The Scope

Vol. 2016

With articles by Paige Bellamy, Ryan Carstons, Kirby Farineau, Joseph Forcier, Vanessa Gleiser, Malik Hall, Jacob Jaminet, Joseph Johnson, Rebecca Jones, Jessica Mayfield, Riley Murtagh, Nicole Nelson, Christopher Rubis, and Shawn Scornaienchi.

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About *The Scope*

This magazine was produced by students in Science Journalism (MASC 491-005), which was taught during the Fall 2016 semester by Jeff South, an associate professor in the Robertson School of Media and Culture at Virginia Commonwealth University, and Sara Williams, head of academic outreach for VCU Libraries.

The course, VCU's first focusing exclusively on science reporting, was supported by a grant that funds projects aligned with VCU's strategic plan, called Quest for Distinction. VCU selected the Science Journalism course as a "disruptively innovative idea" and as a way for students to "make it real." The Quest Innovation Grant funded the publication of this magazine as well as other aspects of the course.

The course brought together students from a range of disciplines. The goal was to help journalism and other mass communication majors think like scientists, and to help students in STEM fields (science, technology, engineering and math) write like journalists. We believe the stories demonstrate that the course was a success. Enjoy!

– Jeff South and Sara Williams

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An advocate for minorities in science

Growing up in St. Kitts, Dr. Teshell Greene of VCU's Biology Department knew she wanted to study science. She went on to blaze a trail for other underrepresented minorities in the field. Now she deconstructs the idea of diversity at VCU.

WRITTEN BY
Paige Bellamy

TAGS
diversity, underrepresented minorities, racism

PUBLISHED
Nov. 1, 2016

It isn't every day that a smart, young woman from the Caribbean island of St. Kitts (population 46,000) moves to New York City (population 8.5 million). Unfortunately, it is all too common for a woman like this to experience sexism and racism in the field of science.

Dr. Teshell Greene, an instructor in the VCU Department of Biology, knew that she wanted to study science since she was a teenager. St. Kitts, with its West Indies neighbor, St. Nevis, represents the smallest nation in the Americas

Dr. Teshell Greene of the VCU Department of Biology

At Pace University and elsewhere in the Big Apple, Greene says she felt accepted: 'You don't experience racial tension in New York City.'

and still follows the English system, leading 13- and 14-year-old students to choose the career path that they want to pursue.

For Greene, the choice was easy. She moved to New York at 14 and kept pursuing science. She earned her undergraduate degree in chemistry from Pace University and then her Ph.D. from the University of Pennsylvania. She has taught at the University of Richmond and Virginia State University and now teaches at VCU.

At Pace and elsewhere in the Big Apple, Greene said she felt accepted: "You don't experience racial tension in New York City."

That feeling disappeared when she moved to Pennsylvania. Greene said she was once refused service at a bank. She was also singled out by her medical pharmacology professor in front of the whole class, while a white, male counterpart, who ended up getting a worse grade, was "babied."

While at Penn, the underrepresented minorities – URMs – formed their own support system, finding none from their school.

VCU often touts its commitment to diversity. How does Greene feel about that?

"Completely disappointed," she said. "The university doesn't understand the culture of where students are coming from."

The school puts a lot of effort into recruiting diverse students, but behind the scenes is a completely different story, Greene said. "Numbers start dwindling; you can't maintain them."

The faculty is a similar story. Greene said there is only a handful of URMs in the Biology

VCU puts a lot of effort into recruiting diverse students, but behind the scenes is a different story, Greene says. 'Numbers start dwindling; you can't maintain them.'

Department. Even then, she said, some of the older male faculty members look down on their younger female counterparts.

"They don't want to listen," she said.

Greene hopes the URMs will form their own support system, as she did at Penn. She is also hopeful that the new dean of the College of Humanities and Sciences, Dr. Montserrat Fuentes, will implement programs that will help sustain minorities.

Before coming to VCU, Greene studied gene therapy, a way to correct genetic disorders by transplanting normal genes into cells to replace missing or defective genes. In the field of science, gene therapy has exploded since its first successful implementation in 1989, quickly becoming commonly used in numerous clinical trials.

While her field has seen immense growth in recent years, Greene does not expect the same kind of rapid progress when it comes to supporting underrepresented minorities.

"Richmond goes slower," she said. •

Researcher studies nervous system development

Using zebrafish, Ph.D. candidate Ashley Purdy hopes to set the stage for research that could cure neurodevelopmental disorders like multiple sclerosis or epilepsy

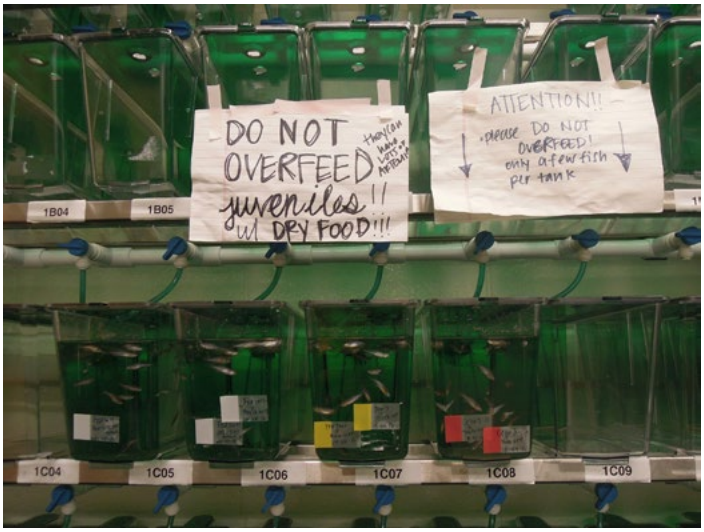
WRITTEN BY
Paige Bellamy

TAGS
axons, neurons, zebrafish

PUBLISHED
Dec. 5, 2016

When you open your eyes in the morning, what told your brain that they needed to open? When you pull the blankets off your body and goose bumps spring up in the brisk cold of the winter sunrise, what told your skin to feel cold? When you yawn and take in a deep breath, what told your brain it needed more oxygen?

The chatty Cathys in your body are your neurons. They report to your brain, and in turn, the brain dictates to other neurons how to respond – whether it's a muscle movement,



Zebrafish that VCU researchers use to study nerve cells. (Photo by Paige Bellamy)

‘You don’t think about all the steps that are required for [a nervous system] to function normally and to have all the neurons in your brain migrate to where they need to go,’ Ashley Purdy says.

an indicator that you should get back under the covers, or just a large intake of O2.

A harder question to answer is how those gossipy neurons came to be in their exact locations when you were still just a fertilized embryo.

Ashley Purdy, a Ph.D. candidate at VCU, recently finished a master’s degree in biology looking at the development of the nervous system, and specifically at how your neurons align themselves in the spinal column.

Acting as the master mail delivery system in the body, the central and peripheral nervous systems are made up of the brain, the spinal column and nerves.

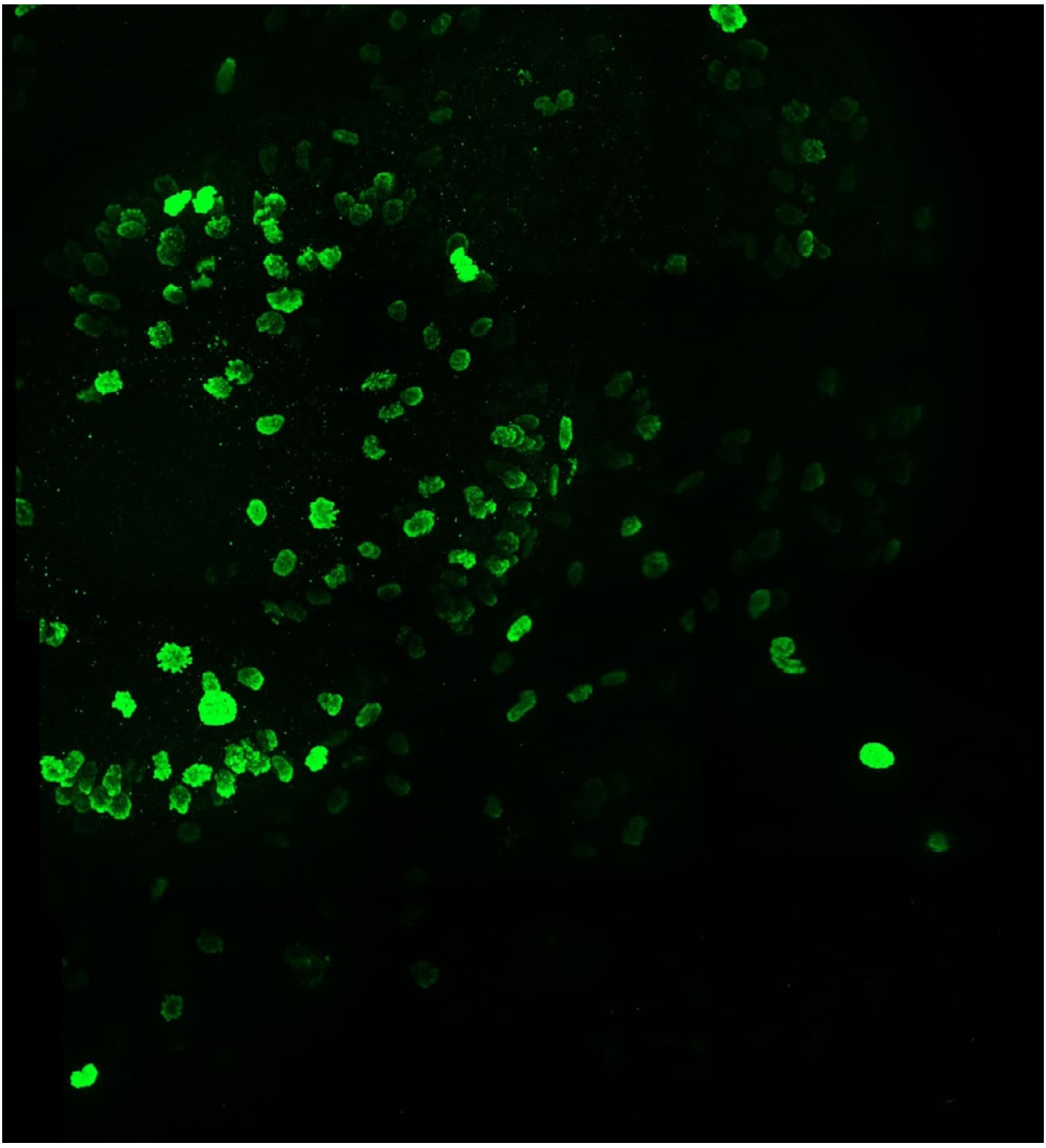
The nerve cells, or neurons, contain axons. These axons act as a post office, making sure the information packages get sent to the correct places in the body. To work correctly, the axons need proteins to form structures in the cell.

Purdy’s research renders these essential proteins null. This allows Purdy to see how each protein affects the development of the nervous system as a whole.

Your body’s “post office” often has expedited shipping in the form of a myelin sheath. This is a fatty material that preserves the electrical signal – the important package being sent from neuron to neuron, for example. Purdy’s master’s thesis centered on this sheath of cells and how it is formed.

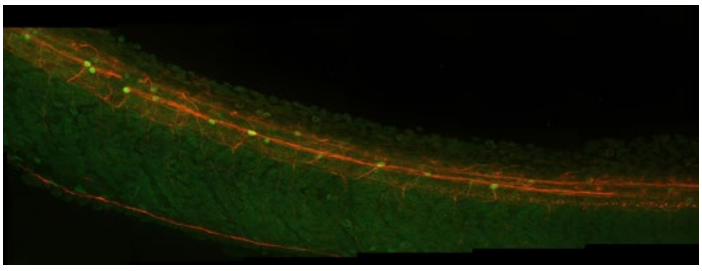
If you didn’t realize how complicated it was to just open your eyes or break out in goose bumps, you aren’t alone.

“You don’t think about all the steps that are



Proliferating cells in a zebrafish eye. (Photo courtesy of Ashley Purdy)

Ashley Purdy, who earned her master's degree in biology at VCU and is now pursuing her Ph.D.



A lateral view of neurons in the dorsal part of the zebrafish spinal cord. (Photo courtesy of Ashley Purdy)

required for [a nervous system] to function normally and to have all the neurons in your brain migrate to where they need to go," Purdy said.

For her master's and her Ph.D., Purdy has been working under Dr. Gregory Walsh, a developmental neurobiologist who joined VCU's Department of Biology in 2011.

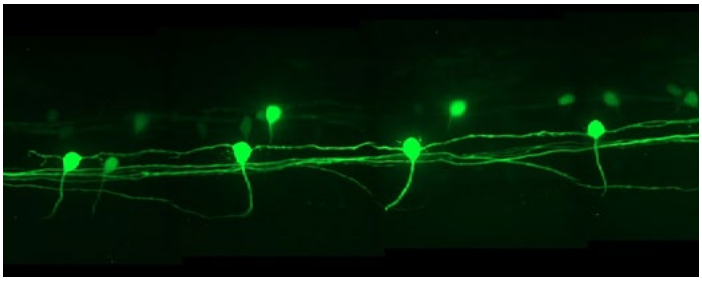
Walsh and Purdy don't just work together. They also share a similar story of "falling into" the field of neuronal development. Both began their journeys as undergraduates conducting research as an independent study and neither have strayed far from the brain since.

Since coming to VCU and establishing his lab, Walsh is happy with its progress, but he doesn't want to expand.

"I find that your interaction with each of the students decreases the more you have in the lab. [..] I don't want to get any larger because I don't want to lose that interaction," he said. "We just want to move our projects forward and try to uncover some of the molecular mechanisms that are important for neural circuit assembly."

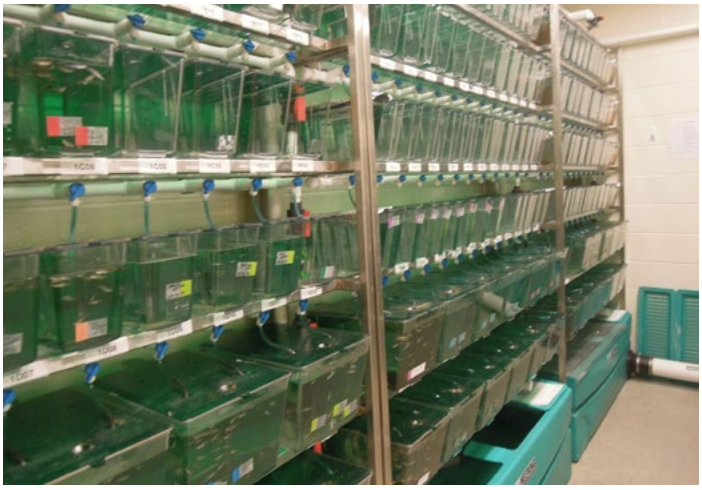
Three Ph.D. candidates and a master's student are running a few different projects in the Walsh Lab in hopes of answering questions about how neurons and the nervous system function. Purdy hopes to do her Ph.D. project in the lab, but she hasn't fleshed out the details yet.

The research could shed light on how neurodevelopmental disorders, like multiple sclerosis or epilepsy, occur. Multiple sclerosis is a disease that damages the myelin sheath on the nerve cells, creating problems for the transmission of the electrical signals.



An up-close look at the neuron cell body and its wispy axon fibers. (Photo courtesy of Ashley Purdy)

By using zebrafish, the researchers can more accurately hypothesize how the human nervous system might respond when the proteins are out of commission.



Rows of containers housing zebrafish. (Photo by Paige Bellamy)

Purdy has researched multiple proteins that, if damaged or missing, may prevent the cells from "getting to the right place, so they are unable to myelinate, which could have implications in MS down the road."

Purdy and the Walsh Lab don't use human embryos to study the development of the nervous system. They use zebrafish, a striped, freshwater minnow popular with aquarium hobbyists and research scientists alike.

One reason for using zebrafish is their unique embryos. The zebrafish embryo is transparent, which allows Purdy and other researchers to shine a laser onto the fertilized embryo and detect any changes in their development.

Another reason relates to the big picture of the study. The proteins "might behave differently in a cell culture than in an organism," Purdy said. By using the fish, the researchers can more accurately hypothesize how the human nervous system might respond when the proteins are out of commission.

In the end, after years of hard work, recognition for the researchers' important work may never come. "We aren't looking for a cure, mostly because there is lots of fundamental research that needs to be done before that can be tackled," Purdy said. "There are a lot of things that are still unknown that we need to figure out before we can make those leaps."

But when a cure for multiple sclerosis is finally found, be sure to check the works cited section at the bottom of the paper for Ashley Purdy's name. •

A wonder drug against cancer, HIV and other diseases?

Researchers at the Massey Cancer Center have found that AR-12 can neutralize the proteins that protect cancer cells. The drug also may be effective against Ebola, Zika and bacterial infections.

WRITTEN BY
Ryan Carstons

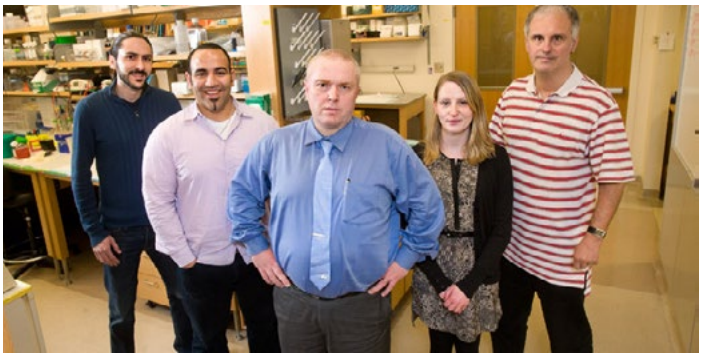
TAGS
AR-12, cancer, chaperone proteins

PUBLISHED
Nov. 1, 2016

Chaperones make sure students stick together during class field trips. The cells in your body have chaperones, too: “chaperone” proteins that keep a cell’s shape intact. Usually, that’s good. But when someone has cancer, these proteins allow cancer cells to reproduce and spread throughout the body.

So a VCU researcher has found a way to ditch those annoying chaperone proteins – and stop the spread of cancer – just like students might ditch their chaperones on a field trip.

‘We saw interesting effects with the AR-12 drug against those viruses and against bacteria,’ Dent says.



Dr. Paul Dent, center, and his team of researchers at the Massey Cancer Center. (Photo courtesy of Dr. Dent)

Dr. Paul Dent, a researcher at VCU’s Massey Cancer Center, is experimenting with a new drug that targets the chaperone proteins that protect cancer cells.

The drug, called AR-12, overrides the chaperones from holding a cell’s shape. AR-12 does its damage by breaking apart the host cell, which is needed for cancer cells to reproduce (otherwise they’ll die). This secret weapon has the potential to fight off not only cancer but also Ebola, Zika and the human immunodeficiency virus, as well as bacterial infections.

“We saw interesting effects with the AR-12 drug against those viruses and against bacteria,” Dent said.

He said cancer cells are very active, thus creating more enzymes. Once the cancer attaches to a cell, chaperone proteins stick with the enzyme and keep it together. But AR-12 can render the chaperones useless.

“These proteins are flopping around like a jellyfish out of water when they’re catalyzing, which means they can fall out of shape easily,” Dent said. “And if they fall out of shape, they’re dead.”

The chaperones protect the cancer by giving it a safe place to live. “The chaperone is snuggled up to the enzyme,” Dent said. “And if the enzyme should ever get a bit incorrectly shaped, the chaperone spends some ATP (adenosine triphosphate) energy and keeps it together.”

You can’t destroy the cancer while the chaperones are protecting it. And neutralizing the chaperones is tricky because there is more than one kind.

One family of chaperone proteins is called

You can't destroy the cancer while the chaperones are protecting it. And neutralizing the chaperones is tricky because there is more than one kind.

HSP90; another is HSP70. Dent said that when HSP90 is attacked, HSP70 is formed – and vice versa. This has posed issues for researchers because when they target one chaperone family, a different one replaces it and protects the cell.

Previous chaperone inhibitors could target only HSP90 or HSP70. This where the drug AR-12 is useful: It blocks both the HSP90 and HSP70 families.

"Unlike many drugs that target one specifically, this drug targets both, albeit not as potently," Dent said. When AR-12 prevents the chaperones from holding a cell together, the cell loses its shape and kills the cancer.

But this possible wonder drug is not on the market yet. Research has been done on AR-12 for years now, but the drug's owner, Arno Therapeutics, is still seeking approval from the U.S. Food and Drug Administration.

"AR-12 was tested in cancer patients. Although it was safe and showed some activity, the drug uptake in patients was variable," Dent said. "So the FDA told Arno Therapeutics they needed to reformulate AR-12 before doing more clinical work."

Dent said he is disappointed that the company hasn't reformulated the drug so that testing can resume.

On its website, Arno Therapeutics describes itself as "a biopharmaceutical company that focuses on the clinical development of targeted cancer therapies and novel drug candidates for unmet medical needs." •

Vaginal probiotic may help in pregnancy

Microbiology researcher Nicole Jimenez is studying how bacteria in the vaginal canal can positively influence the growth of a healthy infant

WRITTEN BY
Ryan Carstons

TAGS
bifidobacteria, probiotics, vaginal canal

PUBLISHED
Dec. 5, 2016

Consuming probiotics is a healthy fad that nutritionists and doctors are encouraging; eat enough, and your digestion will improve. However, millions of “good” bacteria live in us and perform healthy functions. Women, for example, have probiotics that originate in the vaginal canal. One particular kind of bacteria there may provide benefits during pregnancy.

Dr. Nicole Jimenez, a microbiology researcher at VCU, is experimenting with a microorganism called bifidobacteria in hopes that it might help

Microbiology researcher Nicole Jimenez

us understand the development of the infant gut microbiome.

“I’m researching the role this species plays in the vaginal microbiome and how it may provide insight into infant gut development,” Jimenez said.

Studies have been performed on bifidobacterium breve, a species in the Bifidobacteriaceae family, but not many in the vaginal canal.

Bifidobacterium breve is found in gut, oral, human milk and vaginal microbiomes. Previous studies have examined the transmission of commensal bacteria. They show how microbial succession occurs within the gut microbiome of an infant via interaction with the mother’s microbiomes.

“B. breve is theorized to provide a protective role in the vaginal community as it has played a beneficial role in the gut microbiome,” Jimenez said.

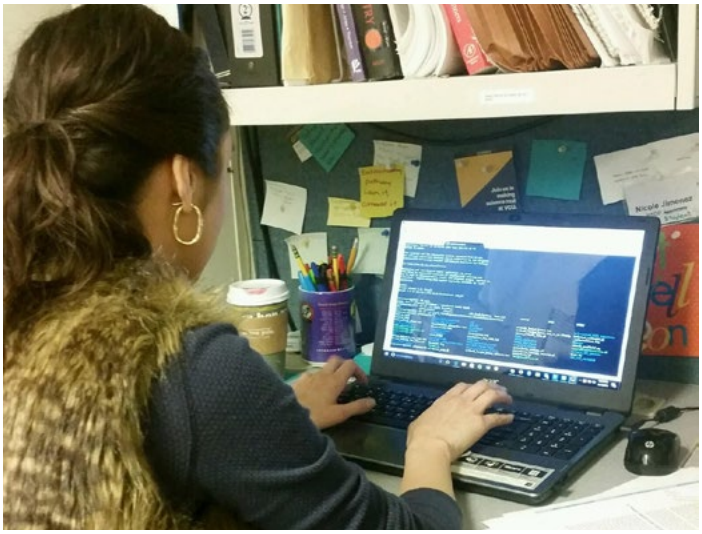
Jimenez says researchers from the Vaginal Microbiome Consortium at the Medical College of Virginia collected samples from a group of women 18 and older. She helped select 12 vaginal samples with assistance from the VCU Nucleic Acid Research Facility to find their genomic sequence. Jimenez is comparing these strains to B. breve genomic sequences from other areas: in human milk, the gut, the mouth and vaginal sites.

“For Aim #1, we focused on the Pan-genome Analysis of Human Niche Specific Bifidobacterium breve strains,” Jimenez said. “We selected samples from women with no current gynecological diagnosis with a B. breve vagitype.”

‘B. breve is theorized to provide a protective role in the vaginal community as it has played a beneficial role in the gut microbiome.’

Dr. Jimenez is researching the role that bifidobacteria plays in the vaginal microbiome.

Her research may provide insight into infant gut development. (Photo courtesy of Dr. Jimenez)



Dr. Jimenez says more extensive research will be done because she is still analyzing the data. (Photo courtesy of Dr. Jimenez)

Jimenez found that the genomic sequences of vaginal B. breve are similar to the genomic sequences of vaginal B. breve from other body sites. However, she says there is plenty more work to accomplish.

“For Aim #2, we wanted to understand the stability of B. breve in the vaginal microbiome over time – in this case, approximately one year,” Jimenez said.

“We selected paired vaginal samples from three women who completed two annual clinical exam visits approximately one year apart and who exhibited at least 25 percent abundance of B. breve in their vaginal microbiome at both visits. Half of these samples exhibited the B. breve vagitype of greater than 35 percent abundance, so three were [also] included in Aim #1.”

Jimenez says VCU’s Nucleic Acid Research Facility performed basic bacterial culturing techniques and genomic preparation for DNA sequencing.

Once Jimenez received the genomic sequence, she could begin identifying “genomic differences and metabolic differences between sequences either from different niche-strain isolates or different isolates from different time points.”

More extensive research will be done because she is still analyzing the data.

“My work is pertinent to the field because it adds more vaginal sequences for future comparative genomic work, since currently there is lack of vaginal Bifidobacterium sequences,” Jimenez said. •

Exploring links between diabetes and depression

Dr. Briana Mezuk probes how mental health and physical health are related, and how people must develop healthy ways to react to stress

WRITTEN BY
Kirby Farineau

TAGS
depression, diabetes, stress

PUBLISHED
Dec. 5, 2016

Some people may think mental health and physical health are completely unrelated, but in fact, they are closely linked, says Dr. Briana Mezuk, a researcher and professor at VCU.

She has devoted years of her career to exploring the various connections between physical health disorders and mental health disorders. In her research, Mezuk also focuses on racial disparities in certain chronic diseases such as heart disease and diabetes and on how economic conditions contribute to overall health.

‘In this country, there are substantial racial disparity in nearly every (physical) health condition you could think of,’ says Dr. Briana Mezuk.

Dr. Briana Mezuk

Mezuk recently was awarded a grant from the C. Kenneth and Dianne Wright Center for Clinical and Translational Research at VCU to study the relationship between diabetes and depression. In that research, she will observe how people respond to stress.

“It’s important for doctors especially to know that health is really a developmental process,” said Mezuk, who views a person’s health as comprehensive and multifaceted. One facet of health that she has researched involves race.

“One of the interesting things about mental and physical health is that in this country, there are substantial racial disparity in nearly every (physical) health condition you could think of,” Mezuk said. In particular, there are glaring physical health disparities between African-Americans and white Americans.

Reducing those disparities is a focus of Mezuk’s research.

African Americans, for example, are more likely than whites to suffer from conditions such as diabetes.

But such disparities are not evident in mental health. Mezuk noted that African-Americans are less likely than whites to develop mental health disorders such as depression.

Genetics doesn’t explain the health disparities, or lack thereof. So what does?

One explanation may involve how people react to stress. Mental stress affects different people in different ways.

According to Mezuk, human beings aren’t too different from other animals in this regard. In lab settings, when an animal is stressed out, it

‘We all do all these things – we all drink or eat when we’re stressed – but what’s important is that we be cognizant of that.’

Needles for insulin, a glucose monitor and metformin – common items for a person living with diabetes.

will often turn to a “self-regulatory behavior” to relieve that stress. While coping with situations is often seen as something entirely mental, how we self-regulate can have a big impact on our physical health.

“We all do all these things – we all drink or eat when we’re stressed – but what’s important is that we be cognizant of that,” Mezuk said. Bad coping mechanisms to stress can add up to poor health over long periods of time, though the reverse is true for good coping mechanisms.

Mezuk wants to change the conversation. She believes that helping people find healthy ways to cope with stress may prevent chronic conditions like diabetes.

Mezuk, whose background is in epidemiology, isn’t doing this alone. She is working with professionals from various fields, including psychologists, health economists and endocrinologists. She knows that multiple perspectives are needed.

“If we can have a much more holistic approach to health, that opens up a door to behaviors and understanding why people do the things they do,” Mezuk said. •

Songbird's winter grounds face environmental threats

Development has reduced the mangrove forests of Panama and Colombia where the prothonotary warbler lives during the winter months.

WRITTEN BY
Kirby Farineau

TAGS
colombia, mangrove forests, prothonotary warbler

PUBLISHED
Nov. 1, 2016

It is common knowledge that birds fly south for the winter, but according to VCU graduate biology student Jessica Reese, the south might not be as safe as it used to be.

Reese has always been interested in bird migration, and her study of the prothonotary warbler, a gray and yellow songbird, has highlighted environmental threats facing the species' wintering grounds.

VCU has been studying these birds closely since

‘Since the 1970s, about 35 percent of the world’s mangroves have been destroyed,’ says Reese, who has visited the forests in the northern coastal regions of South America.

Jessica Reese holding two warblers. (Photo by Jessica Reese)

1987, when professors Leann and Charles Blem started installing nest boxes along the James River. The prothonotary warbler is one of the few species of warblers that prefer cavities for breeding, so these nest boxes help conserve the bird’s population.

This is important now more than ever, as human development has depleted the mangrove forests of Panama and Colombia where these birds live in the winter months.

“Since the 1970s, about 35 percent of the world’s mangroves have been destroyed,” said Reese, who has visited the forests in the northern coastal regions of South America. One area under particular threat, according to Reese, is the 120-kilometer stretch of the Salamanca Island Road National Park in Colombia, where a significant population of prothonotary warblers lives.

The Colombian government has built a highway that passes next to the Salamanca park, connecting the city of Barranquilla with the nearby town of Ciénaga. Since the highway’s construction, Reese said, the hydrology of the local mangrove forest has been severely disturbed, as the highway blocks incoming water.

While the government has made some efforts to improve the general health of the forest, the international environmental community has challenged Colombia to do more to protect the mangroves. One concern: The government has floated plans to expand the highway from two lanes to four.

Mangroves in this area of Colombia have been designated as wetlands of international importance under a United Nations program called the Convention on Wetlands, or the Ramsar Convention. This importance is evident

The mangrove forests in Panama are threatened by development. (Photo by Jessica Reese)

Reese says the mangroves act as buffers from coastal storm surges and are important 'carbon sinks' – natural areas that can absorb carbon dioxide from the atmosphere.

A prothonotary warbler. (Photo by Jessica Reese)

as the depletion of the forest affects more than just songbirds, Reese said.

"Along with being important habitats for prothonotary (warblers), mangroves are also crucially important for a lot of other processes," she said. "They are nurseries for young fish and other commercially important aquatic life."

Reese said the mangroves also act as buffers from coastal storm surges and are important "carbon sinks" – natural areas that can absorb carbon dioxide from the atmosphere.

The forests are threatened by several factors, including coastal development and people cutting down trees for charcoal. While such practices harm the environment, Reese believes it's important to recognize this is an economic issue as well.

"You have all these local people putting pressure on areas with mangroves, and they're just trying to maximize their economics," she said. "They're going in and cutting firewood because they need to sell charcoal."

Reese believes eco-tourism would offer a viable economic alternative for the local population, though it won't necessarily solve the environmental threats to the mangroves. She has suggested that the area set up lodges, provide guides and sell supplies to wealthy international birdwatchers. Such business operations could greatly benefit the local economy while relieving pressure on the mangrove forests on which the prothonotary warblers depend.

Though there is extensive research on this one charismatic songbird, Reese spoke of the bigger picture.

The mangrove forests act as buffers from coastal storm surges. (Photo by Jessica Reese)

“For any animal or plant species, usually the No. 1 threat with extinction is habitat loss and habitat fragmentation,” she said. “I could name hundreds of species that are under threat for similar reasons.” •

Commercial drone research takes off at VCU

Professors Robert Klenke of engineering and William Shuart of environmental studies both incorporate drone usage and research into their classrooms

WRITTEN BY
Joe Forcier

TAGS
drones, quadcopters, unmanned aerial vehicles

PUBLISHED
Dec. 5, 2016

Christmas is just around the corner, and a lot of people, both children and adults, will probably unwrap a remote-controlled quadcopter that will provide hours of entertainment – at least until the batteries need recharging. As microprocessors and mounted cameras have become smaller, unmanned aerial vehicles, commonly known as drones, have skyrocketed in popularity.

But UAVs aren't just child's play. Researchers at VCU say the devices could be used in a

‘Unmanned aerial vehicles are the most dynamic growth sector of the international aerospace industry,’ Bob Klenke says.

One of Robert Klenke’s students working in the lab. (Photo courtesy of Dr. Klenke)

range of beneficial ways, from inspecting bridges and searching for lost hikers to shooting documentaries and surveying land.

One of the university’s leading researchers regarding this technology is Dr. Robert Klenke, a professor in the Department of Electrical and Computer Engineering. Klenke directs a program called the Collaborative Unmanned Aerial Vehicles group, in which students study, design, build and utilize UAVs.

“Currently, unmanned aerial vehicles are the most dynamic growth sector of the international aerospace industry,” Klenke said.

His collaborative has been operating for about two years. Each semester, about 20 undergraduates work in Klenke’s lab alongside graduate students.

Klenke and his students are exploring many facets of UAV research, including innovative flight systems and the miniaturization of UAVs. One team of students, for example, plans to integrate a remote monitor system and joystick controls.

In the past, Klenke’s students have worked with both multi-rotor and fixed-wing UAVs. But now they have included a hybrid capable of vertical takeoff and landing, or VTOL.

The VTOL project team uses a device that takes off as a multi-rotor vehicle and then flies around on fixed wings once it has reached optimal altitude. The vehicle then can land like a multi-rotor vehicle.

William Shuart, environmental technology coordinator at VCU, also is a pioneer in UAV research. While Klenke’s group is oriented more toward designing and utilizing the equipment,

One of VCU's fixed-wing UAVs in flight. (Photo courtesy of Dr. Klenke)

'I think you're going to see more and more types of applications for UAVs,' says William Shuart of VCU Life Science.

Shuart's students take UAVs into the field and put the equipment to the test.

Over the summer, Shuart taught a course in which students planned a surveying mission utilizing a UAV, conducted the mission and analyzed the results, using both fixed-wing and multi-rotor aircraft.

"Our background is looking at environmental phenomena, so whether that's wetland analysis, vegetation health, height of vegetation," said Shuart, who also serves as director of information technology at the VCU Rice Rivers Center.

Multi-rotor UAVs have been both scrutinized and sensationalized. Flying a drone is easy to pick up, and when combined with lightweight cameras, the possibilities are endless.

Not only can you take vivid aerial videos and still photos for personal pleasure, but the technology offers a lot of potential commercial uses as well. For instance, bridge and radio tower inspections have always been tedious and dangerous, but drones outfitted with high-resolution cameras could carry out these inspections efficiently and safely. Companies such as Amazon have suggested using drones to deliver products to customers. And the devices someday might carry medicines to remote areas.

"I think you're going to see more and more types of applications for UAVs," Shuart said.

At the same time, some people fear that drones may invade their personal space and violate their right to privacy. In some cases, people have shot down UAVs that have flown over their property.

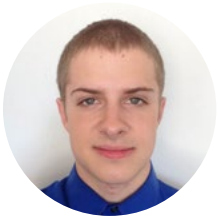
More advanced drones are used by the U.S. government to survey areas, and in the Middle

East, the military has used UAVs to track, attack and kill people it has deemed as terrorists. When Klenke first began conducting his research with UAVs, there was backlash at VCU because of the military use of drones.

Klenke said the UAV research done at VCU deals with surveying and reconnaissance. Under no circumstances are UAVs at VCU weaponized, he said. •

How do police brutality videos affect us?

Dr. Karen McIntyre is planning to conduct an experiment in which she will show a video of police brutality to people while she monitors their heart rate, skin conductance and facial muscles. She hopes to determine the impact this video has on its viewers in terms of stress level and emotions.



WRITTEN BY
Joseph Forcier

TAGS
constructive journalism, police brutality, videos

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We have all seen them, these videos with tragic endings. From Philando Castle in Minnesota to Terence Crutcher in Oklahoma, numerous unarmed African-Americans have been killed by the police, with their deaths documented by a body camera or cellphone.

Such videos can be used to hold police accountable or determine whether officers' actions were justified. But they could be causing stress among people who watch the videos, says Dr. Karen McIntyre, an assistant professor at

Osita Iroegbu, a Ph.D. student in Media, Art and Text, prepares a subject for testing in Dr. Karen McIntyre's lab. (Photo by Joseph Forcier)

Researchers in the Robertson School of Media and Culture are investigating the psychological and physiological effects that a video of police brutality can have on people.

During the process, participants watch videos about violent encounters between police and civilians. (Photo by Joseph Forcier)

VCU's Robertson School of Media and Culture.

She and her colleagues are investigating the psychological and physiological effects that these videos can have on people.

McIntyre is planning to conduct an experiment in which she will show a video of police brutality to people while she monitors their heart rate, skin conductance and facial muscles. For example, she will attach electrodes to a participant's face to track facial expressions and emotions. That technique is called facial electromyography, or EMG.

Similarly, electrodes on the forearms will measure heart rate and indicate how much attention the participant is paying attention to the video. And electrodes on a person's palms will measure sweat glands and how aroused the participant gets while watching the images.

After that, participants will answer a survey about how the video made them feel. Then they will be shown posts on social media with both negative and positive comments about the video. The participants will be asked how those posts make them feel.

Using all this information, McIntyre hopes to determine whether the social media comments affect the stress triggered by the video. "We're looking to see what kind of impact these social media comments have on viewers. Do they intensify the stress? Do they act as coping mechanisms?"

In the experiment, McIntyre plans to use a video in which Linwood Lambert Jr. died in police custody in 2013 after officers in South Boston, Virginia, tased him more than 20 times. The incident was captured by dashboard cameras from the officers' vehicle. The video was shared

Dr. Karen McIntyre of VCU's Robertson School of Media and Culture

widely on Facebook.

A key focus of McIntyre's larger research agenda is what she calls constructive journalism. This is a form of news reporting that attempts to fix a problem or at least get the conversation moving in that direction.

The experiment involving the Lambert video is not directly related to constructive journalism. But there is some commonality: McIntyre wants to see if media content – whether a solutions-oriented news story or a Facebook comment on a graphic video – can have a positive impact. •

International health workers spend year at VCU

As a Humphrey Fellow, a psychiatric nurse from West Africa is learning how the U.S. treats substance abuse and will apply that knowledge back home

WRITTEN BY
Vanessa Gleiser

TAGS
addiction, Ghana, Humphrey Fellows

PUBLISHED
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Samuel Hanu, a 39-year-old psychiatric nurse from Ghana, ordinarily spends his days working with patients in his country's capital, Accra, in West Africa. But he is spending this year at Virginia Commonwealth University, researching how the United States treats substance abuse and mental illness. He hopes to bring his findings back to his homeland.

Hanu is a participant in the Hubert H. Humphrey Fellowship Program, which brings professionals from all over the world to the U.S. for a year of

‘What I’m hoping to take from this program is evidenced-based addiction education, management and prevention,” Samuel Hanu says.

For 2016-17, there are 168 Humphrey Fellows in the U.S.

study.

“What I’m hoping to take from this program is evidenced-based addiction education, management and prevention,” Hanu said. “I want to take back home all that I will learn in the U.S. I admit that I need to make these interventions culturally appropriate so they can have the greatest impact.”

President Jimmy Carter created the Hubert H. Humphrey Fellowship Program in 1978 as a way for the U.S. to share “democracy, social justice and a desire to assist the developing nations of the world.”

Alison Breland, an associate coordinator at VCU for the program, is in charge of academic advising for the fellows.

“We let them take a couple of courses while they are here even though fellows do not earn a degree while in the program. I help them find the classes that fit best and introduce them to professors,” she said. “We also arrange for several workshops on leadership topics that focus on fellows’ leadership styles, how to manage conflicts and how to work in teams, for example.”

Since 1978, more than 4,600 fellows from 157 countries have participated in the program. More than 40 universities have hosted fellows for their year of study.

“Since 2006, VCU has hosted seven to 12 Humphrey Fellows annually, including 12 this year,” Breland said. She said the fellows at VCU are all in the public health field.

Applicants for the Humphrey Fellows Program are accepted first by the U.S. State Department and then by VCU if the university fits with

Samuel Hanu making a presentation about Ghana to colleagues and faculty at VCU. (Photo courtesy of Mr. Hanu)

their interests. VCU has a strong emphasis on substance use, prevention and education "because there are many VCU faculty members working in this area," Breland said.

She has a heartfelt connection to the Humphrey fellows. Getting to know people from so many different countries and cultures is her favorite part of the job.

"If I wasn't in this position I would never have met people from countries such as Myanmar, Togo or Uruguay," Breland said. "I have an incredible opportunity to meet people from different countries and cultures."

Hanu also has a strong connection to the Humphrey Fellows Program.

"It brings mid-career professionals from all over the world, especially from developing countries to the U.S. for a year of study in hopes that these professionals become change agents on their return to their respective countries," he said.

"The focus of the program is solely professional development. This is achieved by affiliation to a U.S.-based institution, which provides the fellow an opportunity to work with an expert in his or her field of study, and to establish professional contacts. The program is also about cultural exchange and leadership development. It is an institution in the U.S. to make contact with the experts in your field and establish professional contacts."

The program equips the fellows with leadership skills and with current research findings in their field of study.

Hanu is eager to apply in Ghana the skills and ideas he is learning at VCU.

‘I want to help people to come back to their normal lives – back to society, their families, their jobs – and to see them happy.’

“I want to help people to come back to their normal lives – back to society, their families, their jobs – and to see them happy. It is a joy that money cannot buy. That’s what keeps me going, and I’ve been doing this for 15 years and counting,” he said.

Hanu said the work ethics and training are similar in Ghana as they are here, but the resources are limited. “We don’t have a constant supply of medications and our emergency response system is poor. People with mental health challenges are not well catered for due these challenges. You could easily die in cases of emergencies.”

In Ghana, substance abuse is treated as “an acute illness,” Hanu said. “Psychological services are not available. Abusers only have contact with psychiatrists when they start to act abnormally.”

“In Ghana, it is easy for an individual with addiction problems to be jailed because it is illegal to be found with such substances. Moreover, there are no institutionalized services for such people. The only type of services available is the therapeutic community concept and Alcoholics Anonymous meetings. However, these are not widely available,” Hanu said.

The most common substance abuse problem in Ghana involves alcohol.

“It is easily available because of my culture – it seems to be key,” Hanu said. “When a child is born, a drop of alcohol and water is placed on the child’s tongue to signify truth and lies. It is the child’s first experience with alcohol and it is done usually on the eighth day, called the Naming Ceremony.”

Many people associate substance abuse

and mental illness with adults, but that is not necessarily the case. Adolescents also are affected in Ghana.

“Marijuana is the second most common drug. The young ones in schools are using it, as well as people in the show business. According to the World Drug Report, marijuana is the most common reason why people will seek treatment for addiction services, and the treatment gap is over 90 percent,” Hanu said.

Like most states, Ghana has criminalized marijuana. Hanu believes that has made the problem worse: “I think if marijuana was legalized, the harms associated to its use will reduce drastically, such as criminal records on our teenagers. Research is indicating that it is a fallacy to think that legalization will lead to increased use.”

“Marijuana used for medical purposes is excellent,” he said. “In the 12th century, it was used to kill so many illnesses. In fact, marijuana use for medical purposes dates back to 2700 B.C. when it was used to cure all sorts of ailments such as dysentery, fever, constipation, etc. The drug was included in the U.S. Pharmacopeia, the official list of recognized medical drugs from 1850 through 1942.”

Hanu said moderation is the key to avoiding addictions.

“Anything you abuse is dangerous – even if you abuse water or sugar or coffee, it’s dangerous,” he said. “So if you abuse marijuana or alcohol, or any such drug, you will suffer from its adverse consequences if not now, then later. People who use it in moderation are fine,” he said.

“However, we wish teenagers would delay their drug usage. The brain of teenagers continues to

The 2016-2017 Humphrey Fellows at VCU

develop right up to the early 20s, so the effects of drug abuse are detrimental to the brain's development."

Moreover, Hanu said Ghana should follow the U.S. in enforcing laws aimed at preventing overindulgence. He learned how strict the U.S. is from a bartender in Richmond.

"One good observation I have noticed here in America is that the laws are enforced. Policies such as driving under the influence and underage drinking are big issues here," Hanu said.

"I tell you, one Friday, I was hanging out with graduate students on one of their nights out, and I wanted to buy myself a drink. The attendant refused to sell me the drink because I couldn't produce my ID. You could imagine the look on my face. I was like, 'For goodness' sake, can't you see that I am well over 21 years?'

"In Ghana, this will never happen. This is called 'Responsible Bar attendant,' and I know these are training programs for bar attendants to be responsible. These are some of the policies I will take to my country."

Hanu said the lessons he has learned as a Humphrey fellow will help improve addiction treatment in his homeland.

"I am hoping that Ghana's addiction services will be a well-integrated service which will be a model for training of future addiction specialists all over the world." •

Many college students abuse alcohol and Adderall

‘Alcohol is the most abused substance,’ says counselor Kristen Kidd Donovan. About 10 percent of VCU students may have addiction problems after leaving school.

WRITTEN BY
Vanessa Gleiser

TAGS
adderall, alcohol, substance abuse

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From Adderall to alcohol, VCU Counseling Services has seen the gamut of substance abuse problems experienced by college students.

Kristen Kidd Donovan, one of the counselors, says most students at VCU don’t abuse alcohol or illegal drugs. “At VCU, the majority of students who drink do so moderately. Roughly a quarter of VCU students don’t drink at all,” she said. But for those who do, the consequences can be devastating.

Most students who drink do so moderately. 'Roughly a quarter of VCU students don't drink at all,' Donovan says.

Experts say some students may have a high GPA and look fine but could be addicted to drugs. It's a problem that cuts across gender, race and socioeconomic class.

"Alcohol is the most abused substance," Donovan said. The tendency to abuse alcohol can be genetic.

"Alcohol affects people in different ways. Some people are genetically wired to process alcohol efficiently. Some don't feel the intoxicating effects of alcohol until their BAC is in a much higher range than their peers." Donovan said.

She said everyone reacts differently to drugs; alcohol can even cause some people to feel itchy. Problems with alcohol can lead to bigger issues down the road.

"Addiction occurs when someone who is genetically predisposed drinks regularly and in sufficient quantity to become addicted. For some, addiction occurs quickly; for others, it can take years to develop."

According to VCU Counseling Services data, about 20 percent of the university's students drink at levels that can lead to addiction. Roughly half of those students fall into moderate drinking patterns after leaving college. What about the remaining half – approximately 10 percent of VCU students?

"The rest continue drinking at levels that support addiction," Donovan said.

Alcohol is not the only substance being misused by young adults. For many college students, Adderall is the study drug of choice: They pop a tablet before pulling an all-nighter to cram for an exam or write that long-delayed research paper.

A bottle of Adderall quick-release pills. (Photo by Vanessa Gleiser)

Adderall may seem as benign as a few cans of Red Bull, but experts at VCU say such stimulants have serious health consequences.

Adderall is a stimulant designed to help those who have attention deficit disorder, attention-deficit/hyperactivity disorder, learning difficulties and trouble staying focused.

However, many students without a learning disability find ways to get their hands on the drug – for example, by finagling a prescription or buying Adderall from friends.

It may seem as benign as a few cans of Red Bull, but experts at VCU say such stimulants have serious health consequences, including reduced appetite, restlessness, anxiety, sweating and elevation in blood pressure.

That's why VCU is strict about prescribing Adderall. University Student Health Services makes this clear on its website:

"To be considered for ADHD treatment at Student Health, a student must provide a written report of a comprehensive ADHD evaluation completed within the last three years. The evaluation must include objective testing, and the written report must include details of the various tests performed. The most common objective test used for evaluation of ADHD is the CPT or Continuous Performance Test ... Once the reports have been reviewed, students will be notified whether or not ADHD treatment can be provided through Student Health. If approved, an appointment can be scheduled with a physician to discuss care."

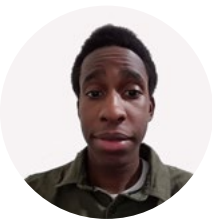
Some people think that obtaining Adderall illegally is no big deal. In fact, it's a serious crime, Donovan said.

"Possession of prescription drugs that are not prescribed to you – especially ADHD drugs like Adderall or pain medication like Percocet or Oxycontin – is illegal and can result in a charge

for possession of a Schedule II narcotic," she said. "A charge like this is especially serious for students hoping to become licensed in a health-care profession." •

Various tests induce, then measure, stress

Graduate student uses both traditional and high-tech methods to simulate stressful situations



WRITTEN BY
Malik Hall

TAGS
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Dec. 5, 2016

We all experience stress in some shape or form, especially university students facing final exams and graduating seniors under pressure to find a job. Now these nerve-wracking situations are being replicated in a lab – but this isn't as sadistic as it may sound.

The Trier Social Stress Test puts participants in pressure-filled simulations and then measures their physiological reaction, including heart rate, blood pressure, skin conductance (sweat) and cortisol (a stress hormone).

‘What you’re really trying to do frankly is get someone really stressed out,’ Sage Hawn says.

The TSST tries to replicate the type of stress you’d deal with in everyday life. “What you’re really trying to do frankly is get someone really stressed out,” said Sage Hawn, a third-year doctoral student at VCU who has worked extensively with such tests.

Hawn is pursuing her doctorate in clinical psychology under Dr. Ananda Amstadter, an associate professor in the departments of psychiatry and molecular genetics. Hawn specializes in stress/trauma and behavioral genetics, and the TSST is an important tool in that field.

“The Trier is pretty vastly used,” Hawn said. “Even where my lab is downtown, there are three studies right now that are using Trier.”

‘The Trier is pretty vastly used. Even where my lab is downtown, there are three studies right now that are using Trier.’

Before the test begins, the researchers takes the participant’s blood pressure and other signs. Then, under the traditional TSST, the individual enters a room with three confederates (actors), who remain stone-faced during a mock job interview.

If the test subject pauses or concludes the speech too quickly, the confederates respond in a robotic-like manner, saying something like “Your time is not finished; please continue.” After the speech, the subject must take a mental math test – starting with the number 1,022 and repeatedly subtracting 13 for five minutes. Then the researchers measure the participant’s vital signs again and compare them with the initial readings.

Though the TSST is generally effective, it has plenty of limitations – notably the lack of standardization. The confederates are rarely consistent. They may vary by race or gender in each trial because certain actors might be unavailable at different times. Moreover,

Graduate student Sage Hawn

even the same confederate might act slightly differently from one testing scenario to the next. Such variations could affect the test subjects' responses and skew the results.

So Hawn has been experimenting with a technological trend – virtual reality – to simulate the stressful situations. The advantage: With VR, each test subject experiences the exact same scenario.

The medical school at the University of South Carolina has pioneered this "eTSST." Participants put on a VR headset such as the Oculus Rift, and then they are immersed in a virtual version of the TSST.

The eTSST avoids the traditional test's inconsistencies by using recordings of the confederates. Though it solved many of the standardization problems, the VR technique has not produced measurements satisfactory enough to justify its continued use.

However, Hawn recently gave a professor at another university instructions for administering the eTSST, so it may be improved in the future.

Hawn has also worked with other stress-inducing methods. In one test, carbon dioxide (CO_2) is administered to the participants to elicit stress in a manner similar to the TSST.

Under this "CO_2 challenge," participants inhale small amounts of carbon dioxide and do particular tasks before, during and after, attempting to mirror the physiological responses of anxiety.

The test uses low, controlled doses of CO_2 that don't cause the participant harm. However, researchers had to overcome extensive hurdles to get approval from VCU's Institutional Review

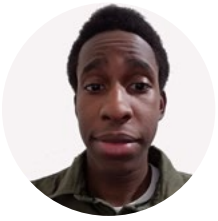
Board, which oversees studies involving human subjects.

Moreover, the cost of conducting the “CO2 challenge” is staggering. “You have to buy these huge CO2 tanks, all of the equipment. You have to make sure your lab is amenable to support that type of equipment,” Hawn said.

For obvious reasons, the CO2 test is not performed on children, so the TSST is typically preferred. For children, the TSST does not involve a mock job interview – though it would be amusing to imagine an 8-year-old explaining why he or she wants to be a firefighter. Instead, the researchers ask age-appropriate questions like, “What is your ideal day?” •

Why can't they all be best in class?

Researchers at VCU and the University of Florida are developing positive-reinforcement intervention techniques to address problem behavior that may be more prevalent among schoolchildren from low-income homes.



WRITTEN BY
Malik Hall

TAGS
child development, intervention techniques, positive reinforcement

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According to psychologist Arnold Sameroff's transactional model of development, human beings affect their environment and vice versa. Unfortunately, children from poor families may be disproportionately affected by the negative aspects of their environment. They may be more inclined to misbehave because of poor nutrition and other factors associated with poverty.

Fortunately, researchers at VCU and the University of Florida are developing intervention techniques to address problem behavior that

Best in Class advocates reinforcement, such as praise and rewards, to shape children's behavior.

may be more prevalent among schoolchildren from low-income homes. The research has an appropriate name: Best in Class.

The research began in 2007 with children in pre-kindergarten from Henrico and Richmond. The resulting intervention methods soon were applied in several communities in Florida. Several years and grants later, the program has expanded to elementary school students as well as pre-K.

The Best in Class concept was developed by:

- Dr. Kevin Sutherland, a professor of the VCU Department of Special Education and Disability Policy at VCU

- Dr. Maureen Conroy, a former VCU professor and now co-director of the Anita Zucker Center of Excellence at the University of Florida

- Dr. Bryce McLeod, an associate professor of the VCU Department of Psychology who specializes in treatment integrity measurements

Sutherland's interest in child development began with his work in residential treatment and teaching of children with emotional and behavioral disorders.

In 2007, officials with the Virginia Preschool Initiative in Henrico County contacted Sutherland and Conroy to develop a treatment for children with problem behavior. After a lot of deliberation and a grant from the federal Institute of Education Sciences, the VCU duo started to develop what is now known as Best in Class.

The intervention is based on three psychological theories:

- B.F Skinner's operant conditioning theory, which says behavior is determined by

‘We’re trying to break the cycle early and make those coercive interaction patterns more positive,’ Sutherland says.

reinforcement and punishment. Best in Class advocates reinforcement, such as praise and rewards, to shape children’s behavior.

- Urie Bronfenbrenner’s bioecological theory. It says our behavior and outlook on life are molded by society, which is molded by the government and media, which are molded by communities, which are molded by families, which mold an individual.

- Sameroff’s transactional theory, which says we affect and are affected by our interactions with our environment. When those interactions are negative, they can create a vicious cycle for the child-teacher relationship.

“We’re trying to break the cycle early and make those coercive interaction patterns more positive,” Sutherland said. “So from a transactional perspective, the child impacts the teacher’s behavior and the teacher’s behavior in turn impacts the child. What we’re trying to do is change that cycle.”

Instead of punishment, the intervention focuses on constructive support such as praise and positive feedback.

Best in Class is known as a Tier 2 intervention. It focuses on 15-20 percent of a selected population – or about two or three students per class. The program uses teacher input and national data to identify students who most need help with behavioral disorders. Teachers then implement the Best in Class teachings on these high risk students, but are more than encouraged to apply these methods to the rest of the class.

The next step in the study is to determine whether the intervention methods have lasting effects on children. The researchers are hoping

to track the benefits over time.

“My hope is that the elementary project that we are developing will demonstrate promise and we will write a grant for a larger study,” Sutherland said. “What I would like to do is follow those kids in subsequent years in school.” •

Demanding class spurs student to Stanford

After taking a molecular biology course at VCU, Nick Rodriguez is working on a Ph.D. in biomedical informatics at Stanford University

WRITTEN BY
Jacob Jaminet

TAGS
molecular biology, Nick Rodriguez, Stanford

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Hearing that Nick Rodriguez goes to Stanford, you probably wouldn't guess that he had dropped out of high school and didn't get the best grades as an undergrad at VCU.

"It's OK to have a nontraditional background," Rodriguez said. "I dropped out of high school and worked in food service for years before I decided to go back to school. My grades weren't stellar, but my passion for learning and science kept me on a good path."

‘The objective of this course isn’t to increase your knowledge but rather to expand your ignorance.’

Jacob Jaminet and Nick Rodriguez at Hoover Tower at Stanford University.

Rodriguez graduated from VCU last spring with a degree in bioinformatics. He is pursuing a Ph.D. in biomedical informatics at Stanford University. He says his interest in biomedical research started as a result of the VCU course Molecular Biology Through Discovery – BNFO 300.

Jeff Elhai teaches that course, which has filled many VCU students with dread. With his long, curly gray hair and calm demeanor, Elhai reminds some students of Einstein. A placard outside his office proudly reads, “Jeff Elhai, ‘Doctor Free Zone.’”

“The objective of this course isn’t to increase your knowledge but rather to expand your ignorance. After all, the process of science occurs at the boundary of what is known, which, as it grows, generates a greater interface with what is not known,” the course website declares.

Over the course of the semester, students are charged with finding a mentor and pitching a single experiment to expand the realm of existing biological knowledge. While working with their mentor, students follow in the footsteps of the pioneers of biology. They read the papers of James Watson and Francis Crick, examine original research results and learn to “think like a scientist.”

Through this process, Nick Rodriguez learned that he was interested in molecular mechanisms as they relate to human disease. He started looking for opportunities to study this which brought him to the lab of Dr. Barbara Boyan, dean of the School of Engineering at VCU. The Boyan lab focuses on bones and cartilage growth and synthesis.

Bones form when cartilage goes through the process of calcification. Small membrane-bound vesicles in the extracellular matrix are

The matrix vesicles serve as a ‘hub for calcification.’ But researchers believe that the vesicles might be involved in other processes as well.

View of Stanford University from Hoover Tower.

an important part of this process. The matrix vesicles contain biochemicals that serve as a “hub for calcification.” Enzymes in the vesicles promote calcium phosphate formation.

Matrix vesicles are also found in areas of the cartilage that are not mineralized, such as the growth plate resting zone and articular cartilage. Researchers have found that matrix vesicles might be involved in processes other than calcification.

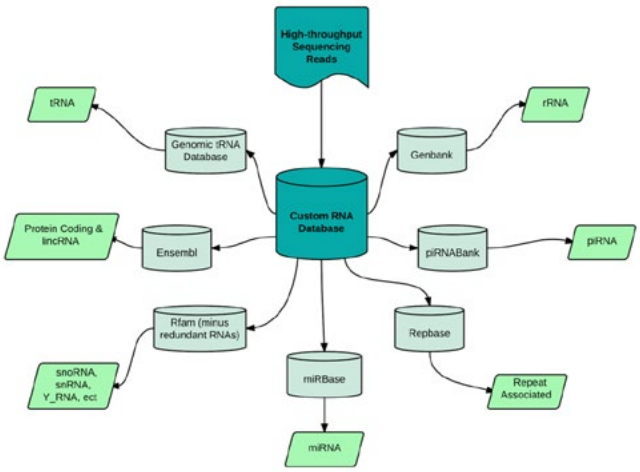
The Boyan lab analyzed the contents of the matrix vesicles and found that they were packed with higher levels of certain microRNAs than the cytoplasm, the jellylike material that makes up much of a cell inside the cell membrane.

RNA is a biomolecule that performs various functions in the cell. One form of RNA called messenger RNA – mRNA – carries the information encoded in the DNA to the ribosome, where it is translated into protein, a process called transformation. During transformation, transfer RNAs – tRNAs – carry the amino acids to the ribosome and link the amino acids together forming a protein.

MicroRNA, also called miRNA, is produced in the nucleus of the cell and transported out into the cytoplasm. There, miRNA binds to a protein and acts like one side of Velcro. The miRNA lodged in the protein selectively binds to mRNA in the cytoplasm. This protein-miRNA complex then cuts the mRNA so it is unable to be translated into protein.

The Boyan group discovered that three microRNAs – miR-122-5p, miR-223-3p and miR-451-5p – were concentrated in the matrix vesicles. These microRNAs do a variety of functions that regulate cartilage, bone growth and diseases like osteoarthritis. The regulation

Jeff Elhai, the instructor for Molecular Biology through Discovery. His course does not focus on filling your head with knowledge but rather expanding your ignorance.



The layout of the bioinformatics pipeline that Rodriguez was responsible for the Boyan lab project. This pipeline sorted out the raw sequences that were collected from the biological experiments and classified them into their functional groups.

networks affects when and where cartilage turns into bone. The matrix vesicles containing these miRNA could be transferred between cells and change the cell metabolism

That research provided inspiration for Nick Rodriguez. He spent long hours in the Boyan lab, including a summer on a life science grant. Through his time in the lab, Rodriguez determined that research was the career he wanted to pursue. He applied to graduate schools across the nation and accepted the offer to go to Stanford.

“Stanford is magically beautiful both academically and physically,” Rodriguez said. At Stanford, he is currently rotating in a lab that uses statistical and machine learning methods to characterize different forms of autism based on clinical and genomic data.

For VCU students who also may aspire to do graduate work at one of the world’s best universities, Rodriguez has some advice.

“Work hard at the things you love,” he recommends. “Make it real.” •

Perseverance pays off for Ph.D. student

Lauren Griggs, the recipient of VCU's Susan E. Kennedy Award, is working to increase the number of women and minorities pursuing STEM careers.

WRITTEN BY
Jacob Jaminet

TAGS
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According to the U.S. Census Bureau, women make up 48 percent of the total workforce but only 24 percent of the workforce in the STEM disciplines – science, technology, engineering and mathematics. A VCU engineering graduate student is trying to change that.

Lauren Griggs, a Ph.D. student in biomedical engineering, was recently awarded VCU's Susan E. Kennedy Award, which recognizes graduate students who are advancing the presence of women in education.

Photo courtesy of Lauren Griggs

‘Just because there’s not too many people who look like me in my field doesn’t mean I’m not going to be successful in my field,’ Griggs says.

The award recognizes the hard work Griggs has been putting into her education through her graduate career at VCU.

“This is my fifth year, and all these things are coming in now,” she said. “I tried for all of these things my first through my fifth year. So if I had given up and said, ‘Oh, I didn’t get it,’ then I never would have been able to be where I am right now.”

Perseverance was needed when she was the only woman of color in her undergraduate classes at the University of Virginia.

“In that respect, it is slightly discouraging sometimes just because you are like, ‘Is this really for me? I don’t see anyone around that looks like me, so maybe I shouldn’t be doing this,’” Griggs said.

“But you have to have that internal drive to be like, ‘Just because there’s not too many people who look like me in my field doesn’t mean I’m not going to be successful in my field.’”

She uses this experience to help incoming freshmen in STEM transition to college through the Louis Stokes Alliances for Minority Participation funded through the National Science Foundation.

Incoming freshmen in this program take a five-week online course to prepare them for college life. They then come to VCU for a week where Griggs teaches their study skills course.

Griggs said being a mentor and a mentee is empowering.

“Try to find a mentor – someone to help support you because if you are feeling lost, connecting with someone else really helps you,” she said.

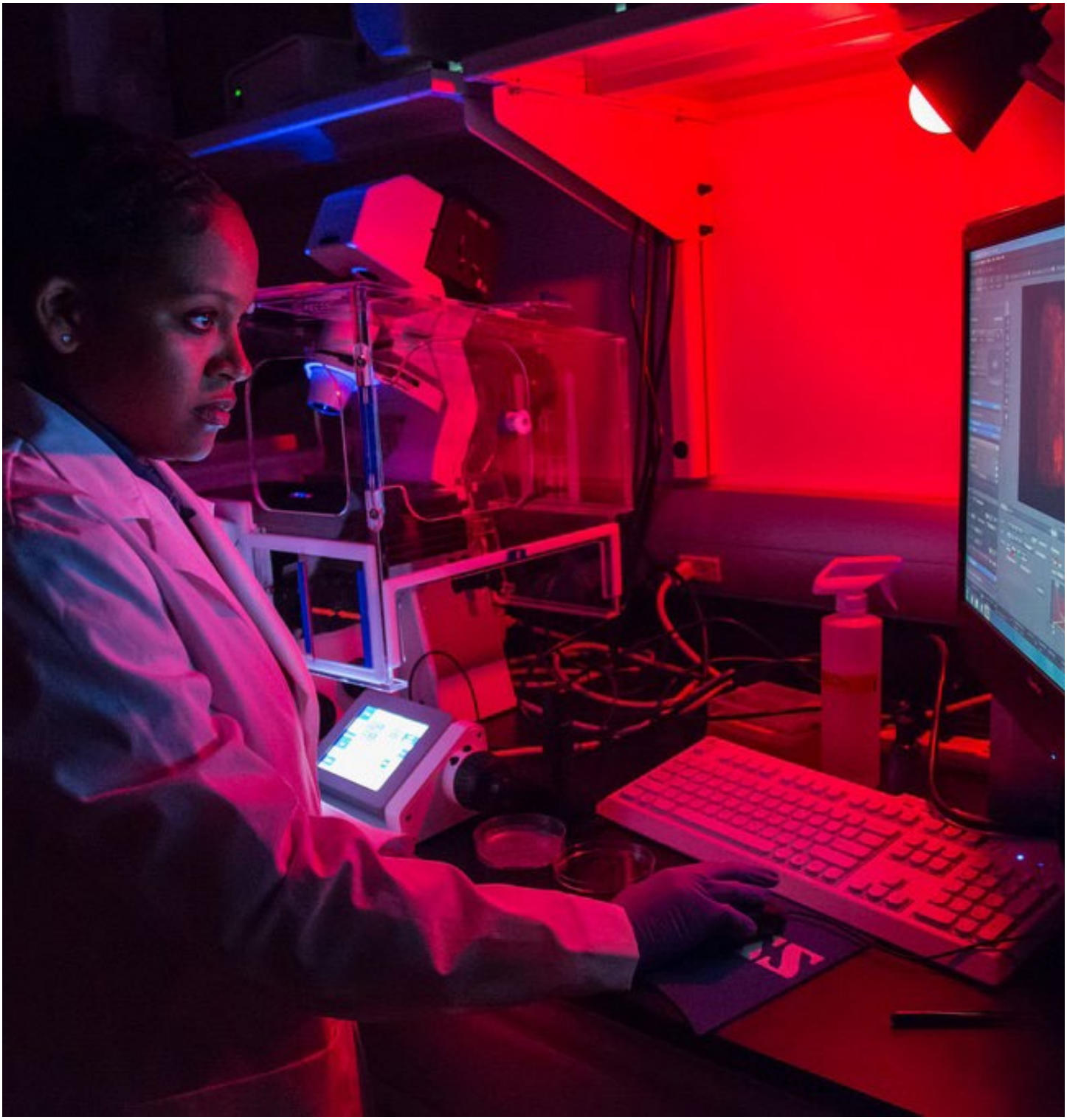

Photo courtesy of Lauren Griggs

Photo courtesy of Lauren Griggs

Griggs says students should find a mentor 'because if you are feeling lost, connecting with someone else really helps you.'

If students feel dissuaded from entering the STEM fields, Griggs wants them to know that people are there to support them along the way.

"I think the biggest thing you can do is persevere. There are going to be times where you feel like you can't make it – specifically minority students," Griggs said. "Just know that you are not alone. Even if you do feel like you are alone, there are a lot of people going through the same thing."

Her perseverance has certainly paid off. Griggs was recently awarded an F31 grant from the National Institutes of Health. The F31 grant is given to predoctoral students from underrepresented groups in the STEM fields. •

Researchers head south to study mangroves and birds

Led by Dr. Cathy Viverette and Dr. Edward Crawford, students will learn about conservation issues and the environmental threats that the prothonotary warbler faces in Panama

WRITTEN BY
Joe Johnson

TAGS
ecology, Panama, warbler

PUBLISHED
Dec. 5, 2016

As the weather cools and leaves turn color, images of holidays and hot chocolate pop into many people's minds. Some imagine family dinners with turkey and cranberry sauce while others dream of snowmen to be built and fireplaces to be lit. Not so for the prothonotary warbler.

Like many migratory birds, this bright yellow songbird seeks warmer refuge during the winter months. But warblers aren't the only ones flying south for the winter. For two weeks in January,

In her work with prothonotary warblers, Dr. Cathy Viverette does outreach with local middle school students. (Photo courtesy of Dr. Viverette)

‘It’s gone. They drained it. All the mangrove trees died, and there’s a golf course next door,’ says Dr. Cathy Viverette.

VCU researchers Dr. Cathy Viverette and Dr. Edward Crawford will accompany 18 students to Panama, where they will study mangrove conservation and avian field ecology.

During an immersive field research experience, students will learn about conservation issues and the environmental threats the prothonotary warbler faces. Their lab will be the austere swamps and mangrove forests of Panama, home sweet home to this little warbler species.

“It’s a great project for getting undergraduates involved in research,” Viverette said. “We have people throughout the breeding area we are working with, and throughout Latin America. It’s great for outreach, it’s great for getting undergrads out into the field and getting them excited.”

Unfortunately, the warbler’s holiday getaway is becoming a bitter homecoming as nesting areas are disappearing at an alarming rate and mangrove forests are being destroyed.

“Although on paper (Mangrove forests) are protected, they’re being drained.” Viverette said. “One of our study sites, which was a site that was studied back in the ‘90s, was our best site. It was a mature mangrove, right on the city’s edge and at the edge of a very large continuous mangrove forest.”

“It’s gone. They drained it. All the mangrove trees died, and there’s a golf course next door. Every time we go down, it looks worse. Every time we go down, there’s more construction – literally high-rise condos at our study site.”

But there is hope. One of the goals of this VCU course is to highlight common conservation struggles that Panama shares with the U.S. Throughout the trip, students will work with

A prothonotary warbler (Photo courtesy of Dr. Cathy Viverette)

Researchers tag the warblers with colored bands. (Photo courtesy of Dr. Cathy Viverette)

A group of VCU students in Panama (Photo courtesy of Dr. Cathy Viverette)

Panamanian biologists in the breeding area and spend at least one day with local schoolchildren.

“We train their biologists when we’re down there,” Viverette said. “They have a huge environmental education program where they have teachers they’ve trained going into the schools. We get at least one day with the school kids who come out into the field with us.”

She said the course – Biology 415 Panama Avian Field Ecology – represents both service learning and a study-abroad opportunity.

“It gives our students an opportunity to learn field skills and how to analyze. They have to come back here and then compile, analyze, interpret and present the results,” Viverette said.

The VCU researchers will give the results to the Audubon Society’s branch in Panama. The organization then can use the data “as justification for protection of the mangroves,” Viverette said.

Studying prothonotary warblers may also give insight into the habits of other birds and the environmental issues they face.

“There’s a few different ways we can study migratory connectivity. And the real reason we’re doing this is conservation,” said Dr. Lesley Bulluck, an avian biologist and assistant professor in the VCU Department of Biology. She said the goal is to address the declining population of prothonotary warblers and other tropical migratory birds.

A diet is worth a thousand words

Water quality is a common issue for Panama and the U.S. The health of a community often depends on access to clean water. A necessity

‘These birds eat aquatic insects so their health and well-being is dependent on water quality, as is the health and well-being of most communities.’

A middle school student in Panama releases a prothonotary warbler. (Photo courtesy of Dr. Cathy Viverette)

for life, it’s no wonder many early civilizations flourished around abundant water sources.

“We call it ‘Chesapeake Bay to Panama Bay and back,’” Viverette said. “Birds are a reflection of the ecosystem. They can be used as an early warning system like the ‘canary in a coal mine.’ And these birds eat aquatic insects so their health and well-being is dependent on water quality, as is the health and well-being of most communities.”

One way researchers can analyze birds’ migratory patterns is by looking at their feathers. Examining the ratios of stable hydrogen isotopes can reveal a lot about a bird’s diet, since isotope levels differ by latitudinal region.

“It just turns out that you are what you eat,” Bulluck said. “We can collect feathers from birds in Colombia, South America and Panama throughout the wintering range, and collect a feather that we know is grown in North America, and then look at the isotopes in that feather and try to pinpoint where they’re from.”

Isotopes refer to the different forms of a basic element based on mass. As an element gains a neutron, its chemical properties stay the same while its relative mass increases. The changes are detectable and varieties of this technique are used in many areas of avian research.

Feather brightness can also indicate habitat quality, Viverette says. Brighter birds usually have a healthier diet, which suggests they eat in better territory. This can have a significant impact on female birds and their young.

“You either have a good diet or you don’t,” Viverette said. “So you would hypothesize that the brighter males and brighter females are going to raise more young, and if you have good

VCU researchers trained Audubon staff members in Panama how to band warblers. (Photo courtesy of Dr. Cathy Viverette)

water quality, you're more likely to have more birds like this."

The goal: protect warbler habitat

These patterns illustrate common challenges migratory species face and where environmental efforts can be focused. Viverette hopes that studies like hers can help secure funding and advance legislation protecting warbler habitat.

"It's convincing governments that there's health reasons to protect them, and that there can be economic benefits from ecotourism if these resources are available, and to train local people to take advantage of that," Viverette said.

Returning students will continue their education in the classroom with a corresponding course taught by Viverette and Crawford in the spring.

"People have to care about something – that's where the bird comes in," Viverette said. "There's a lot we still don't know, and we will never stop asking questions." •

Study may reform police training methods

A VCU doctoral candidate has designed a study that could help improve training of police officers in their interactions with citizens. The study by Shana Mell seeks to show how body worn cameras can be used for observation and subsequent training.

WRITTEN BY
Joe Johnson

TAGS
body worn cameras, hawthorne effect, police training

PUBLISHED
Nov. 1, 2016

A VCU doctoral candidate has designed a study that could help improve training of police officers in their interactions with citizens – a focus of concern among activists in the Black Lives Matter movement.

Nearly every citizen has the capability to record video on their cell phone and instantaneously upload footage to the internet. Numerous police departments have begun issuing officers body worn cameras, or BWCs, in an effort to be more transparent. Many people have called

for increased transparency after the recent shootings of black males by police officers.

Various studies have examined how effective BWCs are in the field. The study by Shana Mell, who is pursuing a Ph.D. in Public Policy and Administration at VCU, seeks to show how BWCs can be used for observation and subsequent training.

Mell was able to see the big picture during police interactions by viewing video recorded by the officers' body worn cameras.

"This is not a body worn camera study," Mell said. "There's people out there who are looking right now, because it's such a big trend, to see if body worn cameras are working."

For Mell's research, BWCs were used as an important tool for candid observation. Mell was able to see the big picture during police interactions by viewing video recorded by the officers' BWCs.

"If you can just think of it as a vehicle to understand police behavior, that's what [this study] is," Mell said. "It was using the body worn cameras as my tool to observe officers. So that's never been done, and this is the first study that I'm aware of."

Observing police behavior in the field is not a new concept, Mell explained. However, in previous studies, the researcher was usually physically present while watching the police-citizen interaction.

Mell said limiting the physical presence of the researcher during observation is important. Using BWC may be the key to helping prevent a phenomenon known as the Hawthorne effect.

"You tend to impact people's behavior when you're watching them," Mell said. "This study attempts to reduce the Hawthorne effect."

‘It gives me the opportunity to be on [the police] call in their interactions with citizens without actually being there,’ Mell says.

‘It gives me the opportunity to be on [the police] call in their interactions with citizens without actually being there,’ Mell says.

BWCs allow for better data collection since the subjects are less likely to alter their behavior due to outside observation. Mell explained that this is why her study is so innovative.

“It gives me the opportunity to be on [the police] call in their interactions with citizens without actually being there,” Mell said.

In her study, Mell used 500 samples of BWC content and viewed thousands of hours of video footage. The study included 70 police officers each with different backgrounds and years of experience.

The study site included only VCU police department officers.

Mell’s procedure mixed several demographic variables with situational and outcome variables. In effect, this method turned qualitative information into a quantitative study, yielding metrics that can be analyzed.

For both the police officer and the citizen in an interaction, Mell logged demographic variables such as race, age and gender. The length of service and rank of the officer were also noted.

After organizing the variables, Mell interpreted the nature of the police-citizen interaction. Understanding the nature of these interactions may help police departments train officers to better follow the four pillars of procedural justice: participation, neutrality, dignity/respect and trustworthiness.

Mell said procedural justice is the idea that treating people fairly can impact your interaction with them. There is evidence that procedural justice provides a means for police legitimacy, in turn allowing police to effectively perform their jobs.

"The idea is that if I'm a police officer and I treat you with respect … then the outcome of our interaction will be more positive," Mell said.

She acknowledged that her study has a few limitations. Future research may explore those limitations.

"There's a few different variables I would adjust," Mell said. "I think the protocol could be enhanced. I'd really like to be able to better measure the incident type," such as whether it was a traffic stop, a misdemeanor crime report or a call for service.

That may allow researchers to determine if one of the four pillars is particularly important during a specific incident type.

Mell believes her study introduces a way for a police department to evaluate officer performance. She hopes the research will allow officers to better understand police-citizen interactions. •

Nuclear engineering program marks 10th anniversary

VCU is the only university in Virginia with an accredited undergraduate nuclear engineering major concentration, as well as M.S. and Ph.D. programs in mechanical and nuclear engineering

WRITTEN BY
Rebecca Jones

TAGS
ABET, engineering, nuclear

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Ten years ago, Virginians who wanted to study nuclear engineering at the graduate level had to leave the state to do so. It was a situation that made for a brain drain – and an opportunity to prepare students for careers with companies like Dominion Resources, the energy giant headquartered in Richmond.

“Around 2007 or so, Dominion’s nuclear business unit employed a lot of people who had come in with bachelor’s degrees, but they had to leave the state to go any further into their

education," said Kerry Basehore, the company's director of nuclear analysis and fuel from 1997 to 2016. "We looked at the situation, and at the fact that the VCU School of Engineering had opened 10 years earlier, and we said, 'Why don't we start a night program?'"

Basehore and colleagues from Dominion met with Russell Jamison, Ph.D., dean of the Engineering School, and the team hashed out a plan. VCU Engineering would begin by offering M.S. courses in nuclear engineering. The classes would be held in the evening, and many would be taught by Ph.D. nuclear engineers from Dominion.

One of those colleagues was Sama Bilbao y León, Ph.D., currently an associate professor and director of nuclear engineering programs at VCU. In fall of 2007, she was a nuclear safety analysis engineer with Dominion and instructor in the school's first nuclear engineering course.

'Historically, Virginia is a pioneer in the area of nuclear engineering, but we were losing talent after a year or two. We had to stop the attrition problem,' Sama Bilbao y León says.

"Historically, Virginia is a pioneer in the area of nuclear engineering, but we were losing talent after a year or two. We had to stop the attrition problem," Bilbao y León said. "In those early meetings, it was clear that both VCU and Dominion would benefit."

Today, it's clear that the benefits to both academia and industry have been dramatic. VCU is the only university in the commonwealth with an accredited undergraduate nuclear engineering major concentration, as well as M.S. and Ph.D. programs in mechanical and nuclear engineering. Over the past decade, VCU has graduated 197 students and attracted more than $5 million in research grants. The program's hallmark has been its ability to balance theory and application in its approach to nuclear engineering education.

Associate Professor Sama Bilbao y León, Ph.D., director of nuclear engineering programs at VCU

“Sama really is the perfect person to head our nuclear programs because of her vast industry and policy experience,” said Gary Tepper, Ph.D., who has chaired the Department of Mechanical & Nuclear Engineering since 2009. He said adding nuclear engineering to the department’s offerings has boosted enrollment.

“In 2009, we had about 300 students. When we added the nuclear concentration, we went to nearly 600 students in a short time. It gave the program visibility and gave students options. They said, ‘At VCU, I have lots of choices,’ and that was obviously attractive to them,” Tepper said.

The program’s progression has been steady and strategic:

• Two years after VCU’s first M.S. nuclear engineering courses in 2007, the department added an undergraduate nuclear engineering concentration option to the mechanical engineering bachelor’s degree.
• In 2010, the VCU Department of Mechanical and Nuclear Engineering was formed.
• In 2012, the nuclear concentration was accredited by the Accreditation Board for Engineering and Technology.
• The following year, VCU enrolled the first students into the Ph.D. in mechanical and nuclear engineering. That degree remains the school’s newest doctorate and the country’s only hybrid mechanical/nuclear Ph.D.

“At every level, our program is distinguished by hybridization and integration,” Tepper said. “It’s a very good partnership for our graduates, as well. They can earn an undergraduate degree in mechanical engineering, for example, but with an ABET-accredited nuclear concentration. This gives them flexibility in how they market themselves. Feedback from companies indicates

To date, VCU's nuclear energy program has garnered more than $5 million in research funding.

that they like that, too."

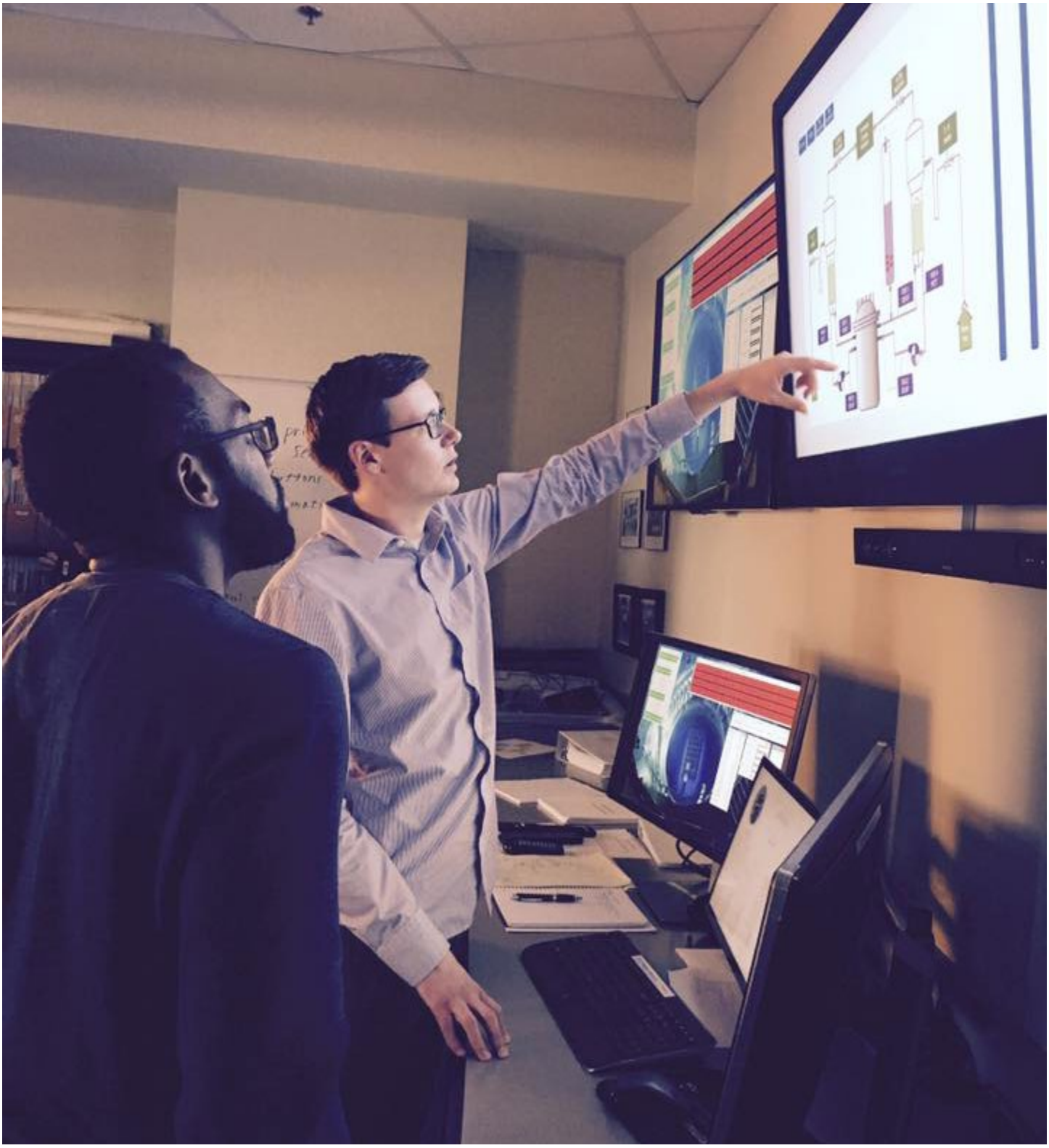
Bilbao y León said the marriage of nuclear and mechanical engineering is also conceptually strong because the two disciplines share many foundation courses including thermodynamics, fluid mechanics, heat transfer and material science. Surveying those synergies and the program's steady growth, she has a clear vision for its next phase.

"We have five research faculty members now and would like to see that number double. Our faculty and graduate students have been awarded a good number of Department of Energy research grants, and this is helping us develop in the right areas to eventually become a powerhouse. VCU has strong expertise in a few core areas that could make us become a go-to program in areas including energy and environmental policy, security and nonproliferation, advanced reactor design and fuel cycle advanced technology."

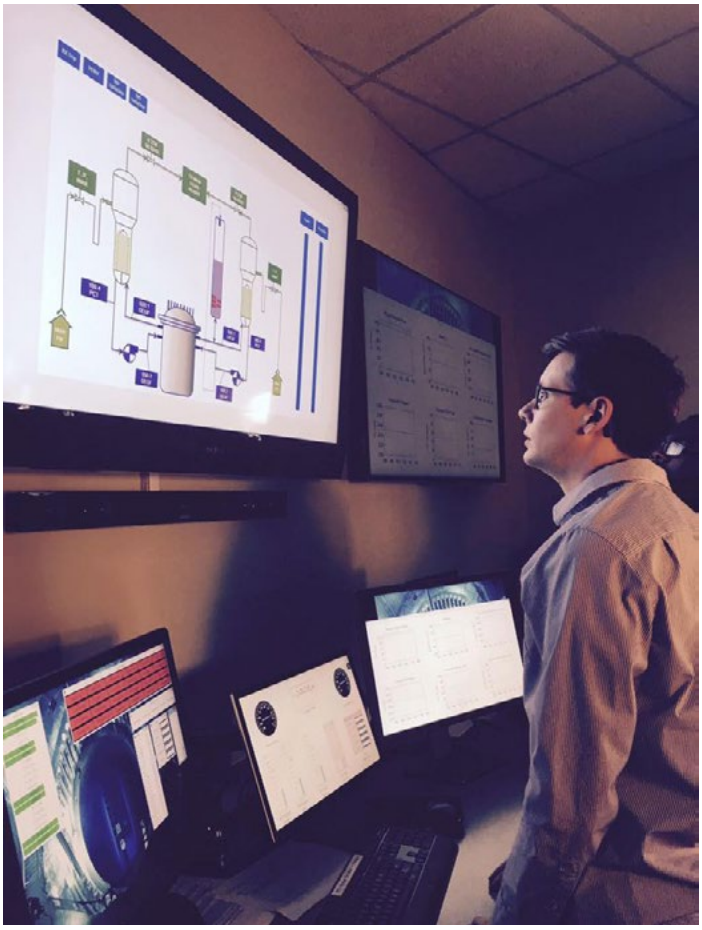
To date, VCU's nuclear energy program has garnered more than $5 million in research funding. Highlights include Tepper's 2010 study of uranyl soil extraction and fluorescence enhancement by silica gel, which advances testing for environmental radioactivity by providing a new method to allow fast and sensitive measurement of uranium in soil.

Bilbao y León's 2012 project titled "Re-Branding the Nuclear Energy Cycle" offers a comprehensive approach to communicating with the public about nuclear energy and building a better understanding of the nuclear fuel cycle.

In 2016, Supathorn Phongikaroon, Ph.D., associate professor of nuclear engineering, and his team developed a method to measure and produce near real-time measurements of



Nuclear engineering senior Kevin Jeunang, left, and Ph.D. candidate Daniell Tincher validate calculations on VCU's nuclear reactor simulator.



Ph.D. candidate Daniell Tincher is one of two VCU students to receive a U.S. Department of Energy fellowship in the 2016 round. Tincher's dissertation project is a redesigned nuclear reactor simulator.

the elemental concentration of salts in nuclear electrorefiners using laser-induced breakdown spectroscopy. This process helps ensure material accountability and safeguards of special nuclear materials.

Students are also contributing to VCU's stream of nuclear engineering research. In 2016, two Ph.D. candidates received highly competitive U.S. Department of Energy fellowships totaling more than $300,000. Hunter Andrews is using his fellowship to develop a method that uses electrochemistry and lasers to reprocess used nuclear fuel. Daniell Tincher is using his fellowship to develop a methodology that makes legacy nuclear codes more usable and user friendly, enabling real-time, event-driven modeling and simulation.

Every summer, VCU's nuclear engineering students can study reactor theory and operate an experimental nuclear reactor in a VCU study-abroad course. Bilbao y León developed the three-credit intensive course in partnership with the Technical University of Dresden, Germany. It features the AKR-2 training reactor, Germany's most modern research nuclear reactor. For two weeks, the students perform startup, shutdown and power maneuvers, as well as several neutron activation and isotope identification exercises.

Bilbao y León and Tepper see a promising horizon for nuclear engineering at VCU. Given the discipline's growth, they look toward expanding the faculty and continuing to build expertise in power generation, national security, radiation detection and nuclear medicine.

It's a continuation of the innovation that took place in 2007 when industry and academia came together to build something new and necessary. Tepper and Bilbao y León look forward to

helping write — and disseminate — the next chapter of that story.

“My goal now is to keep advancing VCU’s name among the U.S. nuclear engineering programs. More and more people are seeing how good our program is,” Bilbao y León said. •

This article also ran in the January 2017 issue of Nuclear News*, published by the American Nuclear Society.*

Reimagining your Rx

VCU researchers are redesigning medicines. In the future, some prescriptions might be manufactured in a factory the size of a refrigerator – or even be produced by your body itself.

WRITTEN BY
Rebecca Jones

TAGS
drug manufacturing, personalized medicine, Pharmacy on Demand

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Say "prescription medication," and most people envision a one-size-fits-all white pill made in a huge factory far away.

While that picture of pharmaceutical production may be largely accurate for now, researchers at VCU are redesigning medicines. What will your future prescriptions look like? Some of them might be manufactured in a small portable factory – or even be produced by your body itself.

Dr. Thomas Roper, director of pharmaceutical engineering in VCU's Department of Chemical & Life Science Engineering (Photo by Hillary Kuhn)

'By taking processes from the macro scale to the micro scale, we are able to bring science and engineering closer to the patient,' Roper says.

According to Dr. Thomas Roper, director of pharmaceutical engineering in VCU's Department of Chemical & Life Science Engineering, tomorrow's medications are moving toward manufacturing processes that shrink the environmental and industrial footprint as they expand global access to drugs. And those meds are likely to be more customized to the patient and easier to take.

"I would say that the theme of my lab is miniaturization for the purpose of personalized medicine," Roper said. "By taking processes from the macro scale to the micro scale, we are able to bring science and engineering closer to the patient."

Pharmacy on Demand, a project that Roper is working on with collaborators from the Massachusetts Institute of Technology, is an object lesson in these themes. In this case, the object is a pharmaceutical factory merely the size of a refrigerator.

Patients in hard-to-access places often have to wait for medicine – or go without it altogether. Pharmacy on Demand is working on an alternative approach based on small, configurable pharmaceutical manufacturing platforms that can ultimately be shipped to different locations to supply patients with locally produced, high-quality meds.

Such a strategy would expand access to pharmaceuticals worldwide, reduce environmental impact and make the manufacturing process safer by avoiding the burden of the construction of manufacturing sites.

"In my opinion, the biggest advantage of these miniature manufacturing facilities is footprint," Roper said. "Take hydrogen, for example,

which is highly flammable and explosive. If you have a big reactor with hydrogen under high pressure, there are huge safety parameters that must be accounted for, but a facility this size is intrinsically safer because there is much less hydrogen available to react at any one time."

Roper hopes to initiate work in the area of biological catalysis that will streamline the pharmaceutical manufacturing process further.

"Another potential way to manufacture medicines is biologically," Roper said. "An area I am interested in is biological catalysis of reactions, so eventually you are creating medicines in a biological host such as E. coli or ultimately even in a human cell."

In this paradigm, the medicine is not a tablet from an amber-colored bottle, but a chemical process that transfers the manufacturing of the medicine to the patient's body.

"In other words, if you string together chemical transformations that can be done by enzymes in a cell, you can effectively eliminate the external manufacturing footprint," Roper said.

He sees other trends away from the production of medicines that patients take regularly and toward the creation of processes that play out in a patient's body over time. These include commercial gene therapies like Strimvelis, GlaxoSmithKline's recently approved treatment for severe combined immunodeficiency or "bubble boy disease."

Roper also points to the development of long-acting medicines that patients take only once every 60 to 90 days. When perfected, they may offer major advantages, including freedom from the stigma of disease and greater assurance that patients will actually take their prescriptions.

Creating ways to increase patient compliance with treatment regimens is an important aspect of pharmaceutical research.

“Patient compliance in pharmaceuticals is terrible, which reduces the effect of the medical treatment. Even in cancer treatment, patients will not always take their medicine when they are supposed to,” Roper said. Creating ways to increase patient compliance with treatment regimens is an important aspect of pharmaceutical research.

He noted an additional advantage to many of the next-generation drugs – one harder to quantify.

“There is a general improvement in patient quality of life,” Roper said. “These treatments come closer to being cures, so people have to spend less time feeling like a patient.” •

A fluffy friend can chase stress away

VCU's Center for Human-Animal Interaction is researching whether therapy dogs can relieve students' anxiety, just as the dogs can help hospital patients

WRITTEN BY
Jessica Mayfield

TAGS
CHAI, stress, therapy dogs

PUBLISHED
Dec. 5, 2016

For students in panic mode over a looming exam, here's a possible stress reliever – one with four legs, soft fur and an irrepressibly wagging tail.

Dogs may help reduce students' stress levels, just as they do with some hospital patients. Researchers from VCU's Center for Human-Animal Interaction are studying whether that's true.

CHAI was established in the VCU School

A therapy dog at a recent “Paws for Stress” event. (Photo by Jessica Mayfield)

‘We saw all these news stories in the media about dogs reducing stress in students, but we didn’t see any evidence that anyone had researched to see if it indeed did,” says Dr. Sandra Barker.

of Medicine in 2001 and is housed in the Department of Psychiatry. As the fall semester winds down, the center’s experts have been participating in “Paws for Stress” events hosted by University Counseling Services. The events, held in the Student Commons, give students the opportunity to play with dogs during a particularly demanding time of final projects and high-stakes tests.

CHAI’s dog therapy program is called Dogs On Call. The dogs are well trained and come from willing volunteers. Each dog and its owner must go through an application process to become part of the exclusive Dogs On Call team.

But the “Paws for Stress” sessions aren’t simply playtime; there’s science going on.

“We saw all these news stories in the media about dogs reducing stress in students, but we didn’t see any evidence that anyone had researched to see if it indeed did,” said Dr. Sandra Barker, the director of CHAI and a professor of psychiatry at the medical school.

So Barker designed a study to see whether evidence supports the claims that playing with a dog can reduce anxiety.

For the study, participating students rated how stressful they felt immediately before and immediately after interacting with the dogs; researchers then compared the ratings. The conclusion was that the dogs helped reduce stress – regardless of whether students had a high level of stress or not.

The research has limitations, of course. For one thing, the students recorded the stress levels themselves, so the data was self-reported.

Chelsea Schmidt, a freshman at VCU,

Dogs On Call is the name of the therapy dog program of VCU's Center for Human-Animal Interaction. (Photo by Jessica Mayfield)

participated in one of the "Paws for Stress" therapy events.

"I feel like it did lower my stress level by distracting me for a little while from what was going on, so playing with a therapy dog before a test would probably help," she said. "I would recommend therapy dogs to anyone who isn't allergic or scared of dogs!"

Students are not the only ones who can benefit from therapy dogs. Other studies have shown that hospital patients can also benefit.

"We're collecting patient satisfaction data right now," Barker said. "We have some of our medical students helping us do that." She said it's "overwhelmingly possible" that patients will react positively to dogs.

Other studies have also concluded that interaction with companion animals can be beneficial to your health.

"The American Heart Association published a white paper revealing all of the studies that have been done on cardiovascular risk factors. They concluded that pet ownership, particularly dog ownership, is associated with reduced cardiovascular risk – and that's huge," Barker said.

'We also have seen studies that interacting with dogs can benefit kids with autism and our psychiatric patients with fear and anxiety. Currently, we are looking at the benefits of our therapy dogs with patients before medical procedures.'

"We also have seen studies that interacting with dogs can benefit kids with autism and our psychiatric patients with fear and anxiety. Currently, we are looking at the benefits of our therapy dogs with patients before medical procedures and looking further at the benefits of pet ownership in our students. There are many benefits. The field is still young, but it's promising."

Playing with dogs may help relieve stress. (Photo by Jessica Mayfield)

VCU researchers are studying whether interacting with therapy dogs can alleviate students' stress. (Photo by Jessica Mayfield)

How you can help

The Center for Human-Animal Interaction is nonprofit and relies mainly on donations. It is a 501(c)(3) charity affiliated with the Medical College of Virginia Foundation.

With the help of donations, researchers can continue doing research and educating the next generation of health professionals. You can donate on the center's website at www.chai.vcu.edu. •

E-cigarettes may be a clue at crime scenes

Forensic scientists at VCU are developing advice for forensic teams if e-cigarettes and other vaping paraphernalia are found at a crime scene.

WRITTEN BY
Jessica Mayfield

TAGS
e-cigarettes, forensics, vaping

PUBLISHED
Nov. 1, 2016

You've probably seen the show "CSI: Crime Scene Investigation" and spinoffs like "CSI: Miami." VCU researchers could provide the inspiration for a new drama: "CSI: Vaping" – about how e-cigarettes could be critical clues in solving crimes.

Forensic scientists at VCU are developing advice for forensic teams if e-cigarettes and other vaping paraphernalia are found at a crime scene.

"The forensic science community is unaware

Photo from U.S. Centers for Disease Control and Prevention

‘We want this information to be spread throughout the forensic science community so when evidence like e-cigarettes come to the forensic labs, they know what to do with it or know the resources to contact,’ Poklis says.

of the compounds that may be found in these e-liquids. It’s our job to make them aware,” said Justin Poklis, one of the leaders on the research team.

The team includes experts in forensic science, chemistry, pathology, pharmacology and toxicology. Their goal is to collect data from a vaping machine that they created and analyze the contents of the vapor coming from e-cigarettes. They want to find out what compounds can be found in e-liquids and how much of it can be ingested through the body.

In 2015, one out of three murder cases in the United States went unsolved for the lack of witnesses or, more importantly, evidence. E-cigarettes might be missed when collecting evidence at a crime scene if investigators don’t know what they might contain. Illegal substances found in e-cigarettes could be a lead to solving a case.

“We want this information to be spread throughout the forensic science community so when evidence like e-cigarettes come to the forensic labs, they know what to do with it or know the resources to contact,” said Poklis, a board-certified toxicologist.

As research continues on e-cigarettes and their contents, the forensic community will have deeper knowledge about what to do with such evidence. Maybe in the near future, we will see how an e-cigarette helped solve a crime. •

Glove's a perfect fit for patients with Raynaud's disease

VCU engineering student Jessica Bishops suffers from a disease that constricts blood flow in fingers and other extremities exposed to cold environments. So she invented a pair of 'magic gloves' that regulate hand temperature in cold environments.

WRITTEN BY
Riley Murtagh

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magic gloves, raynaud's disease, skin temperature

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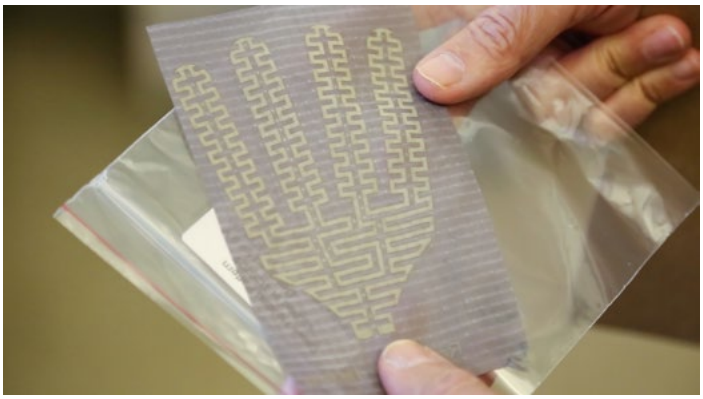
For her senior capstone design project, VCU engineering student Jessica Bishop wanted to give a helping hand to other people like her.

At age 14, Bishop was diagnosed with Raynaud's disease, which constricts blood flow in fingers and other extremities exposed to cold environments or stress. The extremities' inability to warm can cause discoloration, pain and even nerve damage.

Raynaud's disease affects 5-10 percent of the

‘My hands will turn white over the slightest change in temperature,’ Bishop says. ‘It frustrates you, especially because other people can’t really see what’s happening.’



The gloves have sensors that measure skin temperature and a microchip to modulate the heat. (Photo courtesy of the VCU School of Engineering)

population, but only about 10 percent receive treatment, experts say. The disease has no cure, so for people like Bishop, the only option is to treat the symptoms.

“My hands would get cold and turn purple, but I never really took precautionary efforts,” Bishop said. “It’s gotten to the point where my hands will turn white over the slightest change in temperature. It frustrates you, especially because other people can’t really see what’s happening.”

A regular hiker and cyclist, Bishop became increasingly frustrated with available treatments. This led her to an idea: a pair of “magic gloves” that regulate hand temperature in cold environments. During her senior year, Bishop and three other students built a prototype to display at the 2016 VCU Capstone Design Expo.

While there are heated gloves on the market, none of them regulates the hand’s temperature. This can be an issue, as most gloves tend to overheat and cause the wearer to sweat. To address this, the team programmed its glove to heat only when needed, said Dr. Mohamed Gadelhak, faculty adviser for the project.

“It has sensors that measure skin temperature and a microchip to increase, decrease or shut down heat,” said Gadelhak, professor emeritus in VCU’s Department of Mechanical and Nuclear Engineering. “It saves energy, so the battery lasts longer. That way, the person can go skiing for two or three hours, rather than 30 minutes.”

Nathan Kirby, one of Bishop’s teammates, ran simulations to determine when permanent nerve damage can occur. Using heat transfer analysis, he determined it would take about 16 minutes for the hand to reach dangerous temperatures.

‘We wanted something that keeps you comfortable and able to do everyday activities like walking your dog or even driving with a cold steering wheel,’ Bishop says.

“The modeling that I did brought a good idea of the temperature range we were dealing with,” Kirby said. “It also highlighted the danger of Raynaud’s disease and how quickly you can cause nerve damage to your hand.”

The glove is stitched with a conductive steel thread, making it both flexible and comfortable. The thread allows the wearer to distribute heat to specific parts of the hand. Current market-leading gloves heat only the palm and are too bulky, Bishop said.

“We wanted something that keeps you comfortable and able to do everyday activities like walking your dog or even driving with a cold steering wheel,” she said. “And to make sure it’s affordable and available to everyone.”

The team has a provisional patent for the magic gloves and is seeking a sponsor for a permanent patent. If the students receive a sponsor, the model would progress into manufacturing. •

Project tracks veterans' brain injuries

Dr. David Cifu of VCU's Medical School leads a national research study that aims to help physicians understand more about concussions and their long-term effects

WRITTEN BY
Riley Murtagh

TAGS
concussions, neurotrauma, veterans

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It's an injury that leaves no visible scars.

People who suffer a concussion, formally known as traumatic brain injury, can experience headaches, confusion and amnesia, but rarely is there physical evidence of brain damage. While the effects are usually temporary, for about 15 percent of affected individuals, symptoms never fully disappear.

Concussions can occur in any scenario – from playing football or other sports to being in a

‘There are millions of people in this country who have combat-associated concussions from the vagaries of war, as well as secondary mental health disorders from those wars,’ says Dr. David Cifu.

Dr. David Cifu talking to his medical colleagues. (Photo courtesy of Dr. Cifu)

Dr. David Cifu talks with fellow CENC members at a meeting of the consortium in 2014. (Photo courtesy of VCU Department of Physical Medicine and Rehabilitation)

traffic accident. They’re especially prevalent in the military: About 20 percent of U.S. veterans who fought in the Iraq War sustained concussions. Of soldiers who received head trauma, about 8 percent continue to have symptoms today, said Dr. David Cifu, chair of the Department of Physical Medicine and Rehabilitation in the VCU School of Medicine.

“There are hundreds of thousands of people in this country who have combat-associated concussions from the vagaries of war, as well as secondary mental health disorders from those wars,” Cifu said. “We need to understand how they’re going to do in terms of those symptoms. Will they worsen? Will they have degeneration?”

Since 2013, Cifu has led a national research project that aims to help physicians understand more about concussions and their long-term effects. The Chronic Effects of Neurotrauma Consortium, centered at VCU, involves 30 universities and 10 research studies across the country. The U.S. Department of Defense and the U.S. Department of Veterans Affairs jointly fund CENC with a grant of more than $62 million.

While brain injuries have been an issue in every war, they are also common in sports and civilian life. More than 2.5 million concussions are reported annually in the United States; they contribute to about 30 percent of all injury deaths, according to the U.S. Centers for Disease Control and Prevention.

As part of CENC, Cifu is leading an observational study involving 1,100 Iraq War veterans, of whom 880 experienced concussions and 220 did not. Some of these veterans suffered their injury more than 10 years ago. To study the long-term effects, Cifu and his team are using studies like MRIs, balance tests and eye tracking.

Dr. David Cifu

In 2008, Dr. David Cifu, then medical director of the McGuire Veterans Affairs Medical Center, tells Marine Corps Gen. James E. Cartwright, vice chairman of the Joint Chiefs of Staff, about treatment facilities at the center in Richmond. (Photo courtesy of the U.S. Defense Department)

‘If you’re always exposed to constant trauma or stress, and you’ve got depression or anxiety before you have a brain injury, you’re going to do worse after a brain injury.’

“While these are folks that are relying on VAs or health clinics for care, they’re just like you and me. Even though they’ve had these concussions, we’re seeing that they’re still working, have regular lives, houses to live in. They’re productive in their lives,” Cifu said. “But they’re having difficulties, having some persistent headaches or sleep disturbances, or high-level attention or memory problems.”

While researchers have not found a direct causation, about 75 percent of those veterans also suffer from mental illnesses like depression and posttraumatic stress disorder. Treatments exist, but there isn’t a comprehensive treatment that applies to every victim. As of now, the most effective treatment is “prehab” rather than rehab, Cifu said.

“If you’re always exposed to constant trauma or stress, and you’ve got depression or anxiety before you have a brain injury, you’re going to do worse after a brain injury,” Cifu said. “So we want to try and keep the brain as healthy as possible, build resiliency inside these folks so if they do get trauma or a brain injury, they can rebound as quickly as possible and are aware that steps will be done to try and treat them.”

Across the country, more organizations are organizing a call to arms to study concussions. The Defense Department has also partnered with the NCAA to better detect such injuries among athletes. At the University of California, San Francisco, the research group TRACK-TBI is looking at better treatment strategies in the civilian sector.

With the CENC in its final two years, Cifu hopes the consortium will receive additional funding so researchers can continue following veterans who have suffered traumatic brain injuries.

“This isn’t a one-year problem. This isn’t a three-year problem. What we’re seeing are chronic issues, lifelong issues,” Cifu said. •

Pine trees may shed light on global warming

In the lab and on the Appalachian Trail, graduate student Constance Bolte studies ecology, evolution and climate change: How have pine trees adapted, and what will happen if they die off?

WRITTEN BY
Nicole Nelson

TAGS
climate change, evolutionary biology, pine trees

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What can pine trees tell us about climate change? A lot, says VCU graduate student Constance Bolte.

She has been conducting research at “the intersection of ecology and evolution,” focusing on three species of pine trees: the loblolly, the pitch pine and the table mountain pine. Using temperature and precipitation data, Bolte has been forecasting and “hindcasting” the species’ distribution across North America.

Graduate student Connie Bolte

If the table mountain pine dies off, Constance Bolte says, 'We may have erosion problems.'

"Preliminary data shows that this species is contracting," she said, referring to the table mountain pine.

By showing how the area covered by certain pine trees has shrunk and migrated since the last ice age, her research may shed light on climate change and global warming. Bolte also is studying whether or how these plants have adapted and what happens to the environment as pine trees die off.

"I'm not only interested in trees," she said. "I'm interested in ecosystems and how they work."

Bolte is at the tail end of her second master's degree, which she plans to turn into her research project for a Ph.D. She has been working in the lab of Dr. Andrew Eckert, an assistant professor in the VCU Department of Biology.

But Bolte is not just crunching numbers in the lab. This summer, she will embark on an expedition along the Appalachian Trail to gather data and record observations about pine trees.

"I hope to bring more attention to table mountain pine," she said. "If they were to go, and no other species has the ability to grow in that area, we may have erosion problems."

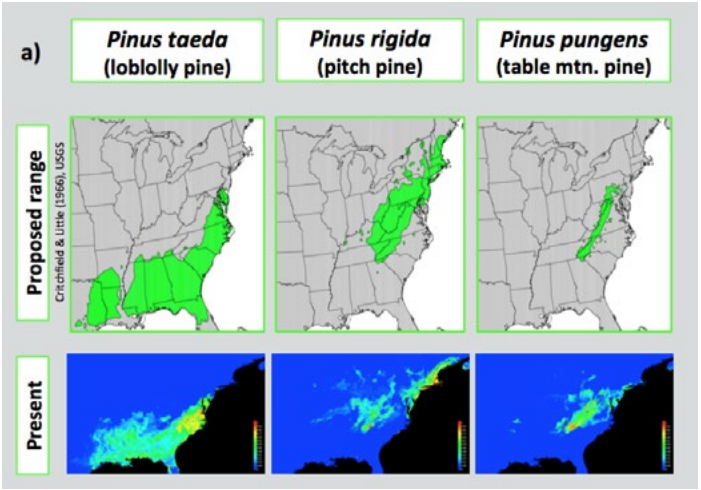
Bolte has been looking all the way back to the last interglacial period. She has tracked the distribution of pine trees and their migration, which she refers to as hindcasting.

Bolte also uses forecasting to predict how the distribution will change in the future.

"We can take where I think the distribution is going to be, and we can overlay impervious surfaces, which is essentially urbanization," Bolte said. "If they (trees) don't co-evolve with the

Connie Bolte in the forest doing research on pine trees

Mass transit, bike and pedestrian infrastructure, and mixed land use are 'important to reducing greenhouse gas emissions.'



Bolte is mapping the areas where different pine trees grow. (Image courtesy of Constance Bolte)

climate, they're going to have to migrate."

It's possible that the pine trees will diverge into new species as the climate changes. But Bolte predicts, "Statistically it's not going to happen – probably not going to happen fast enough – based off of how much carbon we're putting into the atmosphere and how accelerated that is."

As Bolte continues working toward her Ph.D., she questions how growing urbanization, combined with climate change, will impact our ecosystem. Participants at a recent environmental meeting at VCU also pondered such issues.

The Renewable Energy Summit drew professors and members of groups such as the Climate Reality Project and Environment Virginia.

At the event, a panel of experts discussed the technologies and advancements being made in the renewable energy field.

The panelists included Damian Pitt, an assistant professor in the L. Douglas Wilder School of Government and Public Affairs.

As urbanization increases, what should cities do to deal with climate change?

They should invest more in mass transit and bicycle and pedestrian infrastructure and promote mixed land use patterns, Pitt said. "Those things are just as important to reducing greenhouse gas emissions as solar and wind energy are."

Bolte agrees that action is needed to address the challenges of climate change: "I don't think there's anything that any one person or even a collection of people can do … other than lower your carbon footprint." •

Professor studies invasive species in Africa

‘We are in the midst of a biodiversity crisis,’ says Fulbright Scholar James Vonesh. He has been studying why certain species thrive in a new environment while others don’t. Vonesh has developed innovative classes at VCU, including a camping-kayaking trip on the James River.

WRITTEN BY
Nicole Nelson

TAGS
biodiversity, experiential learning, invasive species

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From developing an immersive experiential class on the James River to receiving a Fulbright Scholar award to study invasive species in South Africa, James Vonesh is a role model for students who strive to become researchers.

Vonesh is an associate professor in the Biology Department at VCU. He recently returned from conducting research in South Africa, where he focused on the invasive species of frog known as the Xenepous laevis.

‘We are converting the surface of this planet to be suitable for us,’ Vonesh says. ‘It boils down to habitat loss.’

Vonesh explored why certain species spread and take off when in a new environment while others do not. Why is this important?

“We spend millions of dollars trying to manage and mediate the effects of invasive species,” Vonesh said. “We are in the midst of a biodiversity crisis. We are losing species, and populations of species are being reduced.”

Development is a major cause of the crisis, he said.

“We are converting the surface of this planet to be suitable for us,” Vonesh said. “It boils down to habitat loss.”

Vonesh will delve deeper into this issue as he conducts his current research on the importance of predator biodiversity. He is looking at what happens when predators are released from or added to an ecosystem.

As a teacher, Vonesh stresses the importance of experiential learning. Hands-on experience is the best way to ‘engage in the process of science itself.’

As a professor, Vonesh dedicates about 40 percent of his time to teaching, 40 percent to research and 20 percent to service, such as community work.

As a teacher, he stressed the importance of experiential learning. Hands-on experience is the best way to “engage in the process of science itself.”

“As you get close to the edge, it becomes fuzzier, and there’s less and less evidence on a given question,” Vonesh said. “But that helps you narrow down to a specific question that we don’t know, and then the exciting part of science is that next step – the step into the unknown.”

Vonesh has helped VCU students step into the unknown by developing more immersive hands-on classes. They include:

Associate Professor James Vonesh of the VCU Department of Biology

Professor Vonesh doing research in South Africa

• “Footprints on the James,” in which students take a three-week overnight camping-kayaking trip to explore the biology of the James River.

• “South African Summits to Sea,” which examines the human and natural history of KwaZulu-Natal. •

Researcher honored for 'Outstanding Early Career'

Dr. Matthew Banks, an assistant professor of pharmacology, received the award at VCU's fall convocation. He conducts research on how to treat drug addiction.

WRITTEN BY
Chris Rubis

TAGS
addiction treatment, opioids, phendimetrazine

PUBLISHED
Nov. 1, 2016

The United States is facing a heroin and opioid epidemic, with fatal drug overdoses steadily rising over the past 15 years. Scientists and doctors are working hard researching addiction and developing new ways to treat the growing issue.

One such researcher is Dr. Matthew L. Banks, an assistant professor in VCU's Department of Pharmacology and Toxicology. For his work in this area, Banks recently received the university's Outstanding Early Career Faculty

Dr. Matthew L. Banks

Monkeys are a good model for understanding why humans 'go along this path of misallocating their behavior to abused drugs,' Banks says.

Award.

His research centers on two themes – developing behavioral and pharmacological strategies to treat drug addiction, and making existing medications more effective with fewer side effects. Much of his work at the Medical College of Virginia involves rhesus monkeys.

"The research we do is intended to improve human health and also has applications to improving veterinary medicine," said Banks, who was honored at VCU's faculty convocation at the start of the fall semester.

Banks received his doctorate in pharmacy from Ohio Northern University and his Ph.D. from Wake Forest University. He was introduced to drug abuse research in pharmacy school, though his interest in the field stemmed from his experience as a runner who would often experience the "runner's high".

Currently, Banks is researching whether the use of an NMDA receptor antagonist called memantine would create an opioid sparing effect. The goal is to increase the therapeutic effect of an opioid, requiring a user to take less of the drug for pain management. An NMDA antagonist inhibits the action of the brain's N-Methyl-D-aspartate receptor.

The use of animals in research can be controversial. The MCV campus houses a lab of rhesus monkeys, which are involved in much of Banks' research. The Institutional Animal Care and Use Committee at VCU, as well as the federal agency providing a research grant, must review any proposals for use of laboratory animals to ensure the use is justified and the health and welfare of the animals will be protected. When not being studied, the monkeys live in a vivarium on campus.

Banks' research on the drug phendimetrazine suggests that it may be a viable treatment for cocaine addiction.

Research on animals can yield tremendous benefits. While primates make up only a half percent of all laboratory animals used, they have been crucial in many medical advances such as developing the polio vaccine, understanding the AIDS virus and searching for a vaccine for the Zika virus.

Humans share 90 percent of their genes with monkeys. Monkeys are a good model for understanding why humans "go along this path of misallocating their behavior to abused drugs," Banks said.

Such research can help clinicians treat people with addictions and "get them to reallocate their behavior back to socially adaptive non-drug reinforcers," he said.

While multiple pharmacotherapies exist for treating opiate addiction (such as methadone), the U.S. Food and Drug Administration has not approved treatments for cocaine and methamphetamine addiction.

Banks' research on the drug phendimetrazine suggests that it may be a viable treatment for cocaine addiction. It "decreases cocaine vs. food choice under several different experimental conditions," which means monkeys are more likely to choose food over cocaine after being administered the drug.

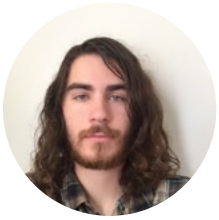
The compound acts as a dopamine transporter inhibitor like cocaine. Because it is a "prodrug," the body metabolizes it into a pharmacologically active compound called phenmetrazine that acts as a dopamine transporter substrate (or releaser). This combination may represent an "innovative treatment strategy for cocaine use disorders," Banks said.

He has discovered that although cocaine

and methamphetamine share similar properties, the two drugs will require different pharmacotherapies to treat their abuse. To Banks, these discoveries are exciting as they represent exactly what “preclinical researchers hope to do – that is, impact human health in a positive manner.” •

Rice Center focuses on restoring wetlands

The center, designed and built with the environment in mind, is an ideal location to study the ecosystem where freshwater and saltwater meet



WRITTEN BY
Chris Rubis

TAGS
James River, Rice Center, wetlands

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Halfway between Richmond and Williamsburg, where Kimages Creek flows into the James River, lies the Inger and Walter Rice Center for Environmental Life Sciences. A restoration project aims to return the area to its original state as a wetland. The project began by removing a dam that had been blocking the flow of Kimages Creek since 1927.

Formerly a YMCA camp, the property was purchased in 1977 by Walter Rice, former U.S. ambassador to Australia, before being donated

The Walter L. Rice Education Building

to the university by his wife, Inger Rice, in 2000. The intent was for VCU to use the land to develop a center for education, outreach and research, which became informally known as the Rice Rivers Center.

The main building, the Walter L. Rice Education Building, is an exemplary model for sustainable construction and has the highest certification under the LEED (Leadership in Energy & Environmental Design) program. It was constructed with sustainably harvested Atlantic white cedar and tropical hardwood. The center's gravel parking lot contains a plastic framework that drains rainwater into bioswales – mini habitats full of native wetland vegetation.

Other features include a "living roof" full of plants that utilize rainwater and insulate the building. Cisterns collect water for flushing the toilets. Thirty-six geothermal wells circulate water underground for energy efficient heating and cooling. It even contains insulation made from old blue jeans and a coat closet made of sunflower seeds and husks.

The center is the perfect backdrop to study 'one of most poorly understood interfaces between fresh and saltwater.'

Positioning of the building lets it capture heat from the sun during the winter. "Light tubes" concentrate sunlight, negating the need for lightbulbs during the daytime. And of course, the center has installed several solar panels.

The center's location along the James River estuary provides the perfect backdrop for researchers to study "one of most poorly understood interfaces between fresh and saltwater," said Dr. Edward Crawford, head of the Wetlands Restoration Project.

Protecting wetland ecosystems is of vital importance. "A hectare of Atlantic Coast salt marsh can produce upwards of 80 tons of organic matter a year," which provides food for

organisms further downstream, Crawford said. Wetland plants leach oxygen in a process called “radial oxygen loss,” which create “oxidized rhizospheres” that house millions of bacteria.

These bacteria break down and transform nutrients and toxins, like nitrogen. Crawford refers to wetlands as “nature’s supermarkets and kidneys” for their ability to produce organic matter and filter toxins and sediments.

That’s why, when he learned about VCU’s acquisition of the property, his first concern was tearing down the dam that had been blocking Kimages Creek since 1927, thereby restoring it to a wetland ecosystem. A storm breached the dam in 2006, and in 2010, approximately a third was removed.

A view of the restored Kimages Creek

Wetlands are extremely diverse and are an important part of many species’ life cycles. Nearly 50 percent of endangered species and 80 percent of breeding birds utilize wetlands at some point in their lives. Now that the connection to the James is restored, fish are free to swim up the creek and use it as spawning habitat.

“Every time I go up there, I see hundreds and hundreds of minnows swimming in and out of the restored wetland,” Crawford said.

Dr. Paul Bukaveckas, a professor of environmental studies and biology, conducted a study to measure retention of nitrogen in the restored creek. He found that compared with similar bodies of water nearby, Kimages Creek had attained normal levels of functioning.

Common sources of nitrogen include wastewater and agricultural run-off. It can cause a “range of problems including excessive algal growth, reduced water clarity and dissolved oxygen, and the occurrence of harmful algal blooms,”

If upstream ecosystems can be restored, Dr. Paul Bukaveckas says, 'This will reduce harmful impacts in downstream areas.'

Looking out from the Rice Center toward the James River

Bukaveckas said. "To the extent that upstream ecosystems can be restored to promote greater nitrogen retention, this will reduce harmful impacts in downstream areas."

Dr. Scott Neubauer, an assistant professor in the Department of Biology, added that wetlands don't suffer the same ill-effects of excess nutrients like nitrogen because "wetland soils typically have little to no oxygen."

"There is an anaerobic (oxygenless) microbial process called denitrification that can convert inorganic nitrogen from the water column into the largely-inert nitrogen gas that already makes up almost 80 percent of the atmosphere," Neubauer said.

Around the time the dam was built, King Fulton, the landowner at the time, clear-cut much of the land. One of the first studies conducted at the Rice Center was geo-referencing the location of all the stumps and determining what types of trees they were. The goal is to create a "virtual swamp" that will let Crawford and others create models of the environment while manipulating variables like temperature and precipitation, allowing them to see what it would have looked like without human intervention.

The Rice Center also has an eddy covariance flux tower – a sort of miniature meteorological station. It measures carbon dioxide, methane and water vapor exchange between the wetland and the atmosphere. "The hypothesis is that in these regenerating wetlands, more carbon is stored within the system than is getting emitted to the atmosphere," Crawford said.

Exciting research is happening all the time at the center. Much of it is done by VCU staff and graduate students, but they also collaborate with researchers from the U.S. Fish and Wildlife

Service, Virginia Department of Game and Inland Fisheries, and even NASA.

An open invitation exists for anyone interested in visiting. “I’d love for every student to have some type of experience at the Rice Rivers Center before they graduate,” Crawford said.

Want to visit the Rice Center?

Tours are open to the public every second Thursday of the month from 1 to 4 p.m. The center is located at 3701 John Tyler Memorial Highway in Charles City. For more information, visit www.ricerivers.vcu.edu. •

How a baby's brief life had a 'positive impact'

After her infant son Thomas died, Sarah Gray donated his organs and tissues to medical research. Finding meaning in Thomas' death has helped Sarah cope with the loss of her son

WRITTEN BY
Shawn Scornaienchi

TAGS
organ research, Sarah Gray, tissue donation

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In 2009, Sarah Gray and her husband Ross were excited at the prospect of welcoming identical twins into the world. Three months into the pregnancy, however, the Washington, D.C., couple found that one of the boys had a rare condition called anencephaly – a birth defect restricting brain and skull growth.

The doctors predicted that the baby, whom the Grays named Thomas, would die during childbirth or live only a few hours or days. Hearing this, Sarah asked the medical staff if

Sarah Gray, author of *A Life Everlasting: The Extraordinary Story of One Boy's Gift to Medical Science*

she could donate Thomas' body for transplant purposes. They put her in touch with the Washington Regional Transplant Community, an organ procurement organization.

On March 23, 2010, Thomas and his brother Callum were born. Six days later, Thomas passed away.

"I wanted to find a way for Thomas' brief life to have some kind of positive impact," Sarah said during a recent interview. She wanted to see the tragedy less as a loss and more as an opportunity.

"We asked our local organ procurement organization if we could donate for transplant, but they said he would probably be too small, but he would be able to donate to medical research. I said, 'Sure, whatever you want, you can have.' And so they were able to match the tissue he had to offer with a few different things."

Thomas' tissues went to four different places:

- His core blood was donated to Duke University.
- His liver was sent to a cell company called Cytonet, in Durham, N.C.
- His retinas were donated to the University of Pennsylvania's medical school in Philadelphia.
- His corneas were donated to Schepens Eye Research Institute, an affiliate of Harvard Medical School.

Finding meaning in Thomas' death has helped Sarah cope with the loss of her son.

"There's something that really takes away the loss," she said. "It's sad no matter what, and that's OK. But being able to see that his tissues could be studied to help people that are still alive has been helpful while going through the grief."

'Being able to see that his tissues could be studied to help people that are still alive has been helpful while going through the grief,' Sarah Gray says.

At home in D.C. last September: Sarah Gray with her son Callum, then 6, and infant daughter Jocelyn.

To Sarah, it was great to hear that her son's tissues had been successfully donated, but she still had a few questions on her mind: What happened next? Was the donation worth it?

She decided to take action and find the answers. Sarah started her journey by contacting her local procurement group in Washington, DC. They put her in contact with Old Dominion Eye Foundation in Richmond. This was the eye bank that received Thomas' corneas in March 2010.

The first person to handle Sarah's request of information was Christina Jenkins, the eye foundation's associate director.

"She wanted to know what type of research was done with the tissue," Jenkins said. "I never had that request before. I didn't know how to handle it; a lot of times we know what the research project is and sometimes we don't.

"I pulled the chart and discovered that it went to Schepens Eye Research Institute. I emailed that to her, and she emailed me right back and said, 'Oh wow, I can say my son went to Harvard.' To me, for someone to have such a positive outlook just on that little piece of information she had, it was really touching – especially as a parent."

In the years since her son's death, Sarah Gray has been one of the nation's leading advocates for organ donations. She has written a memoir, *A Life Everlasting: The Extraordinary Story of One Boy's Gift to Medical Science*, and given an inspiring TED Talk that has been viewed nearly 1.4 million times.

Sarah often jokes about how Thomas got into different schools.

"Thomas got into Harvard, Duke and Penn, and he has a job at Cytonet, and he has colleagues

and coworkers, and they need him in order to do their job," she said in her TED Talk.

In October, Sarah returned to Richmond to visit the Old Dominion Eye Foundation, which was a turning point in her quest to learn about what happened to Thomas' body. This was the organization that pointed her in the right direction and guided her through the organ donation and organ research process.

The nonprofit foundation, which was formed in 1962, helps thousands of people each year. Its slogan is simple yet profound: "Imagine a gift that could be opened 1,000 times a day and see a lifetime of smiles."

The Old Dominion Eye Foundation is led by William Proctor, the group's chief executive officer, and Jenkins. They have dedicated their lives to advocating for organ transplant and research.

'When you really break it down and look at all of the potential diseases that they may be able to cure or treat that directly relate back to Thomas, it's pretty powerful.'

"One of the most powerful parts of my job is working with the donor families," Jenkins said. "That is something that's really dear to me – being able to provide them some light in a very dark time. It's my pleasure to do that, and my honor to be a part of that, and that's the piece of the job that really kept me here."

Many people don't realize the potential benefit of donating organs to the scientific community. Sometimes, the donation can be to a specific person. But even when it's not, an organ donated to research can help millions of people.

"The research is not just about helping thousands now but into the future," Proctor said.

"With Thomas, they still have his cells that they will use ongoing. When you really break it down and look at all of the potential diseases that they

Want to be an organ donor? Here's how

An important part of becoming a donor is having a conversation with your family. It's critical to let them know that you want to help people by donating; that will make it an easier transition when the time comes.

To register as an organ, eye and tissue donor, visit www.DonateLife.net. That is the website of a Richmond-based nonprofit group called Donate Life America.

One person can save up to eight lives through organ donation, restore sight to two people through cornea donation and heal up to 75 people through tissue donation, the website says.

may be able to cure or treat that directly relate back to Thomas, it's pretty powerful."

Nobody knows that more than Thomas' mother.

Sarah Gray has since had a daughter – Jocelyn – and serves as the director of communications for the American Association of Tissue Banks in McLean, Virginia. Her story shows the true potential of a mother's strength and its benefits to the community. The donation of Thomas' tissues has had a monumental impact on families, organ donors and researchers.

"For grieving families that are about to face a loss, and they have a choice to make and they want to think about donating, I would recommend it," Sarah said. "I can't guarantee every experience is going to be like mine. But I did it, and I had a good experience, and I recommend it." •

This article also was published on Dec. 6, 2016, by RVAHub.com*, a news portal for the Richmond area.*

Method may revolutionize athletic training

Coaches at VCU and other universities say velocity-based training, which measures how fast an athlete can lift weights, can provide instant feedback on performance.

WRITTEN BY
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Speed is the key to success in track, football and most other sports. Researchers at VCU have found that speed is crucial to success in weight room training as well.

They are advocating a new method called velocity-based training, which measures how fast an athlete can lift weights. Collegiate coaches around the country are beginning to use velocity-based training to assess the day-to-day readiness and fatigue level of athletes.

Donnelly says the velocity-based method is ‘one of the quickest, easiest ways to assess something that has a big impact on day-to-day training.’

VCU sports performance coach James Donnelly

Utilizing this new technology, coaches can get instant feedback on how their athletes are performing.

The new training method calculates the velocity of a barbell, giving coaches an idea of how much stimulus an athlete is receiving per lift.

The velocity-based method is proving to be “one of the quickest, easiest ways to assess something that has a big impact on day-to-day training,” said VCU sports performance coach James Donnelly. “Over time, we can look at certain speeds using average velocity or peak velocity, depending on the lift being performed.”

Velocity-based training utilizes barbell speed to evaluate how an athlete is performing. Coaches conduct this training by attaching a “linear position transducer” to a barbell and have the athletes perform certain lifts.

The linear position transducer, commonly called a Tendo Unit, is typically a metal cylinder-shaped device the size of a brick. A retractable coil raveled inside the unit is attached to a barbell, and as the barbell moves, the coil unravels. The speed and distance of the coil’s unraveling is transmitted, calculated and displayed by a number on a wall unit. Coaches can use this number to determine the stimulus given to the athlete during that specific lift.

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Donnelly will graduate this fall with a master’s degree in health and movement science. He also received his bachelors of science in health, physical education and exercise science at VCU.

While working with the VCU sports performance department, Donnelly earned certifications from the National Strength and Conditioning Association and the Collegiate Strength and Conditioning Coaches Association. For that

Donnelly says velocity-based training may usher in a new era of athletic performance.

second certification, he studied 640 hours under the supervision of Tim Kontos, director of sports performance for VCU Athletics. In 2015, the coaches association named Kontos a Master Strength and Conditioning Coach, the highest honor given in the profession.

For their workouts, many athletes blindly follow advice handed down by coaches years ago. Donnelly says that's the wrong approach.

"Know why you're doing something," he said. "Don't just do it because you were told to."

A big advantage of velocity-based training is that it gives athletes an instantaneous assessment of how well they are doing. This method may usher in a new era of athletic performance, Donnelly said.

"It's something I think you'll see in most Division I weight rooms here soon." •