gupton.

Due to his extensive experience in pharmaceutical process development, Gupton serves as principal investigator for the effort. The Gates Foundation has given support to the project in order to employ new synthetic and manufacturing methods for global healthcare.

Gupton and and other researchers are developing technology that moves from a traditional single event "Batch" process to a continuous process similar to the assembly line of Henry Ford.

New chemical principles and technology can enable very low cost routes into critical active pharmaceutical ingredients, which will allow for a more efficient use of resouces and streamline regulatory challenges.

This research heralds a dramatic change in pharmaceutical manufacturing technology while increasing access to life-saving medicines worldwide.

"We have a multi-institutional team that has been working well together," said Gupton. "Based on what we have seen thus far we expect this to be a long-term commitment."

The objective of the team's effort is to identify a manufacturing route leading to nevirapine that utilizes the lowest cost raw materials and ultra-efficient manufacturing tools. Gupton anticipates this approach will lead to a new manufacturing process to reduce the cost of nevirapine, which may also be applicable to other drug targets.

Tyler McQuade, Ph.D., is a Florida State University chemistry professor and Gupton's colleague. Their shared interest in pharmaceutical manufacturing led to the founding of the Medicine for All Initiative. McQuade, his team at FSU and the MIT lab researchers test synthetic strategies for more affordable ways to manufacture active pharmaceutical ingredients.

"Most of the World Health Organization recommended therapies are purchased by aid groups and then distributed in Africa and other places where it's difficult to get treatment," said McQuade. "If you can continue to knock the price down further, public health groups that distribute drugs will significantly increase their allotments for the year."

"The approach we are taking has brought applicability not only for these life-saving drugs, but also for reducing the cost of healthcare," said Gupton.

The team at UW is working on process and quality control factors for continuous flow reactors to ensure manufacturing control for nevirapine.

"People don't realize how big of an issue AIDS is," noted Gupton. "It's growing by 14 percent globally a year and 30 percent of all childbearing women in South Africa have AIDS. We have a lot of really bright young scientists and engineers working on this team, and I am very optimistic for meaningful improvements in this area. We feel like this is just the beginning."

For now, with support from the Clinton Foundation and the Gates Foundation, VCU is industriously developing improvements for the production of nevirapine.

Pharmaceutical Engineering Program offered

In response to industry demand for skilled professionals with joint training in pharmaceutics and aspects of engineering, VCU aims to develop a Pharmaceutical Engineering Program. This emerging Ph.D. in Pharmaceutical Engineering will enable graduate students to contribute to this promising field through academic partnership with the VCU School of Pharmacy and the Medical Center. The doctoral program is intended to meet one of the grand challenges set forth as a cross-disciplinary focus area in the School's acclaimed 2013 Strategic Plan.

The department expects the VCU Center for Pharmaceutical Engineering to serve as an enabling capability that will provide synergistic support to the existing Center for Clinical and Translational Research program. Moreover, this program will forge a path ahead to commercial fruition for new drug candidates and improved patient treatments.

RECYCLING ENERGY PROJECT

leading in used nuclear fuel reprocessing

With the advent of the Recycling Energy Project established by Supathorn Phongikaroon, Ph.D., of the Department of Mechanical and Nuclear Engineering, the School is becoming a hot spot for research on the future of sustainable nuclear energy.

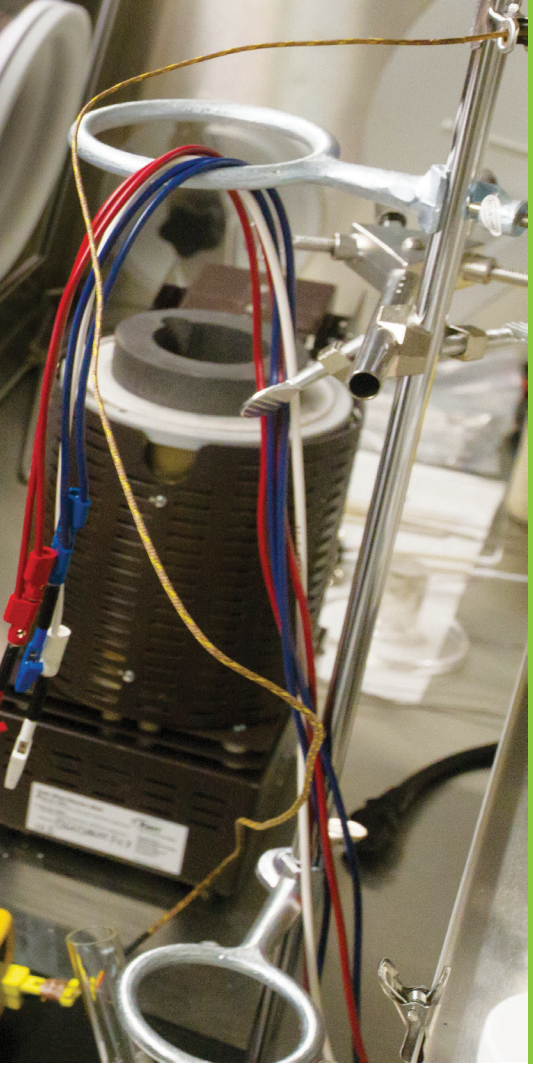
Operating at a high temperature to remove actinide, rare earth and other nuclear fissile products, Phongikaroon seeks not only to make waste stable for long-term storage but also to minimize the volume of these high-level remains.

"The overall goal is to reduce the amount of waste generated and also to create clean efficient energy so that it is more economically viable," said Ph.D. student in Nuclear Engineering, Ammon Williams.

"VCU is the only institute on the East Coast aside from Tennessee that does heavy research in this area," said Phongikaroon.

The Recycling Energy Project is funded through the Department of Energy with collaborators from Lawrence Berkeley National Laboratory, Idaho National Laboratory, the Ohio State University and the University of Utah. Previous collaborations on similar projects have involved Seoul National University and the Korea Atomic Energy Research Institute.

Phongikaroon is no novice when it comes to jumpstarting innovative projects. Before joining VCU, he spearheaded the Pyrochemical Research Group conducting research in treating used nuclear fuel through chemical and electrochemical separations at the University of Idaho, Idaho Falls through Center for Advanced Energy Studies. During that time, the program was the only one of its kind to conduct academic research in this specific area of developing new chemical and nuclear engineering applications in pyroprocessing technology.



Joint Ph.D. in Mechanical and Nuclear Engineering

VCU's Ph.D. in Mechanical and Nuclear Engineering is exceptional throughout the nation due to its hybrid nature that integrates these two engineering disciplines relevant to a large variety of career opportunities and applications. The doctoral curriculum equips graduates for research and academic careers in areas such as energy production, biomedical devices design, nano and smart materials for advanced applications, robotics, nuclear waste transport, storage and disposal, innovative instrumentation design, etc.

For information, email gradmne@vcu.edu

"The overall goal is to reduce the amount of waste generated and also to create clean efficient energy so that it is more economically viable," said Ph.D. student in Nuclear Engineering, Ammon Williams.

Now, the Recycling Energy project is bringing the same level of creative inquiry to VCU. "We are at the back end of the nuclear fuel cycle," said Phongikaroon, referring to the steps taken before wastes are disposed. "The long-term goal is to make nuclear energy sustainable. My dream goal is to facilitate a way to handle waste in a safe manner."

In addition to the research itself, the Recycling Energy project also serves as an opportunity for Phongikaroon's graduate students to study the use of fresh fuel for existing and future nuclear applications. Williams and Dalsung Yoon, a VCU Ph.D. student in Nuclear Engineering, support the Recycling Energy Project by conducting experiments, designing, providing thermodynamic and electrochemical data and preparing samples according to the project plans.

"As an adviser, he's great," said Williams. "He's not a micromanager. He gives you his goals and ambitions and then lets the students make it happen. We get to bring our own creativity and ideas to make a project even better than an individual could on their own."

Yoon said, "I decided to move to Virginia with him and didn't hesitate because I still need to learn a lot from him. He is efficient and really pushes his students. He's like a dad, taking care of his graduate students even outside of the lab."

Phongikaroon remains confident that this project will put VCU on the research and development map with regards to the nuclear fuel cycle. "We are young compared to the rest," he said, "but with our ability to do something about nuclear waste, we will be beneficial to the field."

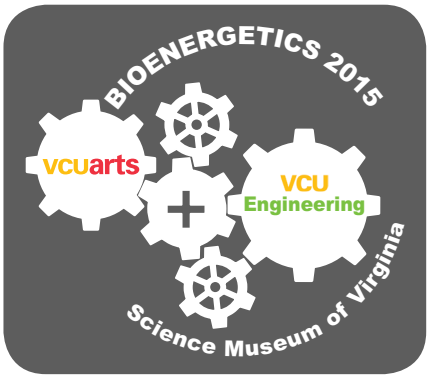
Mitochondria is present in all of us. "Mighty Mom," *created by an interdisciplinary team of art and engineering undergraduate students in the Bioenergetics program, represents how a child's mitochondrial inheritance comes predominantly from the mother. On exhibit at the Science Museum of Virginia from March through May 2015.*

BIOENERGETICS PROJECT

Schools of engineering and arts collaborate on mitochondrial disease research

Under the watchful eye of their primary project leader, Shilpa Iyer, Ph.D., a passionate team of eight artists and eight engineers are joining forces to undertake a clever approach to interdisciplinary research. Their ambitious project, "Bioenergetics: Arts meets Gentle Science in Sickness and in Health," supported by the VCU Quest Innovation Fund, is the first of its kind to blend visual arts and engineering in the construction of interactive modules used to explain bioenergetics to children and their families.

A subset of life science research concerned with the flow of energy through living systems, bioenergetics is an important teaching point for children who suffer from energy problems related to nutrition and mitochondria. "Nearly forty percent of all children have energy problems," said Iyer. "The problem causes extreme fatigue and lack of energy, taking twenty percent more energy to do a task per day. It's a problem that affects every part of your life. We want to do something to benefit sick children and healthy children alike."



Out of forty applicants to the summer program, sixteen VCU students were selected to put their skill sets to work in creating everything from a mitochondria teaching tool disguised as a plush toy to an interactive electronic game that showcases the important steps in the process that mitochondria use to make energy. These tactile prototypes and artistic renderings not only answer the urgent call of energy deficient children and their families, but they also serve to provide VCU students with an invaluable non-linear educational experience.

"I joined the Bioenergetics program out of curiosity and want to express my talents that I felt were hidden in the classroom/lecture setting," said Biomedical Engineering junior, Kevin Ball. "It's not that we are thinking in a new way; we're just channeling the way we think in a different direction because we have a bottomless pit of knowledge and learning available." Through interactions with Sarah Faris, M.A., and Raj Rao, Ph.D., Iyer attested to the benefits of structuring the Bioenergetics project as more of a continuous in-depth communication across disciplines than a lecture focused on topics within a single discipline.

For its members, the project has been eye-opening with regards to how much can be accomplished through interdisciplinary collaborations. Scientific Illustration major Caroline Bivens pondered the possibilities of such collaboration. "Renaissance thinkers set the tone by emphasizing a thorough understanding of philosophy, language, arithmetic, art, science and engineering. Were they achieving these educational feats simply for the purpose of being 'well-rounded'?" wondered Bivens. "Or, perhaps, they practiced something that we have forgotten."

Soon, the public will be able to ask itself the same question when the Bioenergetics project is featured at the Science Museum of Virginia from March through May 2015.

"I believe we can change education with opportunities like Dr. Iyer's Bioenergetics project," said Ball. "A sense of community was established, not only in the people I met throughout the internship, but in that we were doing something for the good of humanity."

"Bioenergetics: Arts meets Gentle Science in Sickness and in Health," supported by the VCU Quest Innovation Fund, is the first of its kind to blend visual arts and engineering in the construction of interactive modules used to explain bioenergetics to children and their families.

BIOMEDICAL

René Olivares-Navarrete, D.D.S., Ph.D.,

receives prestigious 2014 IADR Award

On June 25, during the opening ceremonies of the 92nd IADR General Session and Exhibition in Cape Town, South Africa, René Olivares-Navarrete, D.D.S., Ph.D., of the Virginia Commonwealth University Department of Biomedical Engineering was recognized as the recipient of the 2014 International Association for Dental Research and Academy of Osseointegration's Innovation in Implant Sciences Award.

His research, titled "Control of Macrophage Polarization by Physical/Chemical Surface Properties of Titanium Implant Materials," focuses on controlling the immune response to implant materials in healthy patients as well as the immunocompromised. The award is valued at approximately $75,000 and will serve to fund Olivares-Navarrete's graduate and undergraduate research assistants as well as to facilitate the invention of new technologies for oral care.

"Dean Boyan has been amazingly supportive of my work," said Olivares-Navarrete. "I am grateful for the research foundations we established that led to this award."

The IADR is an international and multi-disciplinary society that promotes innovative research in dentistry as well as the study of bone, endocrinology, developmental biology and materials science. The organization's mission is to advance research for the betterment of oral health.

Olivares-Navarrete's work focuses on the modification of implantable devices for tissue engineering and regenerative medicine purposes. With implant surface modifications, he is working to control macrophage activity and inflammatory microenvironment to help with patient recovery and biomaterial success.

"Once we understand the chemical and physical cues that can control cell fate to a wide variety of cell types, we can incorporate these surface modifications to any kind of biomaterial—polymer, metallic or ceramic," said Olivares-Navarrete.

"The award was an honor because two global organizations who are leaders in dentistry have recognized our work on the importance cell-mediated events leading to implant success," he said.

This acclaimed scientist's research is far-reaching with the potential to commercialize novel dental and orthopedic devices. Olivares-Navarrete's work has been made possible by grants from the National Institutes of Health, the International Team for Implantology in Switzerland, and Titan Spine LLC in Wisconsin.

Daren Chen, Ph.D., named endowed chair

Daren Chen, Ph.D., arrived at the School of Engineering in January 2013 fresh from his professorship at Washington University in St. Louis, Missouri, where his research focused on particle technology and applications.

The opportunity to develop collaborations with colleagues in multi-disciplinary environments, he says, was key to his coming to VCU. The honor of being named the School's Floyd D. Gottwald Senior Chair in Mechanical and Nuclear Engineering strengthened the draw.

"This endowed position gives me great support, allowing me to explore new ideas in the particle research arena without waiting for much-needed resources to become available," Chen said. "Certain resources are required in order to explore the feasibility of new ideas. The Gottwald Chair has allowed me to do that. The chair's funding allows me to explore different ways to approach my work."

A noted particle expert and recipient of the Benjamin Y. H. Liu Award in recognition of outstanding contributions to aerosol instrumentation, Chen is establishing a specialized center for particle technology at the School.

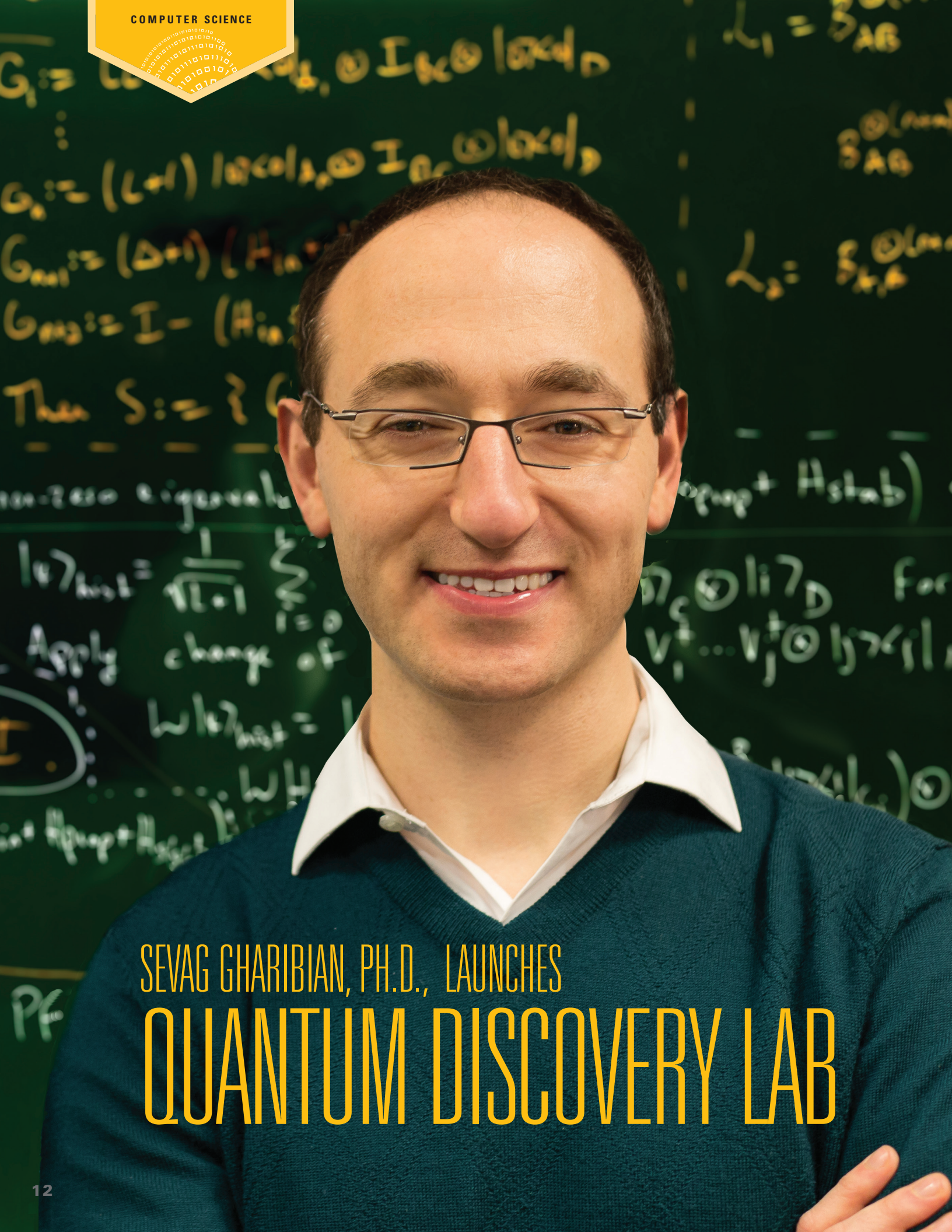
Applications for Chen's research are varied and include atmospheric and combustion aerosol, particulate emission control, micro-contamination control in semiconductor manufacturing, filtration and separation, indoor air quality control, air pollution monitoring and control, industrial hygiene, medicine and pharmaceutics.

MNE and ECE partnership develops energy efficient computer system

The future of microchip efficiency is about to change. Since 2011, Department of Mechanical and Nuclear Engineering Qimonda Associate Professor, Jayasimha Atulasimha, Ph.D., and Department of Electrical and Computer Engineering Commonwealth Professor, Supriyo Bandyopadhyay, Ph.D., have explored new energy efficient ways to store information. Their research has attracted national attention, as well as two grants totaling $1.75 million from the National Science Foundation and the Nanoelectronics Research Initiative of Semiconductor Research Corporation.

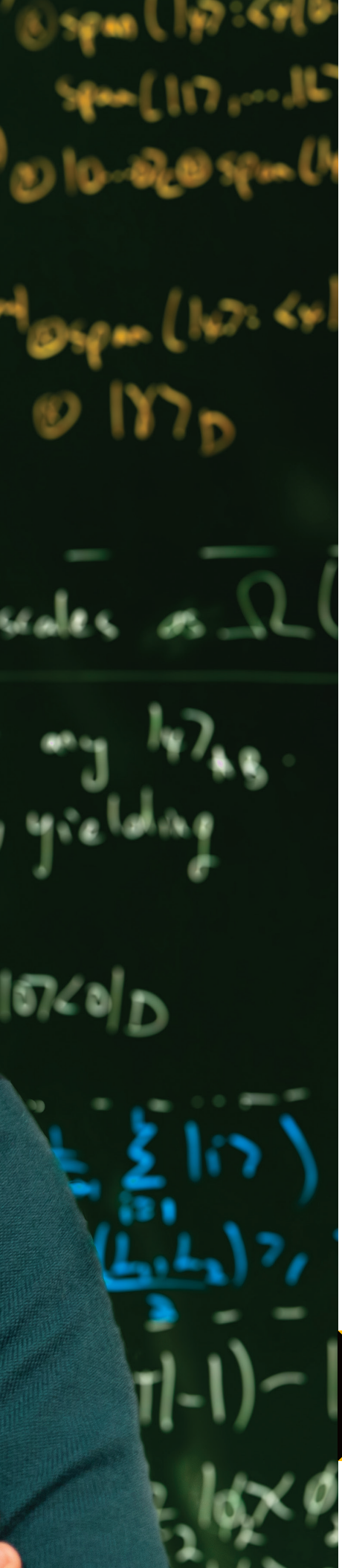
"The real-world application of our research is to make better and more efficient computers," said Bandyopadhyay. Atulasimha continued, "And what we mean by computers is not necessarily desktop computers. We are talking about devices such as Google glass, cell phones and Apple watches."

This collaborative duo has developed a system so energy efficient that no battery power is needed. Information can be stored using surrounding energy produced from mechanical vibrations. Due to their independence from an energy source, these processors are perfect for medical devices such as implants for epileptic patients to monitor brain signals and warn of coming seizures.



SEVAG GHARIBIAN, PH.D., LAUNCHES

QUANTUM DISCOVERY LAB



"In August I heard that there was a new professor in quantum computing, and I decided that I would be one of the first people to talk to him," said Aidan (Asa) Collins, an undergraduate research assistant at Virginia Commonwealth University studying under Sevag Gharibian, Ph.D.

With the School of Engineering strengthening its interdisciplinary efforts, it is no surprise that new Assistant Professor in the Department of Computer Science, Gharibian, began implementing his vision for a theoretical quantum computing research group within weeks of his arrival at VCU. From recruiting undergraduate research assistants to spearheading the department's first Computer Science Day for high school students, Gharibian's Quantum Computing Lab aims to bring quantum computing to the forefront of research and outreach at VCU, a feat indicative of the vibrant energy that all 22 new faculty members are bringing to the School.

"This is a very exotic project that Dr. Gharibian is doing," said Professor and Chair of the Department of Computer Science, Krzysztof Cios, Ph.D., D.Sc.

Spanning disciplines as diverse as engineering, physics and computer science, the fundamental aim of quantum computing is to build a computer based on the principles of quantum mechanics—a set of mathematical laws which describe the miniature world of subatomic particles such as photons and electrons. The Quantum Computing Lab at VCU, in particular, focuses on the theoretical aspects of the area, concentrating on three areas of research: quantum complexity theory, quantum algorithms and the theory of quantum correlations.

"Because quantum computing is so focused on math, most people in engineering have taken enough math courses that they could join the group," said Collins of the lab's accessibility to inquisitive students. "This is interesting research and is not restricted to people who know how to program."

Much like the intangible nature of theoretical quantum computing, Gharibian's Quantum Computing Lab is not a physical lab but the name of a research group including young scholars such as Collins. One of the key research directions of the group is the application of computer science tools to the study of low temperature condensed matter systems.

"When certain elements, such as helium, are cooled to very low temperature, they exhibit strange and exotic behavior," said Gharibian. "By better understanding these exotic effects, our lab aims to provide materials scientists with the fundamental knowledge they need to design the next generation of advanced materials."

Unsurprisingly, deciphering such exotic phenomena is difficult—which is precisely the advantage of introducing new tools from computer science to the area.

"We want to beat condensed matter physicists at their own game," said Gharibian.

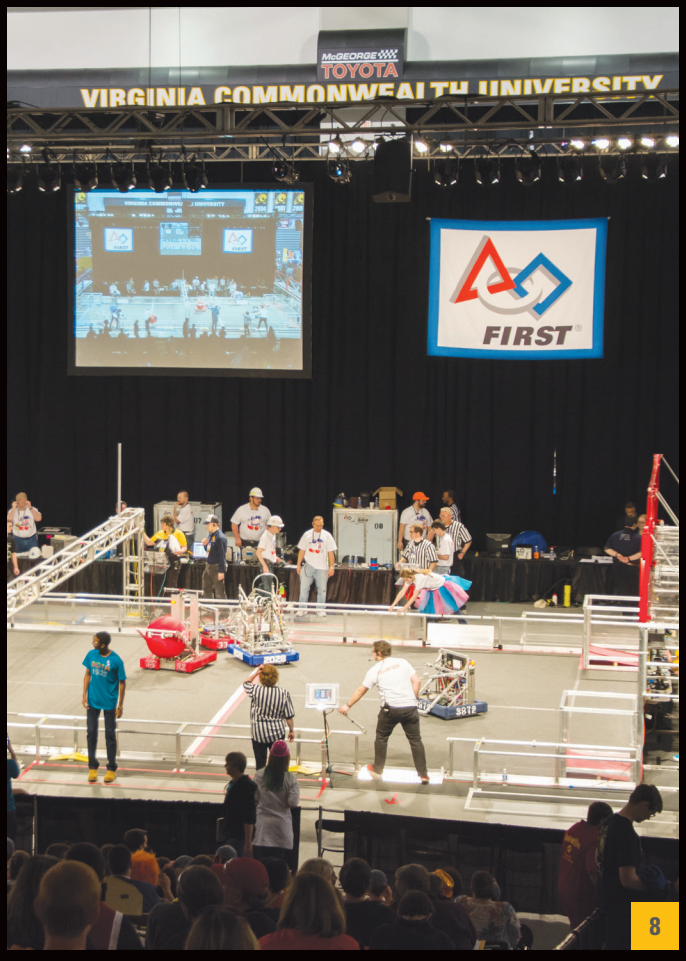
Gharibian obtained his Ph.D. from the University of Waterloo, Ontario, Canada, which boasts the largest quantum computing group in the world. Before joining VCU, he conducted research at the University of California at Berkeley as a postdoctoral fellow, where he worked with leaders in the field of Quantum Hamiltonian Complexity, which his lab focuses on at VCU.

"One of the nicest aspects of VCU is its stage of growth," said Gharibian. "This is a great time to get in on a department that is expanding rapidly, and hence is strongly supportive of new and exciting initiatives which break the mold."

"By better understanding these exotic effects, our lab aims to provide materials scientists with the fundamental knowledge they need to design the next generation of advanced materials."

STUDENT SPOTLIGHT

1 Middle and high school students drop eggs from the upper floors of the Science Museum of Virginia onto cushioned devices below at the American Society of Mechanical Engineers Egg Drop Contest. **2** Mechanical and Nuclear Engineering students get ready to run at the 2014 VCU Broad Street Mile. **3** Students participate in the Engineering Week Scavenger Hunt put on by the Engineering Graduate School Association. **4** Student members of VCU's Engineering World Health chapter present to donors at the fall 2014 Dean's Society Event.



5 Electrical Engineering student, Stefan Sharpley, works on the VCU team's Unmanned Aerial System in preparation for the Small Unmanned Aerial Systems 2014 Competition. **6** RAMS2 team students celebrate their 27th place victory at the 2014 ACM International Programming Competition. **7** A young child generates electricity with his muscles on the Institute of Electrical and Electronic Engineers (IEEE) bike at the 2014 USA Science and Engineering festival. **8** Middle and high school students attend the 2013 FIRST Robotics competition.

Capstone Design Experience

Bringing Industry and Students Together

Capstone Design is the culmination of every VCU Engineering senior's undergraduate career. This year, the Virginia Commonwealth University Capstone Design Experience is featuring more industry-sponsored projects than ever before with partners such as Jefferson Lab, Dominion and Evonik Industries.

Ben Ward, Ph.D., associate professor and Capstone Design Coordinator, said, "There is no substitute to the kind of hands-on guidance provided by our industry and Health Sciences mentors to our student teams. The experience provides rewards to our students, faculty and sponsors."

Student teams in Chemical and Life Science, Mechanical and Nuclear, Biomedical, Electrical and Computer Engineering and Computer Science practice problem analysis, solution-based investigation and prototyping under the guidance of these industry experts.

Ben Ward, Ph.D.
Associate Professor and
Capstone Design Coordinator

Alan Williamson, Chief Technology Officer of Royall & Company, attests to benefits that the Capstone Design Experience provides not only to VCU students, but also to companies honing their on-boarding process for graduates. "We require top quality talent," said Williamson. "The VCU senior design project allows us to effectively have a six-month interview with potential candidates and see how they perform under semi-real conditions."

In the previous academic year, 10 out of 62 projects received guidance external to the School of Engineering. By comparison, this year projects submitted from over 30 companies and four departments in VCU Health Sciences have translated into 41 sponsored Capstone Design projects, representing 53 percent of the 77 projects currently underway. Over 80 percent of the Capstone Design projects in both the departments of Chemical and Life Science Engineering and Computer Science have garnered outside sponsorship.

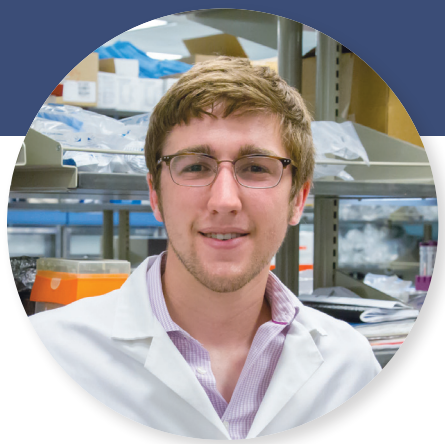
Vinnie Schoenfelder, Principal at CapTech Consulting, explained the balanced real-world education that his company brings to Capstone's young engineers. "More than a coding exercise, CapTech guides the students through an entire project life cycle," said Schoenfelder.

Frank Schmidtmann, Ph.D. and Group Leader of R&D Synthesis at Evonik, explained, "All learnings achieved from the Capstone Design Experience will be incorporated into future project design and ultimately help to develop the solution."

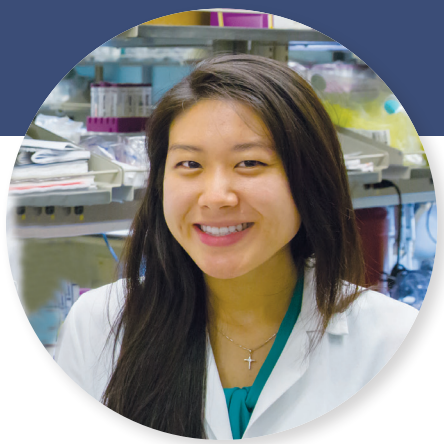
Student teams will present their work at the Capstone Design Expo on April 23 and 24, 2015 at the Science Museum of Virginia in Richmond.

"There is no substitute to the kind of hands-on guidance provided by our industry and Health Sciences mentors to our student teams. The experience provides rewards to our students, faculty and sponsors."

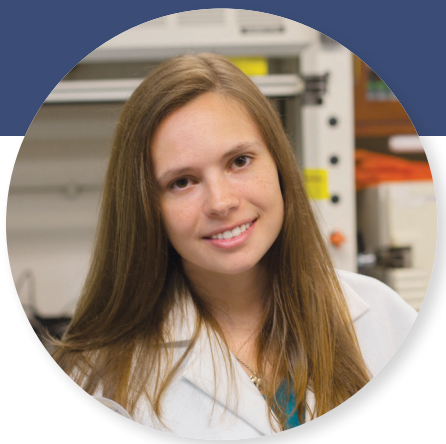
Scholarships and Fellowships



NICO ANDRADE is a double major in electrical engineering and physics and is in his junior year at VCU. He received the Goldwater Scholarship, which awards financial aid to college sophomores and juniors interested in pursuing academic careers in STEM fields. Andrade's research will help lower the cost of operating LED devices.



ALICE CHENG is a Ph.D. candidate at the Georgia Institute of Technology and currently works and conducts research in the VCU lab of Dean Barbara Boyan, Ph.D. Cheng is one of fifty students to receive the Whitaker Fellowship for biomedical research. Her research focuses on increasing osseointegration and longevity of implants.



LAURA HAYWARD graduated from the Department of Chemical and Life Science Engineering in 2014. She was awarded the Fulbright Fellowship in research, a grant offered to outstanding students in scientific fields. The award will allow her to travel to Brisbane, Australia to conduct research for approximately ten months in the field of cancer diagnostics.

CALEB MASSEY is a first year graduate student, was awarded a US Department of Energy Nuclear Energy University Programs Fellowship. In his undergraduate career, Massey worked at both the Oak Ridge National Laboratory and Jefferson Lab. "The Nuclear Energy University Programs award will give me the freedom to focus on the research that I want to do."

JAMES CARR is a graduate student and was awarded an NRC Fellowship that began fall 2013 and will continue through spring 2017. His research in material science, specifically in accident tolerance of nuclear fuel cladding, garnered him this fellowship. "I hope to one day work in a national lab doing research on materials science," said Carr.

AMMON WILLIAMS, is a graduate student and is the recipient of the Fuel Cycle Research Award. Williams's research focuses on molten salt separation and detection techniques with applications in used nuclear fuel treatment at his alma mater, the University of Idaho. "My long-term goal is to be a faculty member teaching at a university."

Twelve exceptional students and alumni at Virginia Commonwealth University's School of Engineering have been recognized for their academic achievements and research pursuits.

Nine Mechanical and Nuclear Engineering (MNE) students received prestigious awards this academic year totaling approximately $243,000. "These awards recognize the outstanding caliber of students we have in the Mechanical and Nuclear Engineering department," said MNE Professor and Chair, Gary Tepper Ph.D.

Additionally, Nico Andrade, Alice Cheng and Laura Hayward were selected as recipients of Goldwater, Whitaker, and Fulbright awards, respectively. Recognition of such caliber is given to a very select number of students around the world. These honors reflect the School of Engineering's fostering of ingenious thinkers.

NATHAN KIRBY is the recipient of a VCU Newport News Shipbuilding Scholarship. In fall 2014, Kirby enjoyed his first year of conducting research. He has been particularly appreciative of the interdisciplinary applications of collaborating with professionals in both the Engineering and Mathematics departments.

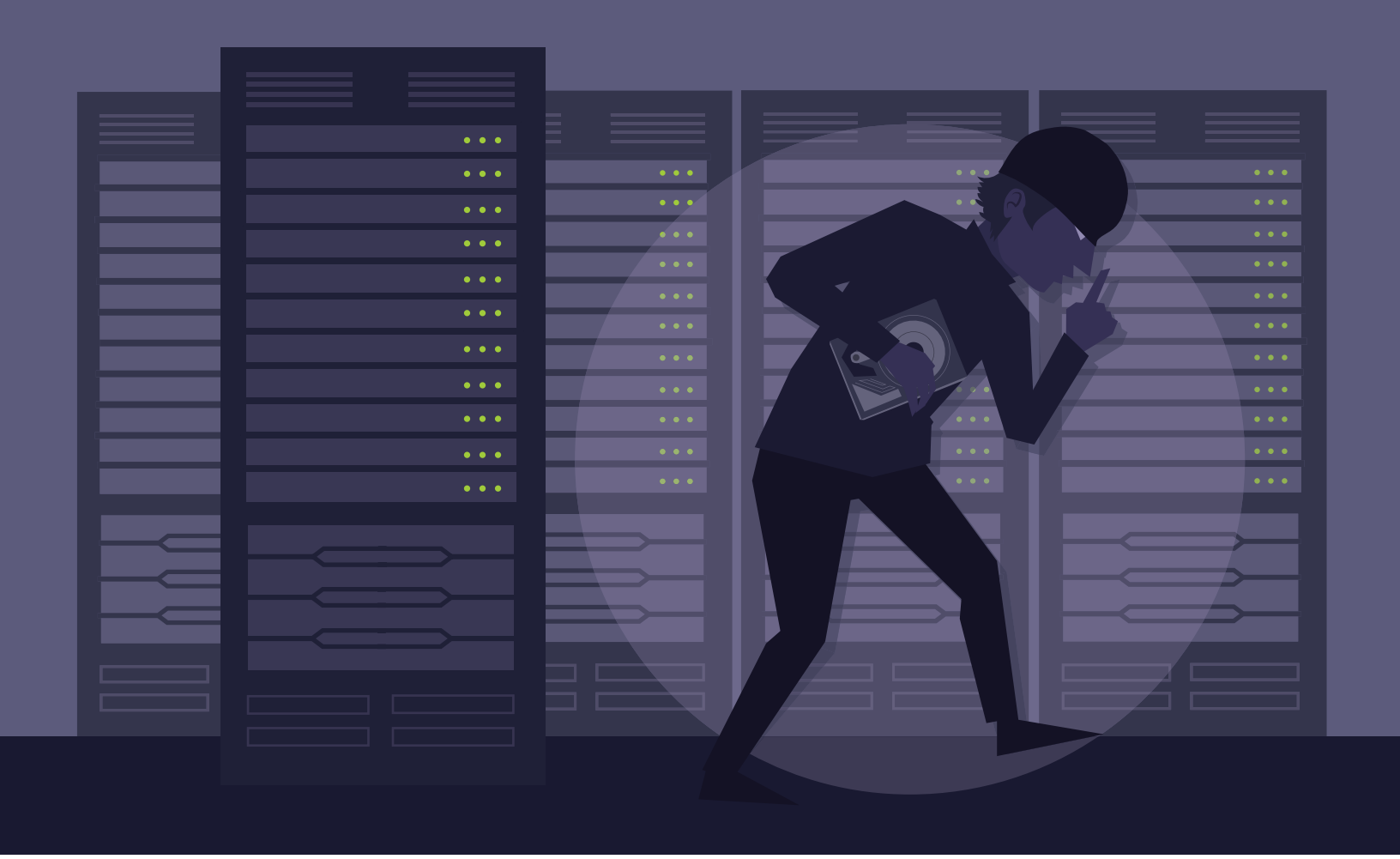
ROBERT RODI is also the recipient of a VCU Newport News Shipbuilding Scholarship. Rodi has cultivated a long-standing interest in robotics and has served as a mentor on two James River FIRST Tech Challenge (FTC) bots teams. "The Engineering department definitely challenged me to study hard and work hard."

YVETTE SMITH is spending the Fall semester of her junior year participating in a co-op internship at Erlanger, Kentucky's Toyota Motor Engineering & Manufacturing North America (TEMA), credits her inspiration in part to her membership in VCU's National Society of Black Engineers (NSBE). She aspires to pursue a career in aerospace engineering.

JONATHAN HILL was awarded The National Academy of Nuclear Training a fellowship for the 2014 — 2015 academic year. "The fellowship allows me to pursue my passion for nuclear science as I work towards my master's degree here at VCU and further, to obtain a suitable career in the nuclear power industry."

LAUREN NICOLE WAUGH is the winner of a NNS Scholarship and an ASME, Nuclear Division Scholarship for the 2014 — 2015 academic year. Senior Waugh has secured a covetable position at Dominion Power after previous work done for the company in spring 2014.

CHRIS DUCIC, an undergraduate junior, received a US DOE NEUP Scholarship. Ducic enjoys his material science and advanced reaction physics classes and credits the MNE department for his recognition. "The education I have received thus far has led me to become more active in my field of study as well as within my community."



CYBERSECURITY prepares students to defend against cyber attacks

Through our smartphones, tablets, computers and other digital devices, we are connected to the Internet virtually every waking moment of the day. As information circulates over scores of websites simplifying our lives with the ease of e-commerce, online banking and social media, we are putting ourselves at risk for identity theft, breeches of privacy and fraud.

Cybersecurity, the defense against these criminal electronic attacks, is a leading global priority that VCU is prepared to meet. With the addition of three new faculty in fall 2014, the Department of Computer Science now boasts six professors teaching computer security courses as part of the newly offered Certificate in Cybersecurity.

Krzysztof Cios, Ph.D., Chair of the Department of Computer Science, spoke to the certificate's high demand in industry. "No organization or company is without the need to protect their information," he said.

A testament to the initiative's immediate value, Victoria Forehand is the first VCU student to graduate with a Certificate in Cybersecurity. "Before taking these classes, I never knew how much vulnerability existed," said Forehand.

Students graduating with this certificate can claim expertise in the field of computer safety. "Cybersecurity now is an aspect of everything we do," said Thang Dinh, Ph.D. and 'Social Network Analysis and Cybersecurity Risks' professor. "Remember the recent leak of celebrities' photos? They are the victims of targeted attacks."

'Cyber Attack and Intrusion Detection,' taught by Carol Fung, Ph.D., focuses on the potential attacks computer users face. "My purpose is to guide students in learning how hackers can invade computers and to teach them defending strategies," said Fung.

Students who complete Fung's course will graduate with the capabilities to set up antivirus software at companies and teach employees about technical safety. Upon receiving the certificate, students are prepared for careers as security managers and systems administrators among other in-demand professions.

"At the Career Fair I discussed my qualifications in computer science with employers, and they have so much interest," said Forehand. "Even if you are not in the computer science field, these classes are beneficial just for the knowledge."

Computer Science on a Hackathon Winning Streak

From San Francisco hackathons to competitions held in their own backyard, students from the VCU Department of Computer Science have competed with and ranked among the nation's best hackers.

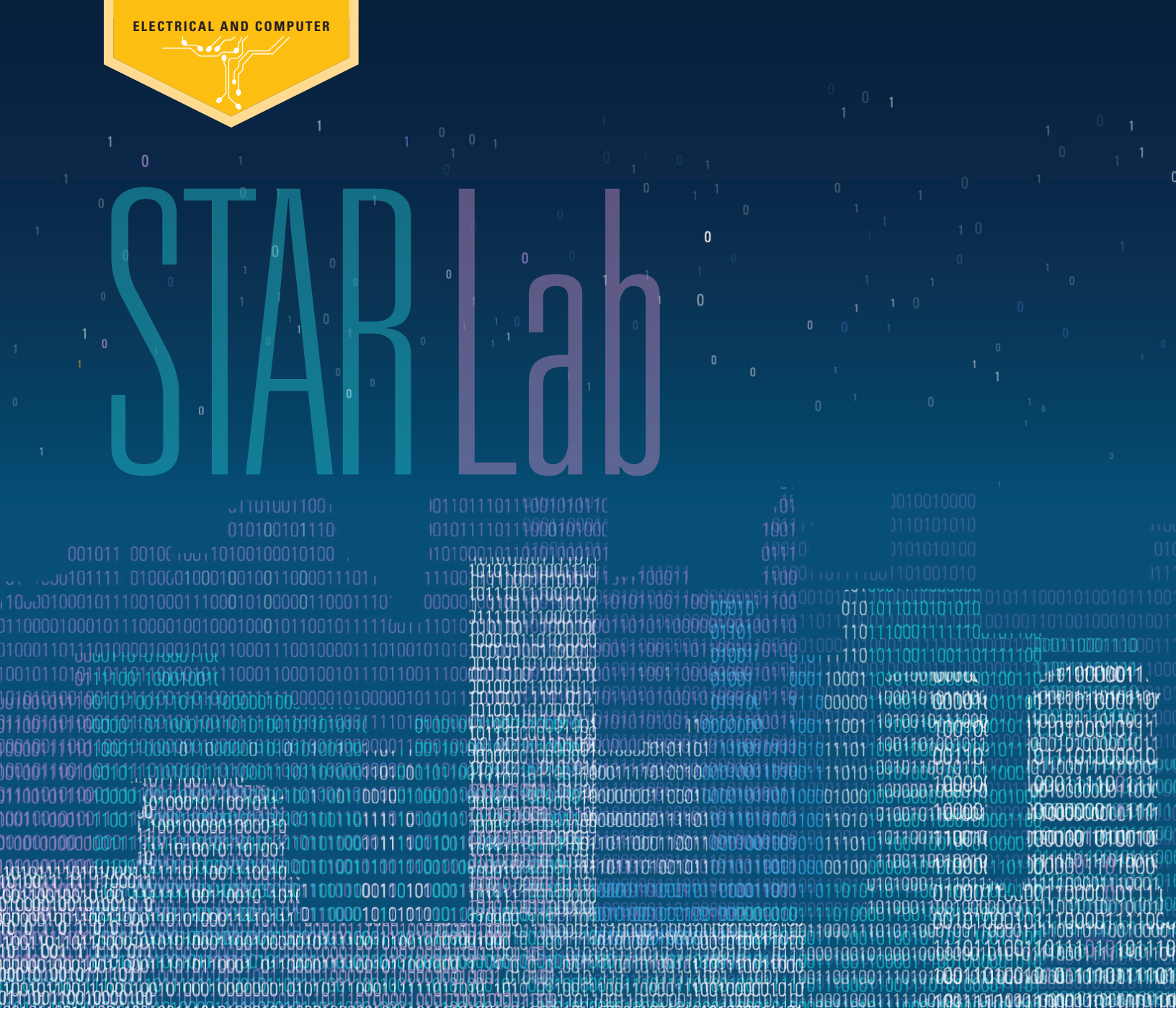
Early in the spring of 2014, Mark Kolev and Ivan Grinkevich represented VCU at Hack UVA. Held at the University of Virginia, the team developed "SecureNet," a web-based application that allows users to email their own devices or receive emails from others with attachments. Attachments are then extracted and placed into a specific directory made available on Google Drive, DropBox, and overarching Kloudless API.

Later that academic semester, Allen Calderwood, Joseph Davis, David Jackson and George Pottant traveled to the University of North Carolina Chapel Hill for Hack NC, where the team developed "LectureBuddy," an educational polling app allowing professors to pose questions to large student audiences. The app was designed for tablets and smartphones, replacing old RF clickers and saving students extra costs.

Glass, Jackson, Koley and Pottant then took the competition to HopHacks, held at Johns Hopkins University in fall 2014. There, the team developed "CheckUp," a mobile app paired with a healthcare website to assist physicians in collecting real-time data about effectiveness of medications outside of healthcare settings.

This winning streak is complemented by VCU's own 24-hour programming marathon, RamHacks. RamHacks kicked off its inaugural year in November 2014 hosted by the Department of Computer Science and Ram Development at VCU. VCU's first home team hackathon bought together college students from across the region to pursue collaborative and competitive programming projects.

RAM HACKS



RESEARCHERS TACKLE BIG DATA MANAGEMENT

When Xubin (Ben) He, Ph.D., joined the VCU Department of Computer and Electrical Engineering in 2010, he brought with him a unique mentorship program for self-starting computer engineering students.

This coalition of researchers is known as 'STAR Lab,' the Storage Technology and Architecture Research Lab. STAR Lab is a project-based resource for postdoctoral, graduate, undergraduate and high school students to conduct research in computer architecture, data storage and design techniques to help with computer I/O efficiency.

To date, this community of researchers boasts thirteen Ph.D. and M.S. alumni, six past postdoctoral and visiting scholars and approximately fifteen former undergraduate members.

"I'm working on data recovery," said Mikey Ruiz, a senior at Patrick Henry High School in Ashland Virginia. "Also, I'm currently conducting a comprehensive survey to evaluate different types of erasure codes. I spent most of my summer in the lab, and now I come here once a week."

Together, STAR Lab members have published over sixty papers, received two best paper awards, obtained two patents and received nearly ten travel awards to attend top conferences.

STAR Lab is a project-based resource for postdoctoral, graduate, undergraduate and high school students to conduct research in computer architecture, data storage and design techniques to help with computer I/O efficiency.

Robert Klenke, Ph.D., Offers Spring 2015 Course in INDUSTRIAL AUTOMATION

In response to a sought-after and hard to find engineering curriculum option, Robert Klenke, Ph.D., is offering an Industrial Automation course, EGRE 553, starting spring 2015 for engineering students.

With the benefit of working with Programmable Logic Controllers, PLCs, students will enjoy the practical approaches to process control opportunities that come with studying Industrial Automation. Uses for PLCs, digital micro controller-based units, range from industrial applications in controlling everything from automated assembly lines to robots. Industry partners have offered their equipment, tours of facilities and guest lectures.

Joe Vorhas, Senior Electrical Engineer at Electrical Equipment Company, said, "Preparing young engineering minds, as it relates to the real world, is one of the most useful endeavors that educators can do. What good is an education unless it can be applied?"

Bob Culley of Delta Automation said, "Not everyone wants to be a design engineer. There are other career paths — sales, service, facilities managements."

EGRE 553 Industrial Automation is the first of many such courses that will be offered to VCU engineering students.

WOMEN IN MECHANICAL AND NUCLEAR ENGINEERING

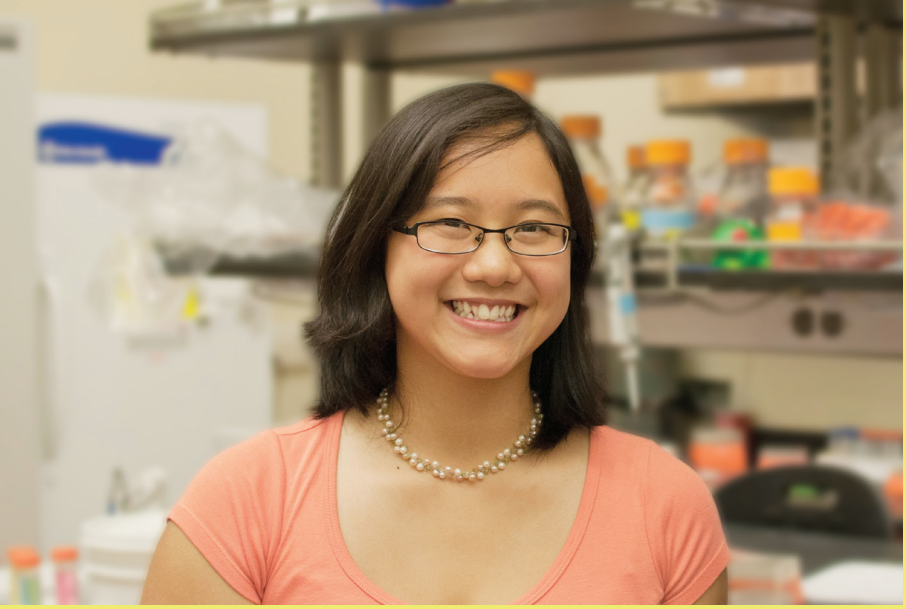
KARLA MOSSI, PH.D., Associate Professor and Graduate Program Director joined the Mechanical and Nuclear Engineering department in 2001 and established the Smart Materials Laboratory just one year later in 2002. She received her Ph.D. in Mechanical Engineering from Old Dominion University in 1998. "I am very proud of helping create the first Ph.D. degree of its kind in the US," said Mossi. "I also get a lot of satisfaction helping students to achieve their degree and accomplish all their dreams."

LALEH GOLSHAHI, PH.D., Assistant Professor earned a doctorate in Mechanical Engineering from the University of Alberta in 2012 and is the recipient of the Natural Sciences and Engineering Council of Canada's National Doctoral Award. "I'm hoping to contribute to a team of VCU faculty to address pediatric respiratory problems and to the education system by making the learning process a joyful experience. Discovering a new phenomenon is exciting for researchers at all different levels." Golshahi said.

HONG ZHAO, PH.D., Assistant Professor joined the Mechanical Engineering department in 2014 with a doctoral degree in Mechanical and Aerospace Engineering from Rutgers, The State University of New Jersey. "After about 8 years in an R&D company, I came back to academia," Zhao said. "I still appreciate my industrial experience and many challenges in practical applications, but in my current position, I enjoy the exciting research, teaching and interacting with students."

JESSIKA ROJAS, PH.D., Assistant Professor came to VCU in 2014 after earning her doctorate in Nuclear Engineering from Missouri University of Science and Technology. Rojas's experience includes practical training at Oak Ridge National Laboratory, Idaho National Laboratory. "Since I started my career in academia, I really wanted to be a professor," said Rojas. "I found VCU to be the right place for me because of how fast the university is growing!"

SAMA BILBAO Y LEÓN, PH.D., Associate Professor and Director of Nuclear Engineering Programs joined VCU in 2011 with a doctorate in Nuclear Engineering and Engineering Physics from the University of Wisconsin Madison. Her professional experience includes serving as the technical head of the International Atomic Energy Agency Water Cooled Reactors Technology Development Unit, as well as a nuclear safety analysis engineer at Dominion Generation. Bilbao y León is one of the founders of the North American Young Generation in Nuclear and extremely active in the American Nuclear Society. "I am proud of my contributions to the birth and meteoric growth of the brand new nuclear engineering programs at VCU," she said.



Student wins Society of Women Engineers Scholarship

In 2014, the Society of Women Engineers (SWE) distributed over 230 new and renewed scholarships valued at more than $700k to celebrate the contributions of young women in STEM. VCU Biomedical Engineering junior and VCU SWE chapter President, Tiffany Wong, joined the ranks of her exemplary peers recognized by the organization with the awarding of her Baltimore-Washington Section Scholarship.

The chapter officer who regularly coordinates service events for SWE at VCU was granted the award based on a combination of her academic merit, letters of recommendation and an essay detailing her plans for utilizing her engineering education.

"I wrote my essay on my intention to further stem cell research and artificial tissues," she said. "Upon taking more classes and exploring the different fields of biomedical engineering, I have discovered that I would like to go into device construction and run clinical trials."

Established in 1950, the SWE international organization aims to provide women engineers with a voice within the engineering industry. Wong attended the SWE14 Annual Conference for Women Engineers in Los Angeles, California from October 23-25 where she met with female leaders in engineering from across the nation.

As a successful woman in engineering, she advised others, "Go through volunteer work or any type of leadership role — it will make you a better engineer."

Millie Dresselhaus kicks off **School of Engineering speaker series**

The 'Queen of Carbon Science,' professor Mildred (Millie) Dresselhaus, Ph.D., regaled a full audience with discoveries, setbacks and triumphs of her 50-year adventure with nanoscience. The 83-year-old pioneer in carbon nanomaterials kicked off VCU's School of Engineering Speaker Series in October by explaining the importance of nanoscience, the manipulation of matter on an atomic level.

Currently an institute professor at MIT in the departments of Electrical Engineering and Physics, Dresselhaus's research has ignited the collective interest of the scientific community for decades.

As a woman completing her Ph.D. in 1958, one year after the launching of Sputnik, Dresselhaus faced adversity in a highly male-dominated field. In 1973 she received a Carnegie Foundation grant to encourage women's study in traditionally male-populated fields. That same year, she was appointed to The Abby Rockefeller Mauze Chair to support the scholarship of women in science and engineering.

"When we were young," Dresselhaus said, "nobody ever imagined we would be doing what we are doing now. So everything imaginable is possible. Just put your mind to it and you will succeed."

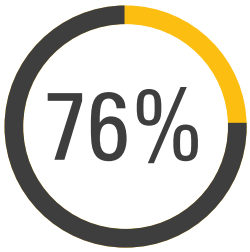
BY THE NUMBERS

KEY RESEARCH AREAS

- SUSTAINABILITY & ENERGY ENGINEERING
- MECHANOBIOLOGY & REGENERATIVE MEDICINE
- MICRO & ELECTRONIC SYSTEMS
- PHARMACEUTICAL ENGINEERING
- SECURITY & MINING BIG DATA
- DEVICE DESIGN & DEVELOPMENT

RESEARCH SUPPORT

- Bill and Melinda Gates Foundation
- The Clinton Foundation
- Department of Defense
- Intel Corporation
- NASA
- National Institutes of Health
- National Science Foundation
- Medtronic, Inc.
- U.S. Air Force
- U.S. Army
- U.S. Department of Education
- U.S. Department of Energy
- Whitaker Foundation



of graduates looking to enter the workforce have confirmed employment within six months.

DEPARTMENTS / DEGREE PROGRAMS

BIOMEDICAL

- B.S. in Biomedical Engineering
- M.S. in Biomedical Engineering
- Ph.D. in Biomedical Engineering
- Combined M.D. and Ph.D. Program

CHEMICAL & LIFE SCIENCE

- B.S. in Chemical & Life Science Engineering
- M.S. in Chemical & Life Science Engineering
- Accelerated B.S. to M.S. in Chemical & Life Science Engineering
- Ph.D. in Chemical & Life Science Engineering

COMPUTER SCIENCE

- B.S. in Computer Science
- Certificate in Cybersecurity
- Accelerated B.S. & M.S.
- Post-Baccalaureate Certificate
- M.S. in Computer Science
- Certificate in Cybersecurity
- M.S. in Computer & Information Systems Security
- Ph.D. in Engineering, focus in Computer Science

ELECTRICAL & COMPUTER

- B.S. in Electrical Engineering
- B.S. in Computer Engineering
- M.S. in Engineering, focus in Electrical and Computer Engineering
- Ph.D. in Engineering, focus in Electrical and Computer Engineering

MECHANICAL & NUCLEAR

- B.S. in Mechanical Engineering
- B.S. in Mechanical Engineering, Nuclear Engineering Concentration
- M.S. in Mechanical & Nuclear Engineering
- M.S. in Mechanical & Nuclear Engineering, online
- Ph.D. in Mechanical & Nuclear Engineering

VCU School of Engineering

ENGINEERING STUDENT DIVERSITY

FEMALE STUDENTS

MALE STUDENTS

- CAUCASIAN
- ASIAN
- BLACK/AFRICAN AMERICAN
- INTERNATIONAL
- HISPANIC/LATINO
- TWO OR MORE RACES
- UNKNOWN
- ALASKAN/NATIVE AMERICAN HAWAIIAN/ PACIFIC ISLANDER

FACULTY

87
TOTAL FACULTY

22
NEW FACULTY IN 2014

ENROLLMENT/GPA

1,652
UNDERGRADUATE STUDENTS

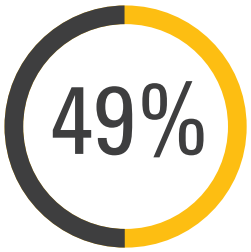
263
GRADUATE STUDENTS

114
M.S. STUDENTS

149
PH.D. STUDENTS

3.96
AVERAGE ADMIT GPA

of students are women.



of graduate students have scholarships.

Engineering World Health students take skills abroad

In the summer of 2014, three students from Engineering World Health (EWH) at VCU traveled to developing countries to repair medical equipment for local doctors and hospitals. Shruthi Muralidharan, President of EWH at VCU, and Brittany Allen, the Committee Chair of the organization's Summer Institute, both traveled to Nicaragua. Paul Howell, the Vice President for EWH at VCU, traveled to Tanzania.

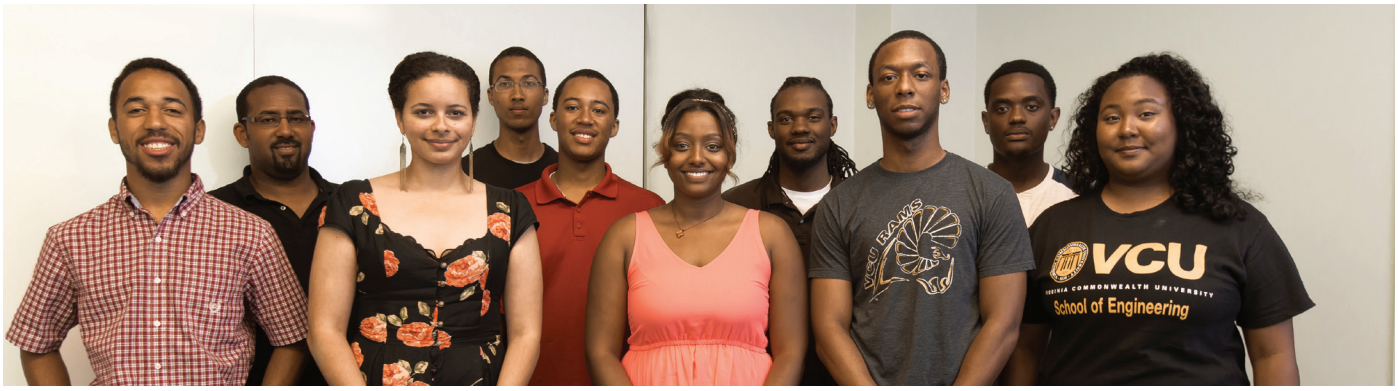
"Working in the hospital was enriching," said Muralidharan. "You realize how innovative people are when you have to fix something out of just what you have."

Shruthi Muralidharan and other EWH Summer Institute students examine a hospital bed frame at the Granada Hospital in Nicaragua to assess salvageable parts.

"The lack of materials forces you to be creative," said Allen. "You get to master problems you didn't believe you could handle before."

"For a long time I was convinced that I was going to medical school," said Howell, "but because of this experience I am now looking into medical device design."

Within two years this EWH chapter has grown from a small student club to a syndicate of engineers committed to creating a healthier world.



NSBE at VCU

In August, the National Society of Black Engineers VCU chapter attended the annual NSBE Regional Leadership Conference. With Richmond as the host city, these student members relished the opportunity to network, showcase past service achievements and highlight exciting future plans to regional leaders.

Winning two awards in 2014 with VCU Student Organization Development, NSBE at VCU has gained status as a thriving chapter. The awards — Outstanding Local Community Service Award and Professional/Academic Student Organization of the Year — were given in admiration of NSBE's mission to increase the number of successful and culturally responsible black engineers worldwide.The organization actively encourages STEM skills in middle and high school students through their Pre-College Initiative programs. Members this year also held a charity dinner for St. Jude's hospital, and sponsored and coached a Lego robotics team.

"Anything and everything we can do for the community is very important to us," said NSBE Vice President, Derrick Williams. "NSBE isn't only for professional development — we build leaders."

Back row from left to right: VCU School of Business Dean, Ed Grier; Congressman Bobby Scott; VCU School of Engineering Executive Associate Dean, L. Franklin Bost; Governor Terry McAuliffe; Associate Dean for Undergraduate Studies, Afroditi Filippas, Ph.D.; Associate Dean for Research, Ram Gupta, Ph.D.; Secretary of Commerce and Trade, Maurice Jones. Front row from left to right: VCU School of Engineering Dean, Barbara Boyan, Ph.D.; VCU President, Michael Rao, Ph.D.; Commonwealth Center for Advanced Manufacturing (CCAM) President and Director, Joseph Moody.

VCU Joins Forces with

CCAM

In December 2014, Virginia Commonwealth University announced its partnership with the Commonwealth Center for Advanced Manufacturing (CCAM) at an event attended by Governor Terry McAuliffe and VCU President Michael Rao, Ph.D.

"CCAM is truly a jewel of the Commonwealth of Virginia," said McAuliffe. "What we are doing today — that's how we will build the new Virginia economy."

VCU is CCAM's fifth university partner, joining the University of Virginia, Virginia State University, Virginia Tech and Old Dominion University.

"What we are hoping to bring to CCAM is manufacturing in the bioscience sector," said Barbara Boyan, Ph.D., dean of the School of Engineering. "We are excited to be able to bring our expertise together with the other members of CCAM and see if we can broaden manufacturing for the Commonwealth."

CCAM bridges the gap between research and commercialization, accelerating new manufacturing technology developments to market.

Over 50 research areas were identified by the School to provide research opportunities for students and professors from all five departments. From medical device design to semiconductor device theory, the School of Engineering has plans to conduct research in a myriad of fields.

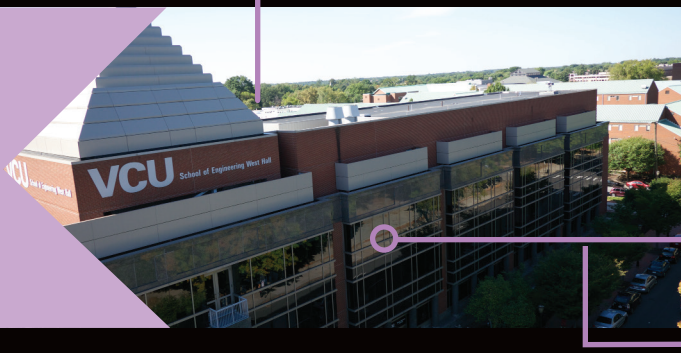
CCAM President and Executive Director Joseph Moody said, "It's leveraging the knowledge of universities like VCU and bringing solutions to industry, which not only retain the industry and allow them to grow here in the state of Virginia, but attract new industries to Virginia."

To learn more about CCAM visit, http://www.ccam-va.com

FACILITIES

ENGINEERING WEST HALL

West Hall was built in 1998 and houses the departments of Electrical and Computer Engineering and Chemical and Life Science Engineering, and the administrative offices for the School.



INSTITUTE FOR ENGINEERING AND MEDICINE

The Institute for Engineering and Medicine, constructed in 2009 as an addition to West Hall, houses labs that foster collaborative programs between the VCU School of Engineering, VCU Life Sciences and the VCU School of Medicine. The state-of-the-art collaborative research environment is one of the largest configurable research spaces in the U.S.

ENGINEERING EAST HALL

In January 2008, the School opened East Hall, a 120,000-square-foot facility housing 48 research labs, 50 faculty offices, six classrooms and other student spaces, allowing for future growth of the School.

TRANSLATIONAL RESEARCH INNOVATION PROJECTS FACILITY

The Translational Research Innovation Projects (TRIP) Facility is a 2,400-square-foot collaborative area that offers VCU faculty and business partners a space for innovative product prototype design and development. Under the theme of Engineering for Healthcare, TRIP welcomes experts from the VCU Schools of Engineering, Medicine, Dentistry, Pharmacy and Nursing and Life Sciences.

WRIGHT VIRGINIA MICROELECTRONICS CENTER: The C. Kenneth and Dianne Harris Wright Virginia Microelectronics Center (VMC) is an interdisciplinary collaboration between the five VCU engineering departments. Within its two Class-1000 cleanrooms, this 7,500-square-foot center focuses on the fabrication and development of micro- and nano devices and state-of-the-art material creation.

SCHOOL OF ENGINEERING FOUNDATION: The VCU School of Engineering Foundation provides guidance and financial support to the School of Engineering. The foundation is governed by a board of trustees whose members are among Virginia's most influential leaders and whose professional efforts are vital to the economic development of the Commonwealth of Virginia.

WELCOME CENTER: Housed in Engineering West Hall, the Student Welcome Center serves as an information hub where guests and visitors can learn about the School of Engineering. Families of undergraduate students, transfer students and others interested in the School can come to the Welcome Center to communicate with professionals and discuss admissions requirements.

CAREER SERVICES: The School of Engineering Career Services empowers students with lifelong career and professional skills through a student-centered approach to career education, and provides opportunities for employer interaction and experiential learning. Career Services collaborates with the corporate community to develop sustainable partnerships and to connect companies with students.

NANOMATERIALS CORE CHARACTERIZATION FACILITY: Located in the Institute for Engineering and Medicine, the NCC is a material characterization facility that specializes in providing sophisticated equipment and analytical services to researchers from both VCU campuses and across the East Coast. Since its establishment in 2008, this nationally ranked facility has boasted the most state-of-the-art nanomaterial characterization tools.

DA VINCI CENTER FOR INNOVATION: The da Vinci Center for Innovation, located in Engineering East Hall, is a unique collegiate model that advances entrepreneurship through cross-disciplinary cohesion. Students from the schools of the Arts, Business and Engineering work together on team-based projects for corporate affiliates. The Center's core is a multi-use space. This space encourages the product development cycle from concept to graphic renderings, to prototypes to test and validation to marketing.

International Workshop on Accelerator Driven Systems

and Thorium Utilization hosted by VCU's Mechanical and Nuclear Engineering department

" This year the workshop featured many different points of view about the feasibility of various ADS concepts and the role that thorium plays in the future."

Physicists, accelerator experts and nuclear engineers from around the world gathered in Richmond, Virginia in October, 2014, to exchange ideas and promote discussion at the Third International Workshop on Accelerator-Driven Sub-Critical Systems and Thorium Utilization.

Virginia Commonwealth University Department of Mechanical and Nuclear Engineering (MNE) hosted the three-day program with Sama Bilbao y León, Ph.D., serving as program committee chair. With representatives from countries including China, Czech Republic, Belgium, Brazil, France, India, Italy, Japan, Sweden, Switzerland, and the United States, as well as the International Atomic Energy Agency (IAEA), the workshop focused specifically on innovative concepts and applications for accelerator driven subcritical systems (ADS).

Bilbao y León relished the opportunity to share ideas with an international group of colleagues. "This year the workshop featured many different points of view about the feasibility of various ADS concepts and the role that thorium plays in the future. The exchange of information we had during the workshop will hopefully start the next big collaboration in these areas to bring us closer to real solutions and stronger connections," said Bilbao y León.

The workshop also served to evaluate the future use of thorium in ADS or other systems. Andrew Hutton, Ph.D., and associate director of the Accelerator Division of Jefferson Lab said, "Our colleagues in India and China are working on accelerator driven systems that use thorium instead of uranium. We could stand to learn from India."

Jean-Pierre Charles Revol of the European Organization for Nuclear Research known as CERN expressed that ADS has the potential to be much safer than existing nuclear reactors and will lead to nuclear waste solutions, "Any and all R&D is good. If someone has a good idea you should give them a chance to explore it."

Bilbao y León endorsed Revol's views and added that the possibilities for ADS are vast, including the fabrication of medical radioisotopes and the burning of used nuclear fuel. "Used nuclear fuel is exactly that — it's a fuel," said Bilbao y León. "It's useful. I don't want to throw away something so useful. I want to use it to produce energy in an ADS."

VCU School of Engineering Accepts In-kind

Software Grant

Virginia Commonwealth University School of Engineering received an in-kind grant of software with a commercial value of $230.9 million from the Siemens Product Lifecycle Management (PLM) software business unit to help educate and train students in design, development, analysis, documentation and manufacturing systems.

According to Siemens, over 77,000 customers use the PLM software worldwide, and nearly 90 manufacturing companies in Virginia use the programs to design products and maintain their operations. This software enables engineers to keep pace with an ever-evolving industry and readies engineering students for the challenges faced by manufacturers.

The School utilizes this network of integrated software to train students in the complete process of engineered devices. With this hands-on preparation, VCU Engineering graduates become more valuable to employers such as Newport News Shipbuilding, Canon, and Rolls Royce.

"This software gives us the ability to educate on a very practical level," said Dean Barbara D. Boyan, Ph.D. "By teaching with programs used in industry, our students will be even more prepared for the real world."

Charles Cartin, Ph.D., assistant professor in the Department of Mechanical and Nuclear Engineering, is spearheading the training and implementation of the software in classes and with colleagues.

"Currently, the Siemens software package is being utilized within the Computer Aided Engineering Design courses where students experience real life design scenarios," Cartin said. "The software provides students a unique opportunity to design, develop, and analyze various engineering components or projects."

Chuck Grindstaff, president and CEO of Siemens PLM Software said, "The manufacturing industry in America is on the rise and is being transformed by a software revolution that is enhancing productivity, increasing efficiency and speeding time to market."

"Here in Virginia where shipbuilding is core to the state's economy," Grindstaff said, "it's important we equip students with the tools that will help them build the world's most complex ships for the U.S. Navy."

DURI & DERI foster scientific curiosity through mentored research

Graduate student, Ethan Lotz mentors high school student, Caroline O'Brien, in Dean Barbara Boyan, Ph.D.'s lab as part of DERI.

Oscar Bastidas, Chemical and Life Science Engineering graduate student, balanced a small green spider in the palm of his hand. "We'll look at this later under the microscope," he told Joseph Rodriguez, his Dean's Early Research Initiative (DERI) fellow. A senior at William Monroe High, Rodriquez has been afforded a unique opportunity to learn engineering principles alongside his VCU mentor.

"I try to keep it fresh and real with general experiments to illustrate basic concepts to him," Bastidas continued.

Bastidas and Rodriguez are one of twenty-one student-mentor teams in the Dean's Undergraduate Research Initiative (DURI) and DERI programs. These programs, instituted by Dean Barbara Boyan, Ph.D., upon her arrival to the School of Engineering in 2013, aim to enhance high school and undergraduate students' exposure to engineering research. At the same time, graduate students and postdoctoral fellows develop skills in mentoring.

Research projects span all engineering disciplines fostered at VCU from "Ex Vivo Polymerase Chain Assembly" to "Effects of Titanium Surface Nanostructures Induced by Oxidation on the Enhancement of Osteoblastic Differentiation." DERI focuses specifically on introducing senior high school students to the laboratory atmosphere, while DURI is geared toward full-time undergraduate students in their junior or senior year who are interested in broadening the scope of their studies.

"The program certainly gave me an appreciation for the area I'm currently working in," said DURI scholar, Benjamin Young. "I don't think I would have gotten started with this research without DURI."

In both initiatives, students not only develop a close relationship with a graduate or postdoctoral mentor but also conduct research in the laboratory of a seasoned faculty member.

In addition to their fall and spring program commitments, DURI scholars are required to complete a summer semester of full-time laboratory work, while DERI fellows complete 40 hours during the summer. This level of immersion is designed to develop real-world transferable skills that will benefit students in their future careers,

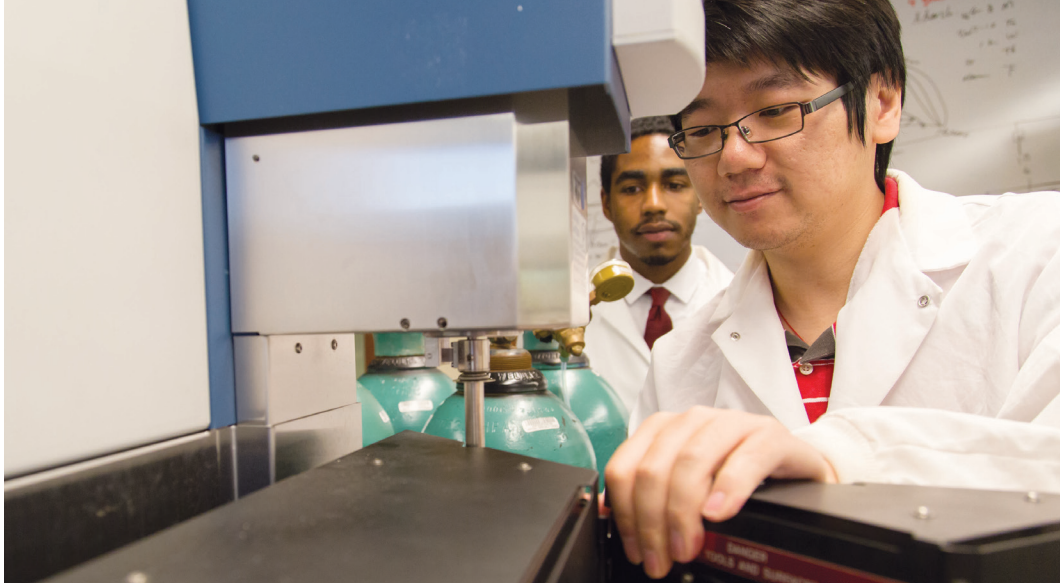
whether in academia or industry.

"The summer work taught me what a thoughtful scientific question was and how well-constructed questions lead to meaningful results," said DURI scholar Gireesh Reddy. "The experience was intense from day one and started a week after the Spring semester ended. I learned to work through challenges and accept their importance as part of the scientific process."

Caroline O'Brien, a DERI fellow and senior at Maggie Walker Governor's School, said of the experience, "When anybody asks me about DERI I love to go on and on about the work we are doing. I love being involved in something that can lead to real-world opportunities to help people."

The DURI and DERI programs also provide graduate, postdoctoral and new faculty mentors with invaluable proposal writing, leadership and teaching experience.

"Working with Adam has been great," said Zachary Canfield, DURI scholar, of his mentor, Adam Fischer. "He's more biology oriented and working with someone whose expertise lies within a field other than my own engineering background helps me to understand different concepts."



Above: Students in the research lab of Kenneth J. Wynne, Ph.D., test ice adhesion.
Below: Shilpa Iyer, Ph.D., stands outside of Engineering West Hall with her DURI students..

With the inaugural DURI and DERI classes of 2014 either well into their workflow or nearing the end of their commitments, the transformative reach of these new outreach initiatives can be felt by faculty, graduate students, postdoctoral trainees and undergraduate students alike.

"These are skills our students will use throughout their lives, whether they pursue careers in academia or in business," said Boyan. "There are few things more gratifying than seeing young people achieve an 'AHA' scientific moment and seeing the expression of joy on their mentors' faces."

"There are few things more gratifying than seeing young people achieve an 'AHA' scientific moment and seeing the expression of joy on their mentors' faces."

Teacher-Scholar awarded NSF grant for life-saving research

With her research in lung injury treatment gaining attention and momentum, **REBECCA L. HEISE, PH.D.**, an assistant professor in the Department of Biomedical Engineering, has been awarded a National Science Foundation CAREER grant for her project, "Propagation of Lung Fibrosis through Mechanotransduction." Almost a half million in support has already been provided for her continued research into discovering how the mechanical stretch of alveolar epithelial cells may affect lung fibrosis.

The National Science Foundation awarded **WEI ZHANG, PH.D.**, professor in Electrical and Computer Engineering, a half million dollar research grant to further his work in enhancing time predictability in GPU based hard real-time systems. Zhang's project focuses on creating new accelerator-based architectures with real-time predictability all while keeping high performance and energy efficiency. "This NSF grant will enable me to conduct exciting GPU research that can potentially benefit various real-time and safety-critical applications," he said.

XUBIN (BEN) HE, PH.D., was awarded a National Science Foundation grant valued at over $318k for his project entitled, "ASF: An Adaptive Scaling Framework for High Scalability of XOR-Based RAID Systems." This is the fifth NSF award presented to He, the graduate program director for the Department of Computer and Electrical Engineering, since he joined the VCU faculty in 2010. "Any business that uses a large amount of computer data storage can benefit from our research," He said.

Outstanding service: VCU Quest for Distinction recognizes Laboratory Manager, Josh Starliper

VCU's Quest for Distinction is a university-wide initiative to promote educational excellence, human health research and global engagement. In 2014, the Quest for Distinction recognized Josh Starliper, Laboratory Manager of the C. Kenneth and Dianne Harris Wright Virginia Microelectronics Center at VCU.

"I believe our Quest for Distinction is setting a goal toward bringing our engineering students into the forefront of what industry leaders are looking for," said Starliper, "not with book smarts but through practical hands-on research."

Biomedical Engineering wins big

Student, faculty and staff representatives from the VCU Department of Biomedical Engineering joined approximately 3,600 of their contemporaries, presenters and keynote speakers in San Antonio for the 2014 Biomedical Engineering Society Annual Meeting (BMES).

Of the twenty-eight students traveling, eight Biomedical Engineering (BME) students took home awards and special accolades, making VCU the recipient of 30 percent of all undergraduate research awards won.

"For many students this was their first time experiencing a national conference," said René Olivares-Navarrete, D.D.S., Ph.D.

Olivares-Navarrete's students, Sarah Ayad, Sarah Cameron, Imran Khatri, Devon Mason, Gireesh Reddy and Bhavya Vendra, won the Senior Design and Research Award. In addition, Reddy took home the Undergraduate Design and Research Award. Joseph Herbert was awarded a 2014 BMES Student Travel Grant, and Erin Hewett won the Reviewer's Choice Award.

"Seeing that VCU could put forth thirty people and the presence that size group brings was great for publicizing our strengths as an engineering school," said Reddy.

"Our students now know that they can compete with anybody in their fields," Olivares-Navarrete said.

Of the twenty-eight students traveling, eight Biomedical Engineering (BME) students took home awards and special accolades, making VCU the recipient of 30 percent of all undergraduate research awards won.

NVIDIA DESIGNATES VCU AS CUDA RESEARCH CENTER

In April 2014, the NVIDIA Corporation selected VCU as its latest Compute Unified Device Architecture (CUDA) Research Center.

NVIDIA is the inventor of the GPU. CUDA is a NVIDIA parallel computing platform and programming model designed to increase computing performance through the use of GPUs.

"High-performance computing, including the GPU-accelerated computing, is crucial to advance science and engineering discovery and to boost competitiveness in global economy, " said Wei Zhang, Ph.D. in the Department of Electrical and Computer Engineering (ECE) and the principle investigator of this VCU research center.

"CUDA helps other people leverage GPU capability," Weijun Xiao, Ph.D., VCU CUDA's co-principal investigator and assistant professor in ECE.

At VCU this new research affiliation will enable Zhang, Xiao, and third co-PI Hong-Sheng Zhou Ph.D. in the Department of Computer Science, to conduct advanced research in unified CPU and GPU software.

"GPU security is an important area to examine," said Zhou. "On one hand, we plan to use GPUs to accelerate secure computing on encrypted data and distributed secret data. On the other hand, given the popularity of GPUs, we plan to provide solutions to defend against a wide range of side-channel attacks, or design highly efficient solutions to address certain specific types of information leakage."

Benefits supported by VCU's partnership with CUDA include the donation of a Tesla K40 GPU Accelerator, discounted state-of-the-art equipment and live online training sessions.

More information about VCU CRC can be found at www.people.vcu.edu/~wzhang4/crc.html.

SENIOR DESIGN ALUMNI GIVE BACK

After Senior Capstone Design, the transferable skills students have acquired are put to the test in the job market. Mechanical Engineering students of the class of 2012, Andy Hobson and Tyler Berry, in coordination with their mentor, Bill Lamp, VCU Engineering Board of Trustees Advancement committee chair, formed a dynamic senior design team worthy of recognition for their marketplace success.

For their senior design project, Hobson and Berry provided the Byrd Theater, a Richmond historical landmark, with a comprehensive design report and analysis of their mechanical systems, HVAC and utilities. Now, two years later, their work may have contributed to the replacement of heating, ventilating, and air conditioning and mechanical equipment.

Hobson and Berry's journey to corporate success took off when the pair applied for the Mark A. Sternheimer Senior Design Award to support their ambitious project. As one of the administrators on the grant's board, Lamp took a liking to the community service venture.

"Senior design creates learning experiences and gives training in actual tools that students need to get a job right away," said Lamp.

From that point on, Lamp coordinated opportunities for Berry and Hobson to join forces with local companies and industry leaders. Today, Berry works as a Mechanical Engineer at Engineers Plus while Hobson is employed as a Sales Engineer at TLA Inc.

"I am now a member of the Sternheimer grant award committee," said Berry. "I look at projects and evaluate them right along with Bill. I am also the Vice President of the Alumni Board."

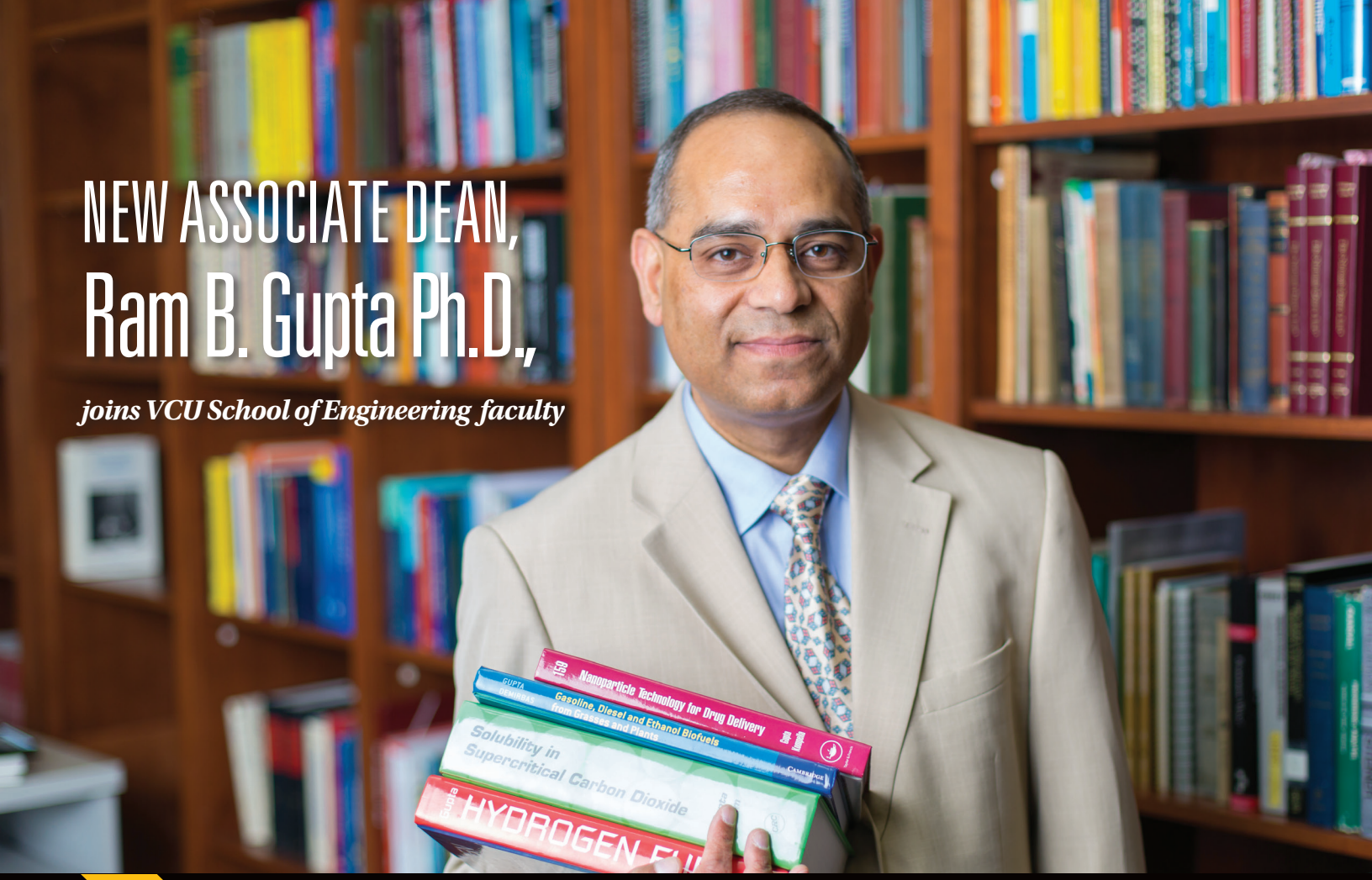
"This year I got elected to the Alumni Board," said Hobson of his continued involvement with the School, "and I am also a part of ASHRAE. ASHRAE helps set standards of building systems, sustainable technology and indoor air quality. I am trying to start a chapter here at VCU."

The alumni duo emphasized that the keys to success for the senior design are to generate student-inspired projects and to look for resources from the School and Foundation.

Berry said, "If there is an exciting project they will find the time to address it just like Bill did in any way shape or form for ours."

NEW ASSOCIATE DEAN, Ram B. Gupta Ph.D.,

joins VCU School of Engineering faculty



"Dr. Ram Gupta's commitment to excellence in research, funding and education complements VCU Engineering's own dedication to becoming one of the nation's greatest competitive research programs," said Dean Barbara Boyan, Ph.D. "We are thrilled to have him."

In August 2014, Ram B. Gupta, Ph.D., began his position as the new associate dean for research with the Virginia Commonwealth University School of Engineering. Gupta joins the School from his previous position as program director for energy for sustainability with the National Science Foundation (NSF). His experiences during his two and a half years as program director for one of the largest programs with the NSF will be invaluable as VCU develops its research programs in engineering.

Gupta's academic background includes nearly two decades as a professor of chemical engineering at Auburn University. He earned his Ph.D. in chemical engineering in 1993 from the University of Texas at Austin, followed by two years of postdoctoral work at the University of California, Berkeley.

He has held numerous board and consulting positions such as his current membership on the Editorial Advisory Board of the ACS Sustainable Chemistry & Engineering journal and his recent role as president of National Academy of Inventors – Auburn University chapter. Gupta's honors, awards and distinctions include the Auburn University Faculty Research Award. In addition to being a fellow of Alabama Academy of Science, Gupta is the recipient of its 2013 Wright A. Gardner Award, which acknowledges the outstanding work of researchers, educators, clinicians and industrialists in the state of Alabama.

"Dr. Ram Gupta's commitment to excellence in research, funding and education complements VCU Engineering's own dedication to becoming one of the nation's greatest competitive research programs," said Dean Barbara Boyan, Ph.D. "We are thrilled to have him."

"I hope to help VCU achieve its mission," Gupta said of the School's strategic plan, "as well as to work successfully at getting grants and connecting to industry and partners outside of VCU."

As associate dean, Gupta will assist faculty in finding available funding, coordinating with faculty to develop strong proposals and managing the allocation of received funds so that the grant process runs smoothly. Gupta also holds the position of professor with the Department of Chemical and Life Science Engineering. "I came to VCU to be a part of the growth trajectory and to make a lasting impact," he said.

NEW FACULTY

DEAN'S OFFICE

Ram B. Gupta, Ph.D.
Associate Dean for Research
"I came to VCU to be part of the growth trajectory and to make a lasting impact."

Ben Ward, Ph.D.
Associate Professor
"There is no substitute to the hands-on guidance provided by our industry and Health Science mentors to our Capstone Design students."

BIOMEDICAL ENGINEERING

Anathea Pepperl, Ph.D.
Assistant Professor
"I hope to study what makes learning engineering principles more accessible to students."

CHEMICAL & LIFE SCIENCE ENGINEERING

Shilpa Iyer, Ph.D.
Assistant Professor
"I would like to pursue mitochondrial genetics and bioenergetics and also develop non-linear educational programs."

Nastassja Lewinski, Ph.D.
Assistant Professor
"I am thrilled to be joining VCU and believe my research program will flourish in this interdisciplinary environment."

Christina Tang, Ph.D.
Assistant Professor
"I am committed to pursuing excellence in research and innovation as well as facilitating student success."

COMPUTER SCIENCE

Sevag Gharibian, Ph.D.
Assistant Professor
"I aim to bring VCU to the world stage in the exciting area of theoretical quantum computing."

Milos Manic, Ph.D.
Professor
"I hope to bring VCU to the world stage of Energy Security."

Bridget McInnes, Ph.D.
Assistant Professor
"I hope to continue and expand research into the processing of biomedical and clinical text."

ELECTRICAL & COMPUTER ENGINEERING

Carl Elks, Ph.D.
Assistant Professor

"I inspire students that making a difference for society starts with making a difference for one."

Yue Zhao, Ph.D.
Assistant Professor

"My experience in power and energy systems, vehicle electrification and commitment to teaching will allow me to achieve more at VCU."

MECHANICAL & NUCLEAR ENGINEERING

Charles Cartin, Ph.D.
Assistant Professor

"I would like to focus on developing a stronger undergraduate program across multiple engineering departments."

Laleh Golshahi, Ph.D.
Assistant Professor

"The vibrancy of the diverse university community reminds me that choosing VCU has undoubtedly been a wise choice."

Frank Gulla, PE
Assistant Professor

"I am able to use my industrial background to share my passion for engineering with students in all of my classes."

Ibrahim Guven, Ph.D.
Assistant Professor

"I am completely on board with the Quest for Distinction. You can feel the dynamic nature and uprising of this place."

James Miller
Assistant Professor

"I hope to use my commercial experience to enable my students to become more effective mechanical and nuclear engineers."

Reza Mohammadi, Ph.D.
Assistant Professor

"I work on superhard and superhydrophobic materials. It's super 'cool'!"

Supathorn Phongikaroon, Ph.D.
Associate Professor

"My ultimate goal is to make other people recognize VCU-MNE nationally in the area of used nuclear fuel reprocessing."

Jessika Rojas, Ph.D.
Assistant Professor

"I am looking forward to continuing with my research in areas such as nanomaterials for applications in nuclear medicine."

Wei-Ning Wang, Ph.D.
Assistant Professor

"I joined VCU, not only because it's one of the top urban research universities in the country, but also due to its brave strategic plan."

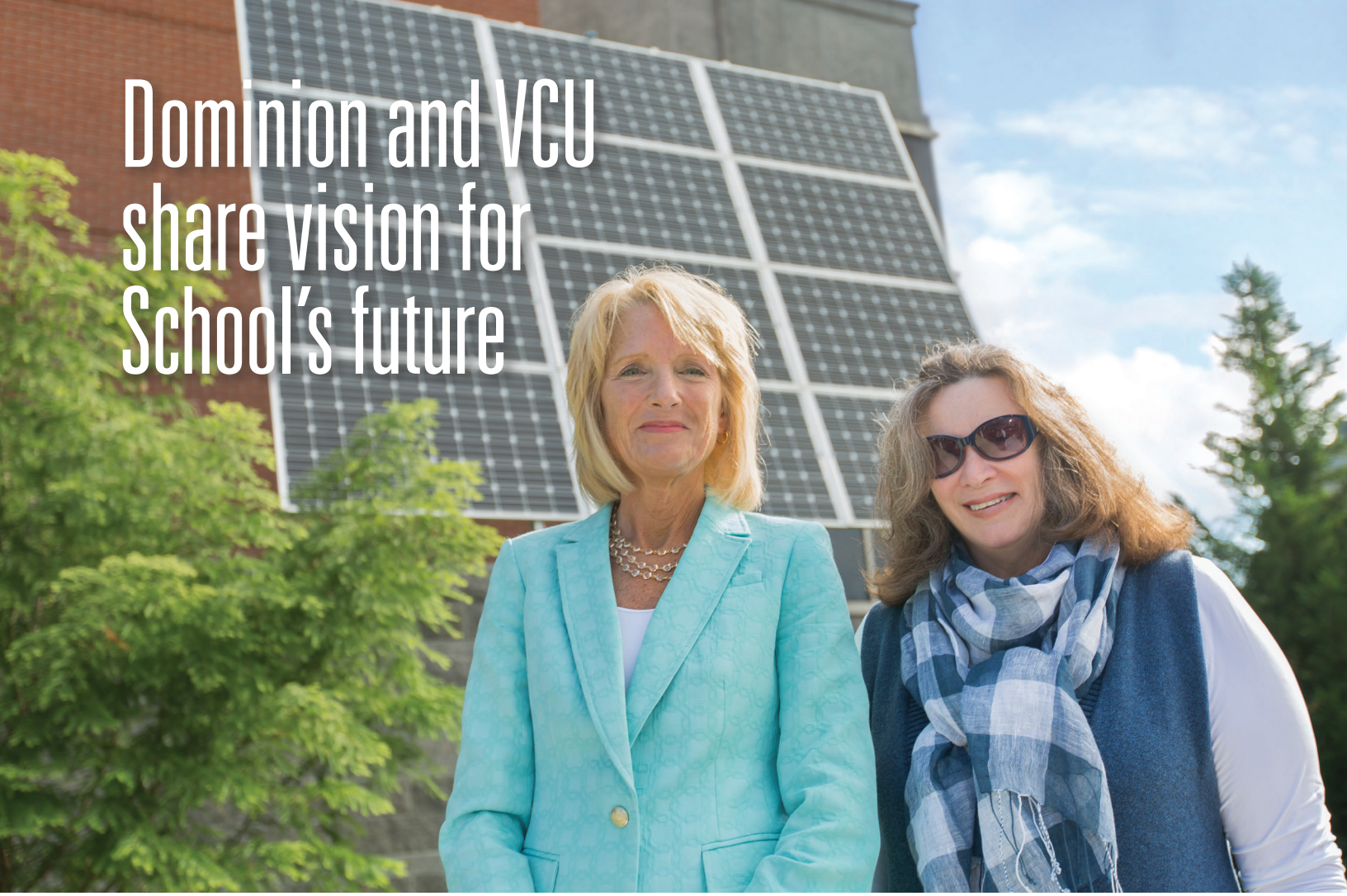
Woon-Hong Yeo, Ph.D.
Assistant Professor

"I wish to continuously develop new research in Bio-interfaced NanoEngineering at VCU."

Hong Zhao, Ph.D.
Assistant Professor

"I will bring my industrial research experience in thermal-fluid interactions and surface engineering to resolve challenges facing industry."

Dominion and VCU share vision for School's future



Mary Doswell, Senior Vice President for Retail and Alternative Energy Solutions at Dominion Virginia Power, began her term as Foundation Board President for the VCU School of Engineering in July 2014.

A major proponent of the School of Engineering and corporate-to-academic partnerships, Doswell served on the School's Board of Trustees from 2012 to 2013. Now she plans to increase the School's research opportunities for students and faculty with industry partnerships.

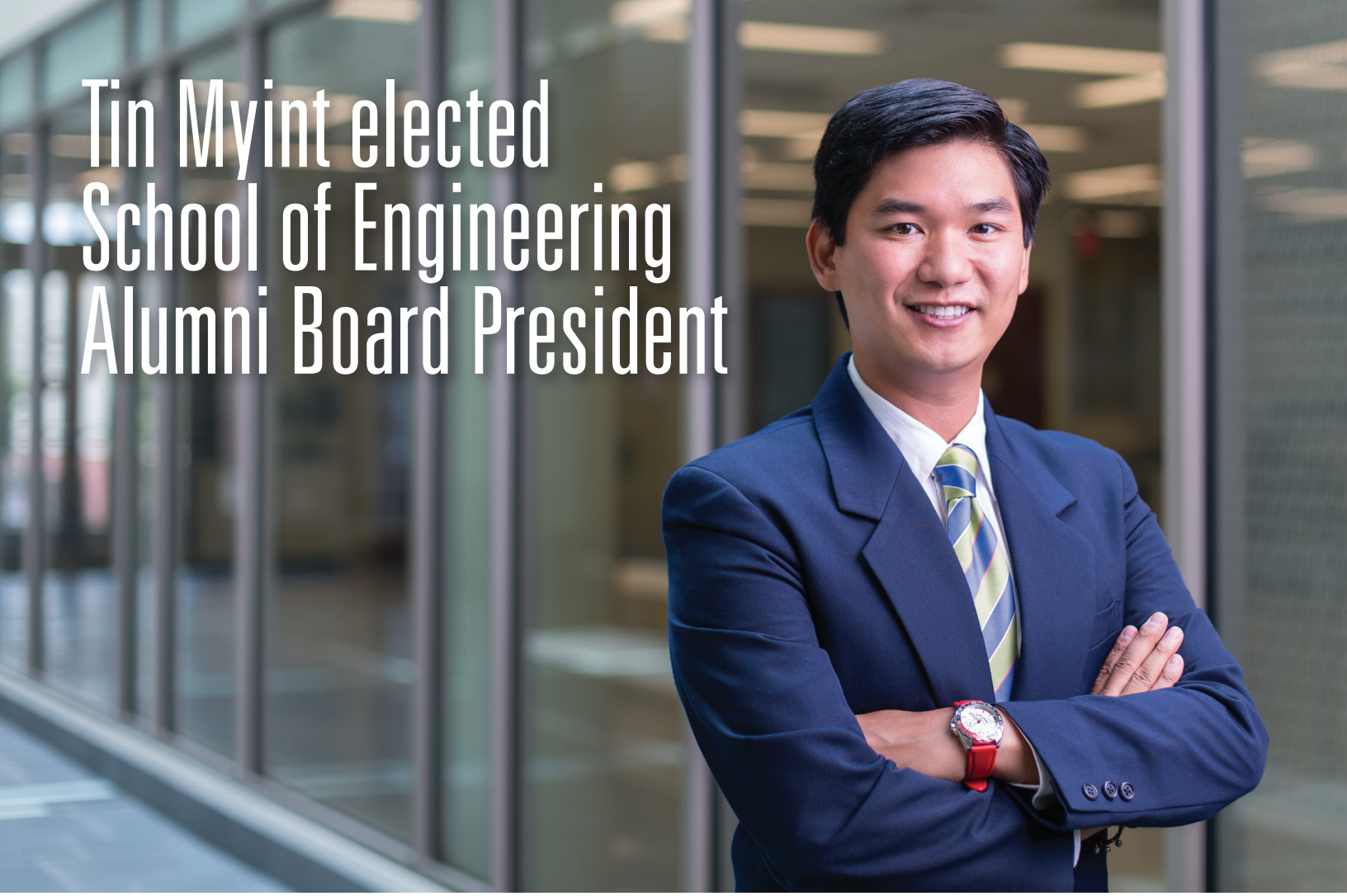
Since the arrival of Dean Barbara Boyan, Ph.D. in 2013, the idea of conducting research intended for commercialization, has become the School's unofficial criteria for research. Doswell, now on both sides of these partnerships, has noticed the School's push for research capable of commercialization. "Mary is a materials scientist and materials science is at the heart of engineering," said Boyan.

As the School adds more research programs to its curriculum, the opportunity for corporate partnerships increases. The recent growth of programs and research has sparked the interest of companies like Dominion and industry leaders like Doswell. "Just in her short tenure here, we are already seeing signs of this movement and there is a 'buzz' about what is going on at VCU," said Dowell. "I am all about making sure that we lay out a plan that clearly identifies the funding that is required in what time frame and the possible funding sources so that we can accomplish the School's goals and manage expectations along the way."

The 'buzz' has captured national interest. As VCU constantly evolves, new partnerships and industry support are the keys to sustained improvement. "With our recent growth, we must renovate our existing buildings to meet the research and educational challenges of the twenty-first century," said Boyan. "Our Foundation Board understands this. With the leadership of Mary Doswell, I am confident we will succeed."

This year, the School of Engineering rose 50 ranks in* U.S. News and World Report. *As VCU constantly evolves, new partnerships and industry support are the keys to sustained improvement.

Tin Myint elected School of Engineering Alumni Board President



This academic year, Tin Myint was elected to serve as the new School of Engineering Alumni Board President. Myint joined the Alumni Board in 2007, the same year he graduated from the School of Engineering. Over the past seven years, he has continued to play an active roll at his alma mater.

Before receiving his degree in mechanical engineering, Myint served as a member of the Student Government Association, American Society of Mechanical Engineers, Formula Society of Automotive Engineers and Virginia For Inspiration and Recognition in Science and Technology. This enthusiasm cultivated as a student, Myint says, led to his exuberant post-graduation participation. "It was natural for me to continue my involvement after I graduated," he said. "I want to share what I know with current students and the younger generation. Students can gain a lot from alumni because we were in their shoes not long ago."

Now working as a Product Development and Customer Solution Engineer at Dominion Voltage Inc., a subsidiary of Dominion Power, Myint credits his success to the practical experiences afforded to him at VCU. Additionally, he plans to work with the Alumni Board to ensure the continuation of these programs. "The engineering fundamentals that I learned in the classrooms became the tools that I needed to navigate in the real world," said Myint. "I want the School to be known for producing quality students that are ready for the real world."

His plan for strengthening the Alumni Board involves increasing alumni participation and attending school-sponsored activities, as well as supporting Dean Barbara Boyan, Ph.D.'s, vision and improving board accessibility to current students and faculty. "I plan to accomplish these goals with the support of the alumni board members," said Myint. "We have a strong team and many dedicated members."

"The engineering fundamentals that I learned in the classrooms became the tools that I needed to navigate in the real world," said Myint. "I want the School to be known for producing quality students that are ready for the real world."

VCU School of Engineering FACULTY

2014-2015 Academic Year

The Virginia Commonwealth University School of Engineering's growth strategy over the next five years includes unprecedented faculty recruitment and retention efforts. Why? So that our students get the very best instruction and the most meaningful real-world experience possible. It is with this dynamic future in mind that we applaud our talented and visionary faculty where they make it real for our students every day.

OFFICE OF THE DEAN

Barbara D. Boyan, Ph.D.

Dean

Professor and Alice T. and William H. Goodwin, Jr. Chair in Biomedical Engineering
E-mail: bboyan@vcu.edu
Phone: (804) 828-0190
Website: www.egr.vcu.edu/about/faculty-staff-directory/barbara-d-boyan-ph-d/
Research Topics:

- Tissue engineering
- Response of cells to biomaterials
- Mechanisms of action of hormones and growth factors in chondrocytes and osteoblasts
- Normal and pathological calcification

James E. Ames IV, Ph.D.

Director of Distance Learning Programs and CGEP Program
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Research Topics:

- Computer security
- Medical applications
- Semi-real-time algorithms
- Performance evaluation
- Graphics
- Database and networks

L. Franklin Bost, M.B.A., I.D.S.A.

Executive Associate Dean
E-mail: lfbost@vcu.edu
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Website: www.egr.vcu.edu/about/faculty-staff-directory/l-franklin-bost-mba-idsa/
Research Topics:

- Device Design and Development Processes
- Entrepreneurial Business Strategy and Development
- US FDA Quality System Regulations and ISO Medical Device Standards

Afroditi V. Filippas, Ph.D.

Associate Professor, Associate Dean for Undergraduate Studies
E-mail: avfilippas@vcu.edu
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Website: www.electrical-and-computer.egr.vcu.edu/faculty/filippas/
Research Topics:

- Numerical analysis techniques and software development for analysis and design of microwave and RF structures
- Signal processing and nonlinear statistical analysis techniques

Ram B. Gupta, Ph.D.

Associate Dean for Research
E-mail: rbgupta@vcu.edu
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Website: http://www.people.vcu.edu/~rbgupta/
Research Topics:

- Supercritical carbon dioxide technology
- Hydrogen fuel, renewable fuels, bioenergy and liquid fuels from biomass
- Nanoparticles and smart medicine

Lorraine M. Parker, Ph.D.

Director of Diversity and Student Programs
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Research Topics:

- Database design
- Fuzzy database
- Missing Information in relational database

Zvi Schwartz, Ph.D., D.M.D.

Associate Dean for Strategic Initiatives
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Research Topics:

- Bone Cartilage and mineralization and their relation to Vitamin D, sex hormones and local factors.
- Periodontal diseases, etiology and treatment
- The Effect of Vitamin D on Cartilage Cells in Vitro
- The Effect of Sex Hormones on Endochondral Bone Formation
- Role and Development of Bone Substitutes
- Surface Characteristics in Implant Success

Ben Ward, Ph.D.

Associate Professor
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Research Topics:

- Capstone Senior Design Program
- Innovation, design and development processes
- High Performance Polymers and Fibers
- Applications of Materials and Surface Science

BIOMEDICAL

Gerald E. Miller, Ph.D.

Professor and Chair

E-mail: gemiller@vcu.edu
Phone: (804) 828-7263
Website: www.biomedical.egr.vcu.edu/faculty/g_miller/
Research Topics:

- Rehabilitation engineering-analysis and design of devices to aid the disabled
- Man-machine interfacing-analysis and design of voice-recognition systems
- Artificial hearts-analysis and design of a multiple disk centrifugal blood pump

Ou Bai, Ph.D.

Assistant Professor
E-mail: obai@vcu.edu
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Research Topics:

- Algorithms and systems development of brain-computer interface
- Human motor control physiology
- Development of brain-computer interface-based device for patients with movement disorders
- System development of imagery-based motor learning for stroke rehabilitation
- Development of algorithms and graphic-user interface for investigation brain neuronal connectivity
- Development of algorithms and systems for computer-aided diagnosis
- Algorithm development of neurophysiological signal processing and classification
- Multimodal functional neural imaging

Barbara D. Boyan, Ph.D.
Dean
Professor and Alice T. and William H. Goodwin, Jr. Chair in Biomedical Engineering
E-mail: bboyan@vcu.edu
Phone: (804) 828-0190
Website: www.egr.vcu.edu/about/faculty-staff-directory/barbara-d-boyan-ph-d/
Research Topics:
- Tissue engineering
- Response of cells to biomaterials
- Mechanisms of action of hormones and growth factors in chondrocytes and osteoblasts
- Normal and pathological calcification

Daniel E. Conway
Assistant Professor
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Phone: (804) 828-2592
Research Topics:
- Mechanotransduction
- Live-cell imaging
- Cellular biomechanics
- Forces at intracellular junctions

Ding-Yu Fei, Ph.D.
Associate Professor
E-mail: fei@vcu.edu
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Website: www.biomedical.egr.vcu.edu/faculty/fei/
Research Topics:
- Bioinstrumentation
- Telemedicine
- Magnetic resonance imaging (MRI) techniques for studies of vessel properties and vascular hemodynamics
- Ultrasonic imaging techniques for studies of cardiovascular dynamics
- Technologies for radiation oncology

Rebecca L. Heise, Ph.D.
Assistant Professor
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Research Topics:
- Pulmonary mechanobiology
- Tissue engineering
- Smooth muscle cell signaling
- Cellular biomechanics

Sharon L. Hyzy
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Research Topics:
- Bone morphogenic proteins
- Animal defect models
- Biomaterial-cell interactions

Russell D. Jamison, Ph.D.
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Website: www.biomedical.egr.vcu.edu/faculty/jamison/
Research Topics:
- Innovation and entrepreneurship
- Leadership of teams in ambiguity
- K-12 STEM education
- Bioregeneration
- Tissue engineering

Christopher A. Lemmon, Ph.D.
Assistant Professor
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Website: www.people.vcu.edu/~clemmon
Research Topics:
- Mechanobiology of fibrosis
- Extracellular matrix biology
- Matrix Mechanics and Signaling in the Tumor Microenvironment
- Cellular traction forces
- Cell mechanosensing

Martin L. Lenhardt, Ph.D.
Professor
E-mail: lenhardt@vcu.edu
Phone: (804) 828-9687
Website: www.biomedical.egr.vcu.edu/faculty/lenhardt/
Research Topics:
- Non-invasive cerebral spinal fluid pressure device
- High noise speech communication system (Northrop Grumman Inc.)
- Baby echolocator: a device to allow deaf babies to "see" acoustically, facilitating perceptual motor development (NIH)
- Military echolator (DHS)
- Baby multimodal (bone construction and vibrotactile) hearing aid using algorithms to track mother's voice
- Tinnitus (phantom sound perception) management system using high frequency stimulation and custom actuator (US ARMY)

René Olivares-Navarrete, D.D.S., Ph.D.
Assistant Professor
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Research Topics:
- Surface Modifications for Dental and Orthopedic Implants
- WNT Signaling
- Mesenchymal Stem Cell and Biomaterials Interaction
- Osteoblast Differentiation and Maturation in Biomaterials
- Limb Regeneration
- Growth Factors in Bone Development and Regeneration

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Associate Professor
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Phone: (804) 828-9491
Website: www.biomedical.egr.vcu.edu/faculty/pawluk/
www.wp.vcu.edu/dtpawluklab
Research Topics:
- Devices and algorithms for assistive technology for individuals who are blind and visually impaired
  - Accessing graphical information
  - Navigation and orientation
  - Mobility aids
- Rehabilitation technology
  - Hand prostheses sensors and control
  - Traumatic Brain Injury therapy
- Human haptic perceptual organization
- The use of multi-modal feedback in teaching K-12 students

Anathea Pepperl, Ph.D.
Assistant Professor
E-mail: aapepperl@vcu.edu
Phone: (804) 827-3996
Website: www.biomedical.egr.vcu.edu/faculty/pepperl/
Research Topics:
- Use of high-frequency ultrasound to investigate wound healing
- Analysis of pressure mapping systems to investigate development of pressure ulcers
- Design of decision tools for the coordination of care for older adults
- Engineering education

Zvi Schwartz, Ph.D., D.M.D.
Associate Dean for Strategic Initiatives
E-mail: zschwartz@vcu.edu
Phone: (804) 828-5824
Website: www.biomedical.egr.vcu.edu/faculty/zvi-schwartz-ph-d/
Research Topics:
- Bone Cartilage and mineralization and their relation to Vitamin D, sex hormones and local factors.
- Periodontal diseases, etiology and treatment
- The Effect of Vitamin D on Cartilage Cells in Vitro
- The Effect of Sex Hormones on Endochondral Bone Formation
- Role and Development of Bone Substitutes
- Surface Characteristics in Implant Sucess

Jennifer S. Wayne, Ph.D.
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Research Topics:
- Experimental and computational modeling of diarthrodial joint function
- Structural stability of fixation constructs
- Articular cartilage: normal function, reparative techniques

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Research Topics:
- Eye tracking systems and eye movement analysis
- Effects of neurological diseases on eye movement control
- Visual task analysis
- Physiological instrumentation and signal processing systems
- Human-machine interfaces based on eye and head movement

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Research Topics:
- Biomaterials
- Cancer research
- Dendrimer
- Drug Delivery
- Gene therapy
- Nanoparticles
- Nanoscience and nanotechnology
- Smart polymeric materials and structures
- Tissue engineering

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Research Topics:
- Behavior and plasticity of stem cells
- Interactions of stem cells with microenvironments
- Clinically applicable stem cell therapy and translational stem cell research
- Stem cells and cancer
- Nanotechnology

CHEMICAL and LIFE SCIENCE

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Research Topics:
- Cross-coupling catalysis
- Flow chemistry/continuous chemical processing
- Organic synthesis in pharmaceutical applications

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Research Topics:
- Research and Development from conception to commercialization in various therapeutic areas including oncology, cardiovascular and infectious disease using small molecules, peptides and proteins.
- Process development of new and existing active pharmaceutical ingredients (APIs) from bench to commercial manufacturing of small molecules, peptides and pegylated peptides under cGMP.
- Development of efficient and cost effective processes using continuous synthesis and flow chemistry.

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Research Topics:
- Systems biology
- Synthetic biology
- Evolutionary biology
- Metabolic engineering
- Computational modeling

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Research Topics:
- Supercritical carbon dioxide technology
- Hydrogen fuel, renewable fuels, bioenergy and liquid fuels from biomass
- Nanoparticles and smart medicine

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Research Topics:
- Mitochondrial Genetics and Bioenergetics
- Induced Pluripotency
- Mitochondrial Disorders and Gene Therapy
- Telomere dysfunction and Genome Stability

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Research Topics:
- Undergraduate instructional laboratories

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Research Topics:
- Nanomaterial toxicity
- Nanomedicine
- Risk assessment of emerging technologies
- Comparative in vitro – in vivo analyses

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Research Topics:
- Phase behavior and modeling of polymer solutions at high pressures
- Phase behavior studies and fluid properties of mixtures at geologically relevant pressures and temperatures
- Novel materials for biomedical and pharmaceutical applications
- Supercritical fluid solvent technology utilized for processing natural and synthetic materials
- Scattering phenomena in polymer solutions at high pressures

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Research Topics:
- Protein Engineering: Peptide Biomimetics, Protein Misfolding, Protein-Protein Interactions
- Statistical Mechanics: Time Force Autocorrelations, Multiple Time Scale Perturbation Theory, Information Basis of Entropy and the Second Law

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Research Topics:
- Stem Cell Bioprocessing
- Biomaterials and Biomarkers
- Pluripotency
- Cancer Stem Cells
- Cellular Reprogramming
- Neural differentiation
- Cellular Engineering
- International Engineering Education

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Research Topics:
- Heterogeneous & Homogeneous Catalysis
- Metal Nanoparticles Synthesis
- Metal Catalyzed Reactions
- Microwave and Continuous Flow Reactions

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Research Topics:
- Smart polymer materials
- Polymer processing
- Hybrid materials
- Catalysis/biocatalysis
- Nanotechnology
- Biomaterials
- Biomedical imaging

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Research Topics:
- Biomaterials
- Tissue engineering
- Regenerative medicine
- Stem cell biology and engineering
- Biofabrication
- Drug testing, screening, and delivery
- Biomedical devise
- Bioreactor
- Nanotechnology
- Cancer Experimental Therapy

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Research Topics:
- Polymer surface science
- Fluoropolymer science
- Silicone science
- Functional polymer surfaces including biocidal polymers and self-stratified coatings for easy release of ice and fouling
- Nonlithographic patterning of functional polymeric materials

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- Single molecule biophysics
- Protein-protein and protein-surface interactions
- Optical biosensors
- Functional biomaterials
- Micro- and nano-fabricated devices
- Biophotonics

COMPUTER SCIENCE

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Research Topics:
- Machine learning
- Data mining
- Computational neuroscience
- Big Data
- Biomedical informatics

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Research Topics:
- Machine learning: nonlinear classification methods that incorporate existing knowledge into training
- Systems biology: integration of prior biological knowledge and multiple sources of data for pathway discovery
- Computational biology: analysis of role of protein mutations in evolution and disease

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Research Topics:
- Wireless Networks: security, localization, deployment and topology control, routing, cognitive networks
- Cyber-Physical Systems: underwater networks, RFID system on roads, mobile phone-based social systems
- Algorithm Design and Analysis: complexity analysis, approximation algorithm design and analysis

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Research Topics:
- Network vulnerability assessment
- Security and privacy in social networks and wireless networks
- Approximation algorithm, combinatorial optimization

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Research Topics:
- Security management; collaborative security
- Intrusion detection; malware/botnet detection
- Security in social networks, mobile networks, and cloud environment

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Research Topics:
- Quantum computing
- Computational Complexity Theory
- Algorithms

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Research Topics:
- Systems Biology: stochastic modeling and discrete event simulation.
- Reverse engineering, analysis and visualization of transcriptional and miRNA interaction networks
- Static/Dynamic modeling and control of network robustness
- Optimization problems in wireless networks

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Research Topics:
- Machine learning, data mining
- Bioinformatics, biomedical informatics
- Fuzzy logic modeling
- System dynamics modeling and analysis
- SVM Algorithms for large datasets

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Research Topics:
- Fuzzy-neural data mining techniques
- Energy Security
- Cybersecurity,
- Human-Machine Interfaces

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Research Topics:
- Natural language processing
- Computational linguistics

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Research Topics:
- Operating system and virtualization security
- Cloud computing security
- Security of networked systems

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Research Topics:
- Secure computing on distributed data
- Secure computing on encrypted data
- Cryptographic techniques against physical attacks
- Quantum (resilient) cryptography

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Research Topics:
- Theoretical and applied cryptography, Information security, and privacy quantum (resilient) cryptography.

ELECTRICAL and COMPUTER

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Research Topics:
- Hardware/software system design
- Embedded system performance modeling and design
- Unmanned aerial vehicle (UAV) flight control system design and testing
- UAV payload design, integration, and testing

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Research Topics:
- Micro and Nanofabrication
- Sensors & Transducers
- Energy Conversion Devices

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Research Topics:
- Development of hydrogen-peroxide molecular beam epitaxy of Zn0 and PZT
- Improvement of the Curie temperature and carrier concentration in GaMnAs magnetic semiconductors grown under near-stoichiometric conditions
- Investigation of the effect of heavy-ion irradiation on strain relaxation and defect structure in SiGe/Si lattice-mismatched heterostructures
- Demonstration of the influence of layer thickness on the strain-relaxation rate in SiGe/Si lattice-mismatched heterostructures

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Research Topics:
- Spintronics
- Nanomagnetism
- Nanoelectronics
- Computing paradigms
- Self assembly of nanostructures
- Carrier transport in quantum confined systems
- Optical properties of nanostructures

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Research Topics:
- Nanofabrication techniques
- STEM education

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Research Topics:
- Medical image processing
- Signal processor architectures
- Document compression for archiving
- Efficient, error-resilient, network-optimized image and video coding

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Research Topics:
- Embedded systems design and analysis
- Dependability analysis of Safety Critical Systems
- Cyber Physical Systems
- Cyber-security and vulnerability analysis of embedded systems
- Instrumentation and Control
- Human Machine Interface and Human Factors
- Sustainable and Renewable Energy

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Research Topics:
- Numerical analysis techniques and software development for analysis and design of microwave and RF structures
- Signal processing and nonlinear statistical analysis techniques

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Research Topics:
- Computer architecture
- Big data analytics
- High performance and reliable I/O systems
- I/O architecture and data storage
- Cluster virtualization

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- STEM education
- Medical image and signal processing
- Artificial neural network applications
- Science and technology in international development

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- GPS applications
- Neural networks
- Linear and nonlinear control theory
- Robotics for nuclear waste handling

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Research Topics:
- Group III-IV semiconductors
- Light emitting diodes
- Nitride semiconductor heterostructures
- Oxide electronics
- Microcavity lasers

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Research Topics:
- Sensory Intelligence
- Medical imaging
- Computer vision
- Robotics
- Online machine learning
- Adaptive target tracking

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Research Topics:
- Statistical signal processing and communications
- Data fusion and distributed signal processing in sensor networks
- Detection, estimation, and tracking
- Dynamic resource management in networked systems
- MIMO radar networks
- Compressive sensing

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Research Topics:
- Group III-nitride and zinc oxide optoelectronics
- Nonlinear optics
- Ultrafast spectroscopy
- Near-field optical microscopy
- Nanophotonics

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Research Topics:
- Programming languages
- Compiler design
- Automatic generation of software

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Research Topics:
- Cascading failures in power grids
- Energy system modeling and optimization
- Integration of renewable generation
- Voltage stability and controls
- Smart Grid Communication Architecture

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Research Topics:
- Real-time and Embedded Systems
- Computer Architecture
- Parallel Computing
- Graphic Processing Units (GPUs)
- Compiler
- Low-Power Computing
- Hardware Security

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Research Topics:
- Real-time and Embedded Systems
- Computer Architecture
- Parallel Computing
- Graphic Processing Units (GPUs)
- Compiler
- Low-Power Computing
- Hardware Security

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Research Topics:
- Electric motor control
- Renewable energy systems
- Smart grids and microgrids
- Condition monitoring, fault diagnostics and prognostics
- Energy storage system

MECHANICAL and NUCLEAR

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Research Topics:
- Chemical sensors
- Nanomaterials
- Radiation detectors
- Functional coatings
- Electroprocessing of polymers

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Research Topics:
- Hybrid spintronics-straintronics for ultralow power memory, logic and higher order information processing
- Nanomagnetism: Nanoscale magnetization dynamics
- Spintronics: Spin transport and manipulation in nanowires

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Research Topics:
- Experimental and computational thermal-hydraulics, two-phase flow and heat transfer for nuclear applications, including the development and verification of suitable thermal-hydraulic and heat transfer correlations
- Modeling of advanced nuclear systems and applications with subchannel, system and computational fluid dynamics (CFD) codes
- Design of advanced nuclear power plant concepts that rely on sophisticated thermal-hydraulic phenomena (e.g. natural circulation, supercritical water systems, molten salt systems, liquid metal systems)
- Nuclear safety and severe accidents
- Energy and environmental policy, energy planning and nuclear infrastructure development, in support of emerging and expanding nuclear programs
- Public perception, as well as education, communication and outreach in the area of nuclear science and technology

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Research Topics:
- Device Design and Development Processes
- Entrepreneurial Business Strategy and Development
- US FDA Quality System Regulations and ISO Medical Device Standards

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Research Topics:
- Design engineering
- Design optimization
- Engineering education
- Fuel cell and hybrid technology
- Manufacturing engineering
- Materials engineering
- MEMs technology and devices
- Rapid prototyping processes
- Solid mechanics

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Research Topics:
- Nanoparticles and nanotechnology
- Powder and spray technology
- Particle instrumentation and characterization
- Particle coating, charging, fluidization and transport
- Filtration and separation
- Air pollution and indoor air quality control
- Drug target delivery and release control
- Synthesis of functional particles for pharmaceutical and biomedical applications
- Health effect and toxicity of particles
- Multiphase chemical reacting flow and reactors
- Micro-contamination control in semiconductor manufacture processes
- Atmospheric aerosol

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Research Topics:
- Fluids in motion
- Flow control
- Viscous pumps and microturbines
- Micro- and nanotechnology
- Large-scale disasters

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Research Topics:
- Aerosol Medicine
- Health-related Aerosol Exposure Control
- Gas and Aerosol Transport in Biological Systems
- Gas-Solid Separation and Filtration
- Biotherapeutics
- Particle Engineering
- Heating, Ventilation and Air Conditioning

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Research Topics:
- Engineering education
- Process control engineering
- Manufacturing engineering
- Total quality management

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- Micro/nano-scale characterization
- Fracture and failure analysis using peridynamics and multi-scale modeling of physical phenomena

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Research Topics:
- Respiratory drug delivery and inhalers
- Nanoaerosols
- Targeted drug delivery systems
- Multiphysics modeling
- Respiratory gas delivery

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Research Topics:
- Photovoltaic materials and devices
- Power generation
- Energy conversion systems
- Engineering education
- Optical characterization of semiconductor materials

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- Engineering education
- Reactor simulation
- Reactor theory
- Nuclear power plant design

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Research Topics:
- Ultra-incompressible superhard materials
- Thin film deposition and Characterization
- Superhydrophobic materials
- Wetting phenomena
- Friction materials
- Tearing energy of sheet metals
- Metal forming
- Elasticity & plasticity

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Research Topics:
- Energy harvesting
- Smart materials

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Research Topics:
- Pedagogy and research in the area of nuclear and chemical separation technology in Fuel Cycle Research and Development
- Electrochemical processes – theoretical and experimental studies in electrorefinery, electrolytic oxide reduction and chemistry, and ion exchange
- Special material detection and analysis via laser and mass spectroscopy techniques
- Interfacial phenomena and multi-phase flow systems involving in nuclear and chemical engineering applications

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Research Topics:
- Radiation-induced synthesis of nanomaterials
- Modification of nanomaterials properties through irradiation.
- Radiation damage and radiation effects on nuclear materials
- Development of nanomaterials as carriers for radioisotopes in targeted radioimmunotherapy (RIT), targeted alpha therapy (TAT), and medical diagnostic imaging

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Research Topics:
- Smooth muscle biomechanics
- Robotic devices for medical applications
- Robotic inspection systems

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Research Topics:
- Nanoelectromechanical systems (NEMS)
- Electrokinetic nanoengineering
- Nanomaterials
- Nanofabrication
- Advanced microscopy
- Nanomechanics
- Small-scale energy storage/harvesting/generation

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Research Topics:
- Response dynamics and vibrations of offshore drilling and production systems and equipment arising from various sources of excitation (wind, waves, currents, seafloor soil conditions, fluids, pressure, thermal, floating platform motions)
- Deepwater marine riser systems and the various nonlinear effects arising from the six degree-of-freedom motions of ships and floating platforms, vortex-induced vibrations, axial dynamics, and three-dimensional nonlinear interactions of the riser systems
- Simulation and control of sophisticated, high-capacity tensioning systems with mechanical, fluid, and thermal transients and floating platform motions are examined by computational methods for operational situations

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Research Topics:
- Superhydrophobic surfaces and interfacial phenomena
- Multi-phase fluid transport in fibrous porous media
- Aerosol flows and nanoparticle filtration
- Heat and mass transfer in porous media
- High-speed jets and nozzle design
- Molecular dynamics simulation

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Research Topics:
- Actinide bearing ceramic nuclear fuel
- Nuclear structural materials
- High temperature materials processing and mechanical testing
- High temperature irradiation behavior of ceramics including mechanical properties and microstructural changes
- Materials-coolant interaction
- High temperature deformation mechanism maps
- Neural networks for probabilistic risk assessment
- Design of nuclear materials irradiation experiments
- Nanofluids for reactor applications
- Computational methods in nuclear reactor physics and advanced nuclear reactor design

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Research Topics:
- Nanomaterials design and synthesis for energy, environmental and medical applications: e.g., catalysts, electrodes, luminescent materials, sensors, and porous materials
- Aerosol process development for thin film deposition, particle synthesis/coating, measurement, and delivery
- Self-assembly of nanomaterials inside gas phase (micro-dropets) and liquid media (bulk)
- Clean coal technologies (oxy-coal combustion, carbon/particle capture, storage and conversion)
- Membrane separation and particle filtration for water treatment and air quality control

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Research Topics:
- Bio-interfaced NanoEngineering
- Skin-Like Electronics for Health Monitoring
- Human-Machine Interfaces via Soft Electronics
- Brain-Computer Interfaces via Stretchable Electronics
- Nanosensors for Disease Diagnostics

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Research Topics:
- Superhydrophobic and superoleophobic surface design
- Solid-liquid surface interactions
- Thermal-fluid interactions across multiple length and time scales
- Self-assembled nanostructured material synthesis
- Micro-/nano-manufacturing and 3D printing

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Pictured above: The apex of Engineering West Hall.

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