2024

VIRGINIA TECH

SCIENCE

THE MAGAZINE OF THE VIRGINIA TECH COLLEGE OF SCIENCE

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Rock Hall of Fame

ALSO FEATURING:
Racing in the Rainforest
P. 18

COLLEGE OF SCIENCE
VIRGINIA TECH

MESSAGE FROM THE DEAN

The genuine meaning of being a Hokie

As I write this, I've had the privilege of leading the Virginia Tech College of Science for just over two years. When I say I've had the privilege, I mean it.

During those two years, in wave after wave, I've come to appreciate the genuine meaning of being a Hokie. I've welcomed incoming first-year students or had lunch with them as they began absorbing the joy of their college decision. I watched as they discovered that the Virginia Tech education and campus experience would be all that they thought and hoped.

I've stood on the stage at commencement and scanned my eyes across the joyous parents and students at the very moment they would transition from undergrads to joining our vast, vocal, and proud band of almost 300,000 alumni. Entering the working world or academia, the new graduates will soon experience the smile and instant bond they get when they run into another Hokie.

This bond among Virginia Tech students, faculty, staff, alumni, friends, and families runs deep and wide. It is absolutely a defining, genuine characteristic of Virginia Tech.

In the pages that follow, you will read about and see examples of what I'm talking about. You'll see stories about our world-class researchers, two of whom (Robert Bodnar and Shuhai Xiao) were welcomed into the National Academy of Sciences this year — joining a third, Patricia Dove, who was inducted into the NAS in 2012.

You'll see the incredible experiences our undergraduates have as Virginia Tech students, such as attending the South by Southwest Conference in Austin, Texas, as part of an economics class, or traveling to the Eastern Shore of Virginia to conduct microplastics research.

And you'll have a chance to "meet" some of our alumni, who continue to give back and support Virginia Tech as part of our Roundtable Advisory Board. As usual, there's so much important and interesting content that I can barely skim the surface here.

I hope you enjoy reading about and seeing what's going on at today's Virginia Tech. I know you will agree with me that Virginia Tech is a special place, and it keeps getting better and better. Thanks again for your support in so many ways of the College of Science and Virginia Tech.

Go Hokies!

Kevin Pitts
Lay Nam Chang Dean's Chair,
College of Science

Follow Kevin on X at @KevinTPitts

VIRGINIA TECH SCIENCE
THE MAGAZINE OF VIRGINIA TECH COLLEGE OF SCIENCE

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WHAT'S INSIDE

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Rainforest Race

A College of Science-led genetic sampling team traveled deep into the Amazon Rainforest to compete in the final round of the $10-million XPRIZE Rainforest.

ON THE COVER

Rock Hall of Fame

Two geoscientists were honored as newly elected members of the National Academy of Sciences on April 26, in Washington, D.C. Membership in the National Academy is considered one of the highest honors that a scientist can receive.

P.22

ENVIRONMENTAL HEALTH

The Virginia Tech College of Science is bringing the spirit of *Ut Prosim* (That I May Serve) to bear in how we steward the Earth. Our scientists, with undergraduate and graduate students at their sides, are drawing up innovative methods to help our community get in front of complicated juggernauts like climate change instead of chasing the destruction left in the wake.

Illustration from Shutterstock.

Rare collection of plant specimens arrives at Virginia Tech herbarium

By Jimmy Robertson

Under normal circumstances, anything with origins from the 1840s would more than likely be in a dreadful state of condition.

But when Jordan Metzgar recently unfurled the contents of a box of plant specimens from the 1840s sent to him from a curator at the Natural History Museum in London, he found himself immediately unearthing exciting ideas for their use.

Rarely do herbarium curators secure such a harvest. That the specimens arrived in such quality condition is even more rare.

"It's unusual to get that kind of opportunity," Metzgar said. "We have a specimen from 1829 and a few things around that age, but getting a set of about 50 specimens from the 1840s and in good condition, that's a first since I've been here."

Metzgar doubles as the curator of the Virginia Tech Massey Herbarium and a professor in the Department of Biological Sciences within the College of Science. An herbarium houses a collection of dried plants within a climate-controlled setting.

Jordan Metzgar

Metzgar oversees the largest scientific preserved plant collection in Virginia, with the Massey Herbarium — located in Derring Hall — holding more than 100,000 specimens.

Once in Blacksburg, Metzgar stored the specimens in a freezer for two days to kill any insects.

"There are a lot of insects that like to sneak in and eat our plants," he said. "Sometimes they can hitch rides from other museums, so when the specimens arrive, I put them in a freezer for two days."

The new old collection continues Virginia Tech's emphasis on collecting native plants and seeds. Native seeds and plant specimens are important for research purposes and to sustain the health of natural ecosystems.

Much of the collection was common native species to Virginia, including several wildflowers such as red trillium. The ages of the specimens created the excitement more than the variety.

Metzgar and his staff permanently mounted the specimens on standard museum paper and attached a label to each one. They also added the names and collecting information to a database. People with an interest in a group of plants can get the data, or if they need a plant for DNA research, they can borrow it from the herbarium.

▲ Students interested in conducting research on plants native to Virginia will be able to take advantage of approximately 50 specimens from the 1840s that were recently sent from London to Jordan Metzgar (at right), the curator of Virginia Tech's Massey Herbarium.

"They're an important historical record. We could look at samples from the same location from 1840 to today. There might be differences due to climate change, a new pathogen, insect, or pest. We'll be able to use them for a lot of biodiversity research," Metzgar said.

Metzgar envisions these specimens lasting another 200 years. VT

↓

Scan to watch: "Massey Herbarium welcomes 200-year-old plants back to America"

Putting Carbon SAFEly Back Underground

By Travis Williams

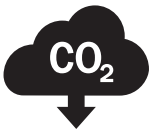
For six years, Uzezi Orivri was a petroleum engineer, focused on extracting oil and gas from the ground.

Now, as part of a U.S. Department of Energy-funded project, the former petroleum engineer is helping revolutionize efforts to keep harmful amounts of carbon dioxide (CO_2) out of the atmosphere by putting it in the ground.

"Carbon sequestration was something I really wanted to do my Ph.D. research on," said Orivri, a Ph.D. student in the Department of Mining and Minerals Engineering. "My work experience as a Petroleum Engineer highlighted the necessity of reducing carbon emissions while simultaneously increasing energy accessibility. This project really aligns well with my research objectives."

Uzezi Orivri

Recently announced by the U.S. Department of Energy Office of Fossil Energy and Carbon Management and administered by the National Energy Technology Lab under federal award number DE-FE0032447, the Atlantic Coast CO_2 Emissions Storage Sink, commonly referred to as Project ACCESS, is a CarbonSAFE Phase II feasibility study in South Florida that will evaluate the potential for safe and permanent geological CO_2 storage at depths exceeding 7,500 feet below the Earth's surface. Overseen by the Southern States Energy Board with Virginia Tech serving as the technical lead, Project ACCESS aims to store more than 1.7 million metric tons of CO_2 per year and reduce the risk and costs of future projects.



Project ACCESS aims to store more than 1.7 million metric tons of CO_2 per year

"With many industrial emitters and a limited history exploring carbon dioxide capture, utilization, and storage opportunities, Project ACCESS represents an initial step toward understanding the opportunities and challenges associated with commercial deployment in South Florida," said Ben Wernette, principal scientist and strategic partnerships lead for Southern States Energy Board. "Virginia Tech is responsible for the design and oversight of the surface characterization program, including all field data acquisition programs and modeling efforts."

Orivri is a part of the Virginia Tech team, which is led by Ryan Pollyea, associate professor in the Department of

◂ Students and Virginia Tech faculty members review rock cores from a 2,500-foot borehole drilled at the Castle Sands quarry to assess the potential for geologic carbon dioxide sequestration in Appalachian-style geology.

Photo courtesy of Ryan Pollyea.

Ryan Pollyea

Geosciences. Pollyea's research program works with industry partners to deploy geologic carbon storage, while linking students with research partners to get real world experience through internships and career opportunities. His graduate students have taken internships at Chevron and Schlumberger-Doll Research Labs, and this past spring Pollyea mentored a student team through the Society of Exploration Geophysicists' (SEG) EVOLVE Carbon Solutions Professional Program. As a result of their work, the student team was selected to host SEG's first virtual U.S. regional geoscience trivia contest.

"We're working to keep CO_2 out of the atmosphere and doing it in a way that's economically, technically, and scientifically sound," Pollyea said. "Our research aims to put CO_2 permanently underground, while also developing long-term plans to monitor and verify that the CO_2 is stored securely."

The Virginia Tech Project ACCESS team also includes:

- **Steve Holbrook**, professor, Department of Geosciences
- **Nino Ripepi**, associate professor, Department of Mining and Mineral Engineering
- **Rohit Pandey**, assistant professor, Department of Mining and Minerals Engineering
- **Piyali Chanda,** research associate, Virginia Center for Coal & Energy Resources

"Our hope is to use projects like this one, working hand-in-hand with industry, to create an enabling environment for decarbonization technologies. This effort builds on significant momentum and we are looking forward to using it as a launchpad for others," Pollyea said.

Each year, the typical passenger vehicle emits about 4.6 metric tons of carbon dioxide, according to the United States Environmental Protection Agency. Based on those numbers, if Project ACCESS develops, it could eliminate the annual CO_2 emissions equivalent to 370,000 passenger vehicles.

Pollyea began studying geologic carbon sequestration in 2007. He said the technology is especially applicable to industries that have extreme difficulty lowering their greenhouse emissions, such as steel and cement production. By successfully retrofitting production plants with carbon capture technology, the emissions could be contained and injected into deep geological formations, allowing those industries to greatly reduce their carbon footprint without sacrificing production.

The end result of this process would deposit and trap CO_2 in many of the same types of geological formations that hold other resources, such as oil and gas, thousands of feet below drinking water reservoirs.

"If your deepest water well is 1,000 feet underground, we're going a mile or more deeper than that," Pollyea said.

Not only will Project ACCESS help industrial sectors with hard-to-reduce CO_2 emissions, it will do so by storing the emissions in the challenging types of rocks many previous efforts have avoided.

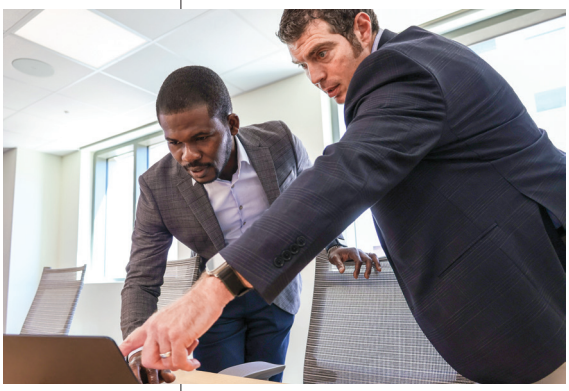
"We're looking at geology that is not the thick, porous sandstone that is a more common target for geologic CO_2 storage," Pollyea said. "Project ACCESS is targeting limestone formations in South Florida, and we've also been working to unlock CO_2 storage in Appalachian-style fold-and-thrust belts. This is new geology for CO_2 storage. This is the hard stuff, but unlocking new geology means that CO_2 storage can be deployed in more places, and with fewer pipelines transporting CO_2 from industrial facilities to storage sites. That would give us more options for a broad range of emitters."

Pollyea said by expanding to different types of rocks there is potential for economic benefits to regions of the country previously hurt by declining industries, such as coal in Appalachia. Part of these benefits could come in the form of repurposing and building on the workforce's existing skill set.

"If we can get this to work, we can unlock a lot of real estate for carbon storage and take a critical step towards Virginia Tech becoming a destination for the kind of interdisciplinary research, innovation, and talent development needed to advance the control of carbon emissions," Pollyea said.

By expanding to different types of rocks there is potential for economic benefits to regions of the country previously hurt by declining industries, such as coal in Appalachia.

▼ Ryan Pollyea (at right) and Uzezi Orivri are a part of a project aimed to help revolutionize efforts to keep harmful amounts of carbon dioxide out of the atmosphere by putting it in the ground.



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Scan to listen: "Curious Conversations" podcast with Ryan Pollyea

Mapping the spread of dengue

Virginia Tech mathematician works with international team to analyze rise in dengue outbreaks

By Melissa McKeown

Weighing just 2.5 milligrams, the mosquito is considered the deadliest animal in the world, causing an estimated 700,000 human deaths annually.

One of the mosquito-borne diseases contributing to that number — dengue, also known as break-bone fever — has risen dramatically in recent years, including in more temperate areas that hadn't previously been affected by the virus.

As the spread of dengue grows exponentially each year, Virginia Tech mathematical biologist Michael Robert and a team of interdisciplinary Argentinian collaborators want to know why.

One of the most significant factors associated with the growth in global dengue transmission is climate change, which has led to increased temperatures, as well as more erratic patterns in rainfall and high levels of humidity.

A 2023 article by Robert and his collaborators illustrated trends between temperature and dengue cases while relationships with precipitation were also found. However, there was not enough data to determine that these changes in climate were significant.

DID YOU KNOW?

Dengue fever is sometimes called "break-bone" fever due to the severe muscle and bone pain it causes.

Now, with the help of a three-year grant — the Burroughs Wellcome Fund Climate and Health Interdisciplinary Award — Robert and his team are focusing on building the infrastructure for collecting better data, so they can then create better models for predicting dengue transmission.

Data collection for this project is taking place in two locations in central Argentina: the urban, more densely populated city of Córdoba, and the smaller, suburban city of Villa Carlos Paz. Students at six high schools have been enlisted to collect mosquito data for the project using ovitraps, containers in which mosquitoes lay their eggs but are unable to escape. While the ovitraps provide information about mosquito population, nearby meteorological stations collect hourly data on conditions such as temperature, precipitation, and humidity to offer a more complete picture.

"Getting the high school students involved in this citizen science project is really important," said Robert. "It's not only an introduction to science and data collection, but it's also giving them some agency in the public health problem that's happening, which is something that we don't always get to do."

One goal of Robert's research in Argentina is to create new predictive models — more specifically, an early warning system for dengue transmission that can be turned over to a public health or vector control department.

Robert notes that what is happening in central Argentina could be an indicator of what is to come closer to home.

"We need to be paying more attention to what's happening in other places, in part because we're not necessarily going to be safe from these issues," said Robert.

Photo from Adobe Stock.

New center showcases Virginia Tech's strengths in global sustainability

By Felicia Spencer

◂ **Cayelan Carey,** professor of biological sciences and Roger H. Moore and Mojdeh Khatam-Moore Faculty Fellow

◂ **Quinn Thomas,** professor of forest resources and environmental conservation and Data Science Faculty Fellow

Cayelan Carey and Quinn Thomas had been leading and conducting separate efforts to counter the effects of climate change, land use, and other pollution for years.

But when they combined their individual expertise in 2018, they began thinking about how to get in front of global warming, rather than chasing the destruction left in its wake.

This year they became co-directors of the newly established Virginia Tech Center for Ecosystem Forecasting.

The center combines Carey's extensive research with lakes and reservoirs throughout the globe and Thomas's technical innovation and data science research with Virginia Tech's land-grant mission to serve.

"This is exactly the kind of thing that completely aligns with our campus priorities — tapping into the excellence and expertise of our faculty to make our communities more sustainable and providing our students opportunities to get involved in hands-on research," said Kevin Pitts, dean of the College of Science, which is the center's administrative home.

Similar to how meteorologists forecast weather, ecological forecasters collect and analyze environmental data, build and share ecological models and software, create and assess a diversity of forecasting methods, and then translate and communicate forecasts for end-user decision support.

Cayelan Carey, professor of biological sciences and Roger H. Moore and Mojdeh Khatam-Moore Faculty Fellow, and Quinn Thomas, professor of forest resources and environmental conservation and Data Science Faculty Fellow, began forecasting freshwater ecosystems in a partnership with the Western Virginia Water Authority in 2018. The center has been able to supplement the existing operational guidelines used by the Western Virginia Water Authority with research-based insights to help provide the public with safe drinking water.

With warming air temperatures and other pollution, many freshwater ecosystems have exhibited greater variability and degradation, which is exemplified by toxic phytoplankton blooms, unsafe concentrations of nutrients and contaminants, fish kills, and low oxygen levels. These effects make lake and reservoir water harmful for swimming and fisheries.

To preempt this degradation before it starts in Southwest Virginia reservoirs, Thomas and Carey developed a state-of-the art forecasting system to deliver daily forecasts and inform the water managers of future water quality conditions. This enables them to anticipate and mitigate the effects and provide optimal water quality.

The center is now generating daily forecasts for lakes across the U.S. To date, they have received 10 federal grants totaling over $6 million to develop fresh-water ecosystem forecasts for lakes and reservoirs around the world.

▾ Quinn Thomas (standing at second from top left) and Cayelan Carey (standing at fourth from top right), co-directors of the Virginia Tech Center for Ecosystem Forecasting, celebrated the official launch of their center on March 27 with center-affiliated faculty, workers, students, and their Australian partners.

▲ The VA Lakers (from left: Aanish Pradhan, Adam White, and Mariah Bolden) give a presentation to the Lake Sunapee Protective Association.

Center for Ecosystem Forecasting supports Capstone projects for Computational Modeling & Data Analytics program

By Melissa McKeown

For students in the Computational Modeling and Data Analytics (CMDA) program, completing a Capstone project is a degree requirement. Each semester, teams of 3–4 students collaborate with government, industry, or institutional partners to solve a real-world problem using data science.

Researchers from the Center for Ecosystem Forecasting have been frequent CMDA Capstone sponsors, including in Fall 2023, when the "VA Lakers" (students Mariah Bolden, Aanish Pradhan, and Adam White) were tasked with creating models to improve water quality forecasting at Lake Sunapee, N.H.

After the project was completed, these students had a unique opportunity to showcase their communication skills, presenting their findings directly to the Lake Sunapee Protective Association.

"Data scientists need to be able to convey very complex statistical, mathematical, or computational science topics to a non-technical audience," said Pradhan, "so representing that information precisely and accurately is a skill that every data scientist should have."

Microplastics in the marsh

Undergraduate Summer Research Experience

By Felicia Spencer

Austin Gray knows microplastics pose a macro threat.

"Humans are not just exposed to microplastics," said Gray, assistant professor of biological sciences. "We are consuming them. They're within the blood, they're in breast milk, and there are a lot of concerns that we don't know about."

An expert on environmental toxicology, Gray recently teamed up with Tina Dura, assistant professor of geosciences and an expert on coastal stratigraphy, to collaborate on the first microplastics summer research experience offered to Virginia Tech students.

Designed to teach and mentor undergraduate students, the four-week program provides students with experience in every aspect of research from topical studies and immersive field work to lab analysis and professional development. The experience is funded by the Virginia Tech Seale Coastal Zone Observatory, which is a new initiative at the intersection of developing science and environmental policy.

"By bringing these two areas of expertise together, we were able to come up with a new way to involve undergraduates in collecting data and looking at how microplastics have been present in these intertidal marsh environments through time," said Dura, director of the Coastal Hazards Lab and an affiliated faculty with the Global Change Center. "A lot of the microplastics work that's out there has focused on surface sediments, and what we're doing now is looking for when microplastics first appeared in marshes."

Gray and Dura's first summer research experience launched in June. Along with an intensive overview of marsh ecosystems, the program allowed students to collect sediment core samples from the saltmarshes of the Chesapeake Bay and the Atlantic Ocean and taught them how to extract and test the samples.

Austin Gray

Tina Dura

"As a biology major, I didn't know a lot about soils, or anything about geology," said undergraduate Piyali Roy. "Coming out here and doing the core processing and the modern transects and learning how that ties into microplastics and ecology is really cool. I've also never really been hiking on a marsh before, so that was really fun."

Gray and Dura both believe this partnership may lead to other innovative collaborations and are already looking ahead to future programs and the possibility of including additional researchers.

← Scan to watch: "Microplastic summer research experience"

Photo by Spencer Coppage for Virginia Tech.

▲ Top left: Brandon Hatcher, a master's student specializing in paleoseismology, uses a GPS device in tall grass.
Top right: From left: Jessica Depaolis, Tina Dura, Brandon Hatcher, Piyali Roy, Allison Montgomery, Maddi Williams, Ted Docev, Andrew Allard.

◀ On left: The group analyzes a core sample.

▼ Bottom left: Williams, Allard, and Dura analyze a core sample.
Bottom Right: Undergraduate researchers Ted Docev, Allison Montgomery, and Maddi Williams discuss notes.

Bullfrogs: Sound of Summer or Sign of Trouble?

By Meryl C. Mims

▲ Meryl C. Mims

Reprinted with permission from The Roanoke Times.

Summer in Southwest Virginia is full of sights, scents, and sounds we associate with our home. You will likely hear the familiar, low, repetitive call of the American bullfrog. Unfortunately, the bullfrog songs that are a hallmark of our freshwater habitats in the eastern United States are a sign of trouble elsewhere.

Bullfrogs are one of many species contributing to a global crisis of *invasive species*. Species move and are being moved all over the globe at increasing rates, sometimes becoming unwelcome residents. Globally, these invasive species cause hundreds of billions of dollars of economic and ecological damage per year. Notorious examples of invasive species that have entered our region include the spotted lanternfly, tree of heaven, Japanese stiltgrass, and northern snakehead fish.

At the same time, some species native to our region are invasive elsewhere. Over the last 150 years, American bullfrogs have been introduced all over the world as a cheap source of protein — frog legs, anyone? But they are also voracious predators, eating anything that fits in their mouth. They reproduce quickly and can travel many miles in only a few days. They spread disease, contribute to ecosystem health decline, and can decimate local wildlife. Globally, American bullfrogs have caused an estimated $17 billion in damage from 1986 to 2020.

At Virginia Tech, we study best practices for controlling and eradicating invasive populations of American bullfrogs. We partner with federal scientists to use acoustic recorders for early detection of bullfrogs when they call at new locations. We can estimate how far and fast bullfrogs travel. We also collect DNA from bullfrogs, estimating the size and travel patterns of new populations. We combine this data with climate information in computer simulations to identify locations where bullfrogs pose a distinct risk. Although bullfrog eradication is possible, it's not feasible everywhere, and control can go a long way. Our research aims to identify the most cost-effective way to pinpoint key populations for removal, and the lessons apply to other invasive species, too.

The Virginia Tech Invasive Species Working Group is developing the broad expertise necessary to make Virginia Tech a global hub for innovative and effective invasive species research and management. True progress will start with the science, but ultimately will require a broad-based, community level effort.

Meryl C. Mims is an associate professor of biological sciences at Virginia Tech

Bullfrogs are one of many species contributing to a global crisis of invasive species.

Photo courtesy of Meryl Mims.

Read additional featured columns by College of Science faculty members in *The Roanoke Times*.

"All the News That's Fit to Print"

The New York Times

THE WEATHER
Today, mostly sunny, windy, cooler, high 41. Tonight, clear skies, less windy, low 30. Tomorrow, more sunshine than clouds, light wind, high 49. Weather map is on Page A20.

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Supreme Court Agrees to Hear Immunity Case

Decision Helps Trump by Delaying a Trial

By ADAM LIPTAK

WASHINGTON — The Supreme Court on Wednesday agreed to decide whether former President Donald J. Trump is immune from prosecution on charges of plotting to overturn the 2020 election, further delaying his criminal trial as it considers the matter.

The justices scheduled arguments for the week of April 22 and said proceedings in the trial court would remain frozen, handing at least an interim victory to Mr. Trump. His litigation strategy in all of the criminal prosecutions against him has consisted, in large part, of trying to slow things down.

The Supreme Court's response to Mr. Trump put the justices in the unusual position of deciding another aspect of the former president's fate: whether and how quickly Mr. Trump could go to trial. That, in turn, could affect his election prospects and, should he be re-elected, his ability to scuttle the prosecution.

The timing of the argument was a sort of compromise. Jack Smith,

The East Coast Is Sinking

Land is slumping into the ocean, compounding the dangers from a rise in sea levels. A major culprit is the overpumping of groundwater. Page A12.

ATLANTIC CITY, N.J.

Egg Harbor City

Brigantine

Atlantic City

CHANGE IN ELEVATION BY 2050

-9 cm -6 -3 0

NORFOLK, VA.

Hampton

Chesapeake Bay

Hope for Biden And a Warning From Michigan

Primary Test Is Passed; Gaza Is Still a Thorn

This article is by Reid J. Epstein, Jonathan Weisman and Nicholas Nehamas.

WASHINGTON — President Biden and his allies had reasons for both hope and concern after a Michigan primary election that revealed the party's painful divisions over the Israeli-Palestinian conflict and confronted him with his largest measure of Democratic opposition to date.

He avoided his anxious supporters' darkest predictions by winning the Tuesday primary, 81 percent to 13 percent, over an "uncommitted" movement that sprang up to protest his backing of Israel. Yet more than 100,000 voters registered their disapproval of him, signaling serious discontent among Arab Americans, young voters and progressives as he tries to stitch back together his winning 2020 coalition.

Democratic unease with Mr. Biden's handling of the Mideast war will not go away as the presidential primary calendar moves on to more than a dozen Super Tuesday states next week, but his allies are optimistic that Michigan will

McCONNELL TELLS SENATE IT'S TIME HE STEPPED ASIDE

GIVING UP LEADER POST

Says His Views Have Left Him Out of Sync With Trump-Led G.O.P.

By CARL HULSE

WASHINGTON — Senator Mitch McConnell, the longtime top Senate Republican, said on Wednesday that he would give up his spot as the party's leader following the November elections, acknowledging that his Reaganite national security views had put him out of step with a party now headed by former President Donald J. Trump.

"Believe me, I know the politics within my party at this particular time," Mr. McConnell, who turned 82 last week, said in a speech on the Senate floor announcing his intentions. "I have many faults. Misunderstanding politics is not one of them."

His decision, reported earlier by The Associated Press, was not

◀ In February, the university earned around 430 major metro and top-tier media mentions, reaching an estimated 43.3 million people. Much of the coverage was driven by the publishing of land subsidence research by lead author Leonard Ohenhen, a graduate student working with Associate Professor Manoochehr Shirzaei at Virginia Tech's Earth Observation and Innovation Lab in the the College of Science. They earned mentions in dozens of publications internationally, including *USA Today*, *New York Post*, *Newsweek*, *Wired*, and the front page of the *New York Times*.

From NYC to D.C. and beyond, cities on the East Coast are sinking

By Virginia Tech News

Major cities on the U.S. Atlantic coast are sinking, in some cases as much as 5 millimeters per year — a decline at the ocean's edge that well outpaces global sea level rise, confirms new research from Virginia Tech and the U.S. Geological Survey (USGS).

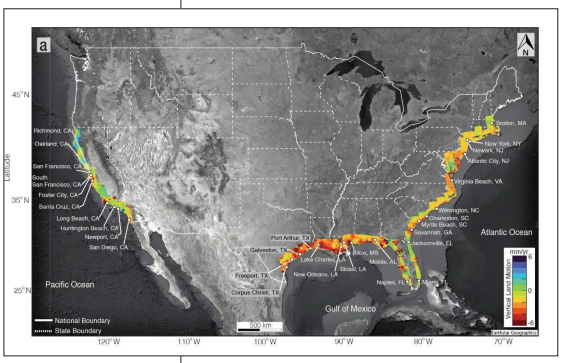
Particularly hard hit population centers such as New York City and Long Island, Baltimore, and Virginia Beach and Norfolk are seeing areas of rapid "subsidence," or sinking land, alongside more slowly sinking or relatively stable ground, increasing the risk to roadways, runways, building foundations, rail lines, and pipelines, according to a study published Jan. 2 in the *Proceedings of the National Academies of Sciences*.

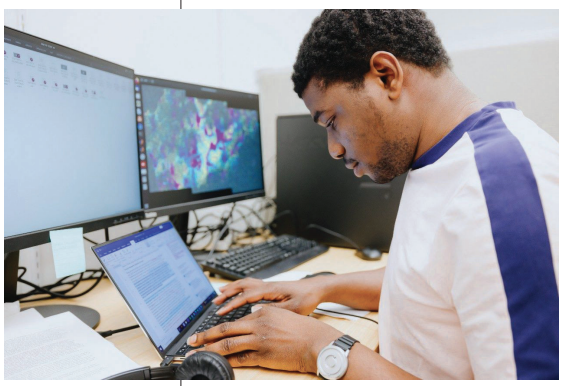
Associate Professor Manoochehr Shirzaei and his research team pulled together a vast collection of data points measured by space-based radar satellites and used this highly accurate information to build digital terrain maps that show exactly where sinking landscapes present risks to the health of vital infrastructure.

Using the publicly available satellite imagery, the team measured millions of occurrences of land subsidence spanning multiple years. They then created some of the world's first high-resolution depictions of the land subsidence.

"This information is needed. No one else is providing it," said Patrick Barnard, a research geologist with the USGS and co-author of the study. "Shirzaei and his Virginia Tech team stepped into that niche with his technical expertise and is providing something extremely valuable." VT

▼ Flood risks for 32 cities on three coasts by 2050.





▶ Leonard Ohenhen, a graduate student working with Associate Professor Manoochehr Shirzaei at Virginia Tech's Earth Observation and Innovation Lab.

HUMAN HEALTH

Enabling people to live long and healthy lives requires scientific advancements that address a multitude of issues, and from scientific disciplines across the spectrum. Virginia Tech's researchers are urgently working on many of these issues: finding ways to improve a person's sleep, preventing alcohol-related violence, bolstering immunity, and safe driving. The challenges are great, and our work is tackling them head on.

Illustration from Shutterstock.

Unraveling the link between alcohol and relationship violence

By Ralph Berrier Jr.

Beer pong. Quarters. Flip cup. The drinking games college students play can seem like an alcohol-laced version of intramural sports.

When college-aged drinkers imbibe too heavily, the risk for physically harming a romantic partner rises considerably.

What if there was a way for heavy drinkers to monitor their alcoholic intake and blood-alcohol levels in real time, before it cascades into physical violence?

Or, as Virginia Tech researcher and assistant professor of psychology Meagan Brem put it: "If we can identify a cut-off where students' risk for perpetration [of violence] would be highest, we might be able to perform just-in-time delivery of interventions to prevent perpetration."

Brem, director of Virginia Tech's Research for Alcohol and Couples Health (REACH) Lab and an Institute for Society, Culture, and Environment Scholar, leads a team of researchers in the development of a study where self-identified heavy drinkers use pocket-sized electronic devices to monitor their drinking habits, alcohol levels, mood, and behavior. The study, initially supported by seed funding from the institute, has recently secured a $434,491 grant from the National Institute on Alcohol Abuse and Alcoholism, part of the National Institutes of Health.

Brem and her professional and student colleagues will assemble a group of 100 heavy-drinking men and women students who have self-reported histories of intimate partner violence who will then be expected to report their drinking habits and other information for 30 consecutive days.

Each day during the 30-day study period, participants will receive prompts through their phone at five specific times that will ask them to submit results from a breathalyzer and to answer a brief survey.

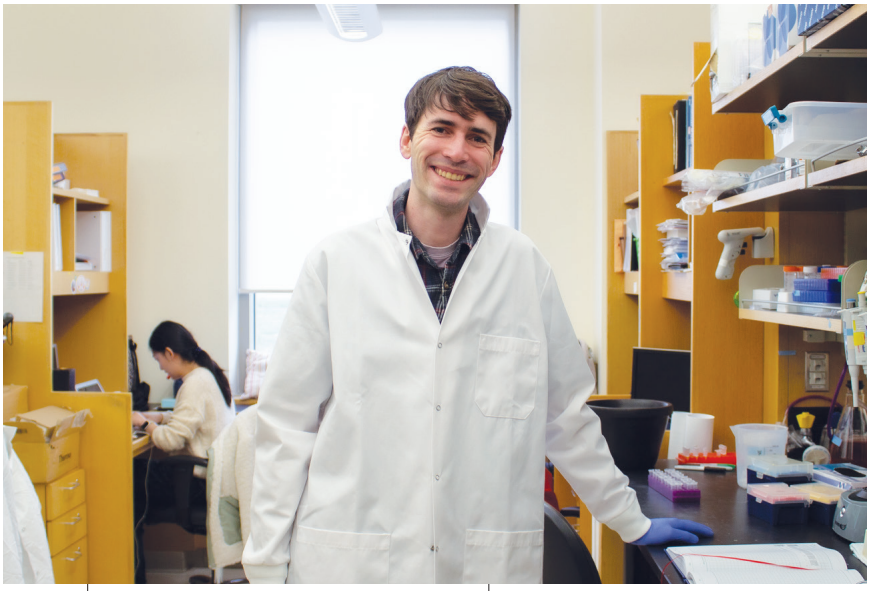
Even though participants' survey answers might be hard to quantify, the breathalyzer information is not. Working closely with co-researcher Warren Bickel, behavioral research professor with Fralin Biomedical Research Institute at VTC whose research has involved the use of breathalyzers, Brem expects to get objective data about student drinking and the likelihood that someone could perpetrate violence against an intimate partner.

Meagan Brem

The more information the public has, the better prepared it will be to prevent domestic violence and mitigate the fallout, according to TJ Shaw, a Ph.D. candidate and research assistant helping guide the data collection.

"We need to know if we can design an intervention system to reduce the likelihood of violence before it happens," Shaw said.

▶ Joshua Farnsworth, a REACH Lab Research Assistant, demonstrates how to use the portable breathalyzer.



▸ Blake Caldwell, a Virginia Tech Presidential Postdoctoral Fellow, has been published in *Cell Reports* for his epigenetic research.

Novel discovery may benefit severe immune conditions

By Felicia Spencer

Discovery of a DNA shift in the innate immune memory of cells may aid in the fight against one of humans' most deadly foes — sepsis.

"Sepsis is a horrible burden, not only in terms of mortality, but also money. It is the most expensive medical condition to treat in the U.S., like $20 billion a year, which is almost double the next highest," said Blake Caldwell, a Virginia Tech Presidential Postdoctoral Fellow.

The lead author of a study published in *Cell Reports*, Caldwell and his collaborators demonstrated that changes to the structure and organization of DNA create an exhausted memory state in monocytes, the white blood cells that facilitate immune responses in the body.

"We found there's a critical involvement of DNA methylation in controlling innate immune memory," Caldwell said. DNA methylation is when a small molecule called a methyl group gets added to DNA, proteins or other molecules. "This impacts the capacity of monocytes to remember a past immune challenge and change their behavior in the future."

This exhausted state contributes to most sepsis patients' immune systems remaining critically disabled for months or years after the initial shock is treated.

"This is a very important work that sets a milestone marker for the novel phenomenon of innate immune memory," said Liwu Li, professor of biological sciences and Caldwell's mentor.

The research team also discovered that therapeutic interventions can prevent the DNA change and help the white cells stay in better fighting shape.

"By adding a drug that blocks the acquisition of DNA methylation, we can change the behavior of these monocytes. We can actually intervene and prevent those DNA methylation changes from occurring," said Caldwell. "We can restore normal monocyte activity, and I think that is what sets this study apart."

Caldwell credits the breakthrough in part to his previous studies and prior research experience.

Caldwell's team found that DNA methylation plays a large role in the long-term misbehavior of the white blood cells in sepsis and other severe immune conditions. And by blocking this change from occurring, researchers can right the behavior of the cells, which has implications beyond sepsis alone.

"The things we can cover using sepsis as a model for the innate immune system often apply more broadly because it's the same pathways that are being activated by COVID-19, coronary artery disease, and other severe immune events," Caldwell said. "It's a primitive but highly conserved biological system."

> "Sepsis is a horrible burden, not only in terms of mortality, but also money. It is the most expensive medical condition to treat in the U.S., like $20 billion a year, which is almost double the next highest."
>
> — Blake Caldwell, Department of Biological Sciences

Photo by Felicia Spencer for Virginia Tech.

Sleep Soundzzzzzz

By Kelly Izlar

Sleep is transformative in more ways than we know.

Sleep specialists, including Sujith Vijayan, have found that sleep's beneficial brain rhythms can be enhanced by another type of rhythm: sound waves.

"By playing sounds during sleep, we can change brain dynamics and improve learning and memory," said Vijayan, who is an associate professor in Virginia Tech's School of Neuroscience.

Sleep can act like a memory booster — taking a nap might help more on a test than last-minute cramming — but it may also be important for what Vijayan calls cerebral "housekeeping."

"It turns out the blood vessels in your brain get bigger while you sleep, so sleep is how your body cleans out a lot of the everyday toxins," Vijayan said.

In Vijayan's experimental studies, research participants engage in certain learning tasks and then fall asleep in a sleep room wearing an EEG (electroencephalogram) headcap to record brain waves. Researchers monitor participant electrical brain waves and play soft sounds when the waves reach critical moments.

Electrical brain waves vary in frequency with the different stages of sleep. The first part of a sleep cycle is usually deep, restorative sleep. Rapid eye movement (REM) sleep, which comes later in the cycle, is also called paradoxical sleep because the brain activity looks like an alert, wakeful brain.

The realm of vivid dreams, REM sleep is also the realm for processing emotional memories. Vijayan is using auditory stimulation to probe this chaotic, critical stage of sleep.

Sujith Vijayan

Rapid eye movement (REM) sleep is also called paradoxical sleep because the brain activity looks like an alert brain.

In one computational modeling study published recently in the *Journal of Neuroscience*, Vijayan explored how these techniques could help restore the healing quality of sleep for people suffering from post-traumatic stress disorder (PTSD).

With support from a National Science Foundation CAREER award, Vijayan is also investigating if the brain's work during sleep can help people learn tasks associated with brain computer interfaces, which allow an individual to use their brain activity alone to control an external device like a wheelchair or a cursor on a computer screen.

▲ Gavin Vess, Jeremy Decker, Jarod Le, Martha-Patience Taah

◀ Graduate student researcher Gavin Vess models the EEG headcap worn by sleep study subjects.

In these and other projects, Vijayan continues to advance understanding of the relationship between sleep rhythms and memory, learning, and housekeeping. In his vision of the future, sound can be used as therapy and medicine to modulate brain waves.

"It's like when you have an extremely high fever, you take a Tylenol to get your temperature back down," Vijayan said. "I think we can get to the point that we can restore brain rhythms during sleep so the body can do what it needs to do to heal."

▸ Virginia Tech physicist C. Nadir Kaplan (at left) and doctoral candidate Chinmay Katke (right) discovered a microscopic phenomenon that could greatly improve the performance of soft devices, such as agile flexible robots or microscopic capsules for drug delivery.

Virginia Tech physicists: The path to faster, more flexible robots

By Lon Wagner

In the journal *Physical Review Letters*, Virginia Tech physicists revealed a microscopic phenomenon that could greatly improve the performance of agile flexible robots or microscopic capsules for drug delivery.

Doctoral candidate Chinmay Katke and Assistant Professor C. Nadir Kaplan in the Virginia Tech Department of Physics, along with Associate Professor Peter A. Korevaar at Radboud University, Nijmegen, The Netherlands, proposed a method that could speed up the expansion and contraction of hydrogels — enabling these man-made materials to perhaps move with a speed and dexterity close to that of human hands.

Soft robots are already being used in manufacturing, where a hand-like device is programmed to grab an item from a conveyor belt — picture a piece of soap — and place it in a container to be packaged. The ones in use now lean on hydraulics or pneumatics to change the shape of the "hand."

Akin to our own body, hydrogels mostly contain water and are everywhere around us, like shaving gel. Katke, Korevaar, and Kaplan's research appears to have found a method that allows hydrogels to swell and contract much more quickly, which would improve their flexibility and capability to function in different settings.

Katke, Korevaar and Kaplan's new theory about microscopic interactions between ions and polyacrylic acid: they can make hydrogel swell much faster when the released ions inside the hydrogel are unevenly spread out. They called this "diffusio-phoretic swelling of the hydrogels."

Why is that change important?
Kaplan explained: Soft agile robots are currently made with rubber, which "does the job but their shapes are changed hydraulically or pneumatically. This is not desired because it is difficult to imprint a network of tubes into these robots to deliver air or fluid into them."

Imagine, Kaplan says, how many different things you can do with your hand and how fast you can do them owing to your neural network and the motion of ions under your skin. Because the rubber and hydraulics are not as versatile as your biological tissues, state-of-the-art soft robots can only do a limited number of movements."

How could this improve our lives?
Katke explained that the process they have researched allows the hydrogels to change shape then change back to their original form "significantly faster this way" in soft robots that are larger than ever before.

Larger agile soft robots that could respond quickly could improve assistive devices in healthcare, "pick-and-place" functions in manufacturing, search and rescue operations, cosmetics used for skincare, and contact lenses.

Photo by Spencer Coppage for Virginia Tech.

Should the legal driving age be increased? No, says Virginia Tech statistician

By Kelly Izlar

Driving lessons can be a gauntlet of fire — for parents and children. As a parent and an expert in driving risk factors, Feng Guo has strong opinions about when and how kids should be driving: as early as safely possible with many, many hours under supervision.

"Operating a vehicle can be overwhelming at first," said Guo, Patricia Caldwell Faculty Fellow and professor in the Department of Statistics. "They need an experienced driver in the car to remind them of critical details."

In addition to his experience parenting young drivers, Guo formed this expert opinion after 17 years researching traffic safety as the lead data scientist at the Virginia Tech Transportation Institute.

In 2014 and 2017, he coauthored papers in the *New England Journal of Medicine* and the *Proceedings for the National Academy of Sciences*, respectively, that provided quantitative proof that using a phone while driving increases crash risk, especially for young drivers.

A decade later, phone usage seems like an obvious risk factor, but back then, there was very little data to support this claim. Guo and his team leveraged the Virginia Tech Transportation Institute's naturalistic driving dataset, 30+ years of data collected from in-vehicle cameras and sensors, to evaluate risk factors during the seconds leading up to a crash.

Guo has plied this dataset to answer questions such as how to measure driver distraction (eye glance is a good indicator), how long you can look away without substantially increasing crash risk (about two seconds in a 15-second period), and the ebbs and flows of risk throughout a driver's life.

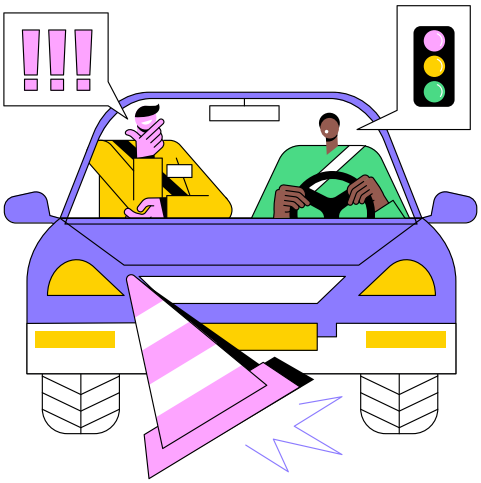
In his more recent work, Guo is conducting statistical analyses to evaluate the safety of automatic driving systems, incorporating machine learning and artificial intelligence models to process much larger quantities of real-world data.

As a statistician, Guo doesn't make any assumptions about the safety of a new technology until he can make sense of the implications.

"That's why statistics is so important," Guo said. "You can have new technologies, new concepts but ultimately, we need to quantitatively verify that claim or hypothesis — which can be a lengthy, complicated process."

But there are some questions to which Guo has no qualms providing a quick, decisive answer — such as 'should the driving age start after age 18?'

"Absolutely not," Guo said. "Kids should be getting hundreds of supervised hours behind the wheel. After 18, that opportunity is no longer guaranteed."



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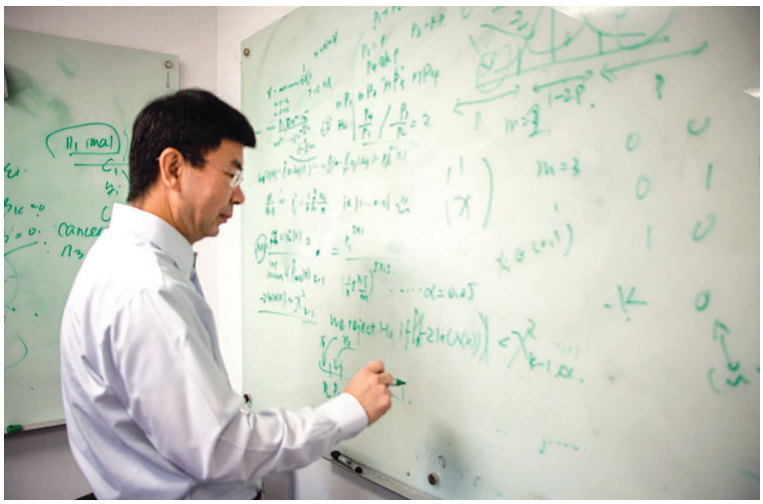

◂ Feng Guo, professor of statistics and the lead data scientist at the Virginia Tech Transportation Institute.

RACING IN THE RAI

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VIRGINIA TECH COMPETES IN XPRIZE RACE TO TRACE RAINFOREST BIODIVERSITY WHILE LEAVING NO TRACE

Winners of the $10 million XPRIZE Rainforest competition, which challenged teams to use novel technologies to expedite monitoring of tropical biodiversity, will be announced at the 2024 G20 summit in Rio de Janeiro this November.

BY KELLY IZLAR

ILLUSTRATION BY KLAWE RZECZY

TEN MILLION-DOLLAR PRIZE. 72 HOURS. SIX TEAMS. ONE SQUARE KILOMETER OF RAINFOREST. NO TOUCHY.

On a beautiful, hot morning in early July, Julie Allen and her genetic sampling team of all-woman early-career scientists and undergraduate students were ferried up the Rio Negro. A pod of dolphins served as escort.

Allen's group was a part of Limelight Rainforest, a multinational team from 10 different institutions that traveled deep into the Amazon Rainforest to compete in the final round of XPRIZE Rainforest. Each of the six finalist teams had 24 hours to autonomously survey the biodiversity of a patch of rainforest.

Automated technologies offer a gentler, more hands-off approach to biodiversity surveying that can help keep rainforests intact, while significantly increasing the number of species surveyed, said Allen, a Virginia Tech biologist.

"Rainforest species are disappearing faster than we can survey them," Allen said. "If we don't have a fast way to survey forests, there won't be forests left to survey."

At the stroke of noon on July 8, in the shadow of a giant clock counting down the hours, Allen's team successfully released a squad of drones equipped with traps to collect images, acoustics, insects, and other data streams across the rainforest canopy to survey biodiversity.

A major leg of the team's strategy relied on environmental DNA (eDNA), trace bits of DNA that organisms shed in soil, water, and even air. By simply brushing a leaf or sampling a scoop of water, scientists can assemble a snapshot of all the organisms in a given place.

They worked in the enclosed tents through the night, wearing lab coats, masks, and gloves in the 95-degree heat, pipetting feverishly until dawn.

As soon as they were deployed, the drone team run by Outreach Robotics began scouting for an on-site body of water, where eDNA can be found in high densities. The plan was to lower a water sampler through the canopy. But carefully. Dropping a sampler or losing a drone would violate the no-contact rule of the competition.

"It's all about risk. How much do we trust this hole in the canopy to get our sampler down there and back up again?" Allen said. "Fortunately, we had remote sensing models that identified the most likely places to find water to reduce our search area."

But they didn't see water in the early afternoon. Or the late afternoon. Allen recalled her growing sense of urgency as the light lengthened.

"Please, please, please let us find water, and be able to collect water," Allen said. "But there was none."

"Like none at all," said Isabella Burgos, Virginia Tech lead DNA operations manager.

Finally, as the sun sank low into the sky, an angled sunbeam sparked up the tiniest reflection through the canopy. What was it? A pool, a spring?

Allen never knew for sure, but it was big enough for a few samples, and they got a good long pull. By the end of the day, they had located several

sources of water and filtered enough for eDNA extraction.

Meanwhile, besides biting their nails off hoping for water, Burgos, Allen, and the rest of the sequencing team had been setting up a thick-walled, windowless eDNA tent to prevent sample contamination.

By the time the water and other samples got back, it was well after dark.

The eDNA team, led by Virginia Tech Postdoctoral Fellow Niyomi House, worked in the enclosed tents through the night, wearing lab coats, masks, and gloves in the 95-degree heat, pipetting feverishly until dawn — all while being monitored by judges.

"It was brutal," Allen said.

After it was all over, Burgos did the math: she slept 15 hours in six days, but it was "the best time."

"Even if we sweated more than we had ever sweated in our lives and were beyond exhausted, we were still laughing, we were doing it together," Burgos said.

The team generated more than 27 million DNA sequencing reads in 48 hours and identified hundreds of species, including a jaguar.

Data collection wrapped up before noon the next day, followed by a 48-hour sprint to process the samples and match them up against a huge database of organisms known to exist in Brazil. The team generated more than 27 million DNA sequencing reads in 48 hours and identified hundreds of species, including a jaguar and several other elusive creatures via eDNA.

But everything they found stayed in the rainforest.

"We brought nothing back with us. The sequences are being registered with Brazil's National System of Genetic Resource Management and Associated Traditional Knowledge system," Allen said. "This way, they know what we found, and the data stays in the country where it was produced."

Because, Allen explained, the competition is not so much about what they found as how they found it: a rapid big-picture survey of the rainforest that leaves no trace. VT

Limelight Rainforest is committed to abiding by Brazilian laws related to genetic heritage, associated traditional knowledge, and benefit sharing. XPRIZE collaborated with the National Institute of Amazonian Research (INPA) to obtain necessary permits for collecting eDNA/DNA sampling activities during the testing days. All eDNA/DNA sequencing data will be registered through SISGEN, ensuring transparency and adherence to regulations, and no genetic data will be published without clearance from XPRIZE and its government partners, ensuring compliance with all relevant regulations.

VIRGINIA TECH TEAM MEMBERS:

Julie Allen
assistant professor, biological sciences

Niyomi House
National Science Foundation postdoctoral associate, biological sciences, DNA technology lead

Isabella Burgos
lead DNA operations manager

Daniela Campos
fourth-year biological sciences major, lab and field DNA technician

Kanna Yerks
second-year biological sciences major, lab and field DNA technician

Brianna Bartelbaugh
second-year biological sciences major, lab DNA technician

Jayden Cosby
third-year double major in water: resources, policy, and management and environmental data science, lab DNA technician

Om Agrawal
fourth-year business information technology major, cybersecurity management and analytics, data scientist and machine learning intern in bioinformatics

National and international collaborators:
The team includes researchers and experts from Colorado Mesa University, Outreach Robotics, University of Nevada, Reno, Université de Montréal, University of Florida, Universidad Icesi, Yanayacu Biological Station, and the Universidade Federal do Paraná.

Rock Hall of Fame

BY KELLY IZLAR
ILLUSTRATION BY KLAWE RZECZY

Two geosciences professors were honored as newly elected members of the National Academy of Sciences on April 26, in Washington, D.C. On that day, Robert Bodnar and Shuhai Xiao signed the academy's prestigious Registry of Membership, which was initially signed by Abraham Lincoln. Bodnar and Xiao followed in the footsteps of Patricia Dove, also of the Virginia Tech Department of Geosciences, who was inducted in 2012. Membership in the National Academy is considered one of the highest honors that a scientist can receive. Members are elected in recognition of their distinguished and continuing achievements in original research.

Shuhai Xiao deciphers the geologic past to prepare for the future

Xiao studies the interactions between life and Earth, especially at a critical point in geologic history when animal life became much more abundant. For this original scientific research, he was inducted into the National Academy of Sciences.

One day, 320 million years before the first dinosaur, a creature dragged its tail across a sandy stretch of ocean floor and died.

Fast forward to 2017, Virginia Tech geobiologist Shuhai Xiao and his collaborators marveled at what was left of that creature entombed along with the track it left behind — and clocked it as the oldest convincing evidence of a moving animal.

"The animal's tail and trail were preserved together, and that's critical because usually you only get one or the other," Xiao said. "This fossil shows us who did it and what they did."

The finding is one of Xiao's many discoveries that contributed to excellence in original scientific research, for which he was inducted into the National Academy of Sciences on April 26. Membership in the academy is one of the highest honors given to a scientist in the United States.

A geobiologist with a geological history focus, Xiao looks to the rocks to understand the interaction between life on Earth and the Earth itself — specifically at a time period that took place 500 million to 600 million years ago, when animals emerged explosively onto the scene.

What drove this rapid expansion of animal life? There are several hypotheses, but a leading theory holds simply that oxygen became more abundant. Xiao has spent the last decade testing this hypothesis by inventorying how oxygen moved through the environment. To gauge the amount of oxygen present in ancient environments, Xiao collaborates with Virginia Tech geochemists Ben Gill and Rachel Reid.

"Scientists can't take an oximeter to a fossil to directly measure the oxygen, but oxygen leaves traces in the rock record," said Xiao, who is a faculty member in the Virginia Tech College of Science and Patricia Caldwell Faculty Fellow. "The more oxygen present, the more we see certain types of elements concentrated in the rock."

As Xiao and his team ponder the level of oxygen from their study of rocks, they are plumbing the fossil record to validate that the increase of oxygen levels and the expansion of animals happened at the same time.

"It's kind of like in forensic science when you establish an alibi," Xiao said. "They have to be there at the same time to be connected."

Another factor that could have led to the growth of animal populations is what Xiao refers to as the predator-and-prey arms race. A predator, for example, runs faster to catch its prey while the prey develops a new way to hide or escape, spinning a feedback loop that leads to more and different kinds of animals.

It's the interactions — the give and take — between life and Earth that has most engaged Xiao throughout his career. For instance, the relationship between animals and oxygen is a two-way street. Yes, animals consume oxygen and exude carbon dioxide, Xiao said, but it's more complex because animals siphon and shuffle oxygen all over their environment. Sediment-dwellers will pump oxygen-rich water into their burrows for irrigation while coral reefs bring massive

ROCK EADER

bioproductivity through oxygen distribution in seas around the globe.

"We think a lot about how humans change the Earth. We don't think as much about how other organisms changed it in much bigger ways billions of years before," Xiao said. "But what's different with humans is the pace at which we are changing our planet. It's unprecedented and startling."

Xiao is drawing lessons from the geologic past, not only to provide context and guidance in the face of climate change, but to enhance the search for life on other planets.

"People in the business of looking for life on other planets really need to know what we are finding on Earth," Xiao said. "If we were to find evidence of life out there, it's much more likely that we would find fossils of simple organisms preserved in rocks than animals walking around on the surface."

Scan to watch: "Shuhai Xiao & The Interactions Between Life and Earth"

With support from the National Science Foundation, Xiao is sharpening his life-finding tools. Building on an extensive foundation of expert field work, Xiao's collaboration with geochemists in the Geoscience Biogeochemistry Laboratory at Virginia Tech has brought a new perspective to his research in the past few decades.

Thus equipped, Xiao is flipping the pages back before early animals to shed light on the origin and diversification of all eukaryotes — organisms whose cells have a nucleus — which evolved into multicellular organisms and are credited for ushering in a whole new era for life on Earth, including animals, plants, and fungi.

"Rocks record stories that happened in the geologic past," Xiao said. "They're basically a book of history. But a rock cannot speak for itself, so we have to decode it."

With each new chapter, Xiao learns more about how organisms interacted with each other, how they changed the Earth, and how the Earth changed them in turn.

"Rocks record stories that happened in the geologic past. They're basically a book of history. But a rock cannot speak for itself, so we have to decode it."

Robert Bodnar excavates secrets from deep space, deep Earth, deep past

Bodnar studies ancient droplets of fluid trapped within minerals from deep under the Earth and from outer space. For this original scientific research, he was inducted into the National Academy of Sciences on April 26.

On March 22, 1998, seven boys playing pickup basketball in Monahans, Texas, were jolted out of their game when a football-sized meteorite punched into the pavement.

The meteorite was covered with a black crust and still warm to the touch. Classified later as an "ordinary chondrite meteorite," the space rock was anything but ordinary to one Virginia Tech geochemist who managed to acquire a piece of it in 1998.

Robert Bodnar, University Distinguished Professor, used a diamond saw to slice his meteorite sample as thin as a human hair and then polished both sides. When he placed it under the microscope, he immediately found what he was looking for: tens of thousands of tiny fluid droplets trapped inside the meteorite's crystalline structure.

And then he saw something else:

"There were vapor bubbles moving inside many of the droplets," Bodnar said. "And it struck me that these bubbles had been moving around in those tiny water droplets for 4.5 billion years."

For the last 40 of those years, Bodnar has been teasing out the secrets of ancient droplets like these, whether trapped within minerals from outer space or from deep within the Earth.

For excellence in this original scientific research, Bodnar was inducted into the National Academy of Sciences on April 26. Membership in the academy is one of the highest honors given to a scientist in the United States.

Called "fluid inclusions," rock-bound droplets like the ones found in Bodnar's meteorite sample can be thought of as time capsules that preserve a record of the composition, temperature, and pressure of the environment where — and when — the crystals originally formed.

Working with Michael Zolensky from NASA Johnson Space Center and colleagues from the University of Texas, Austin, Bodnar has continued to study the Monahans meteorite to search for organic molecules.

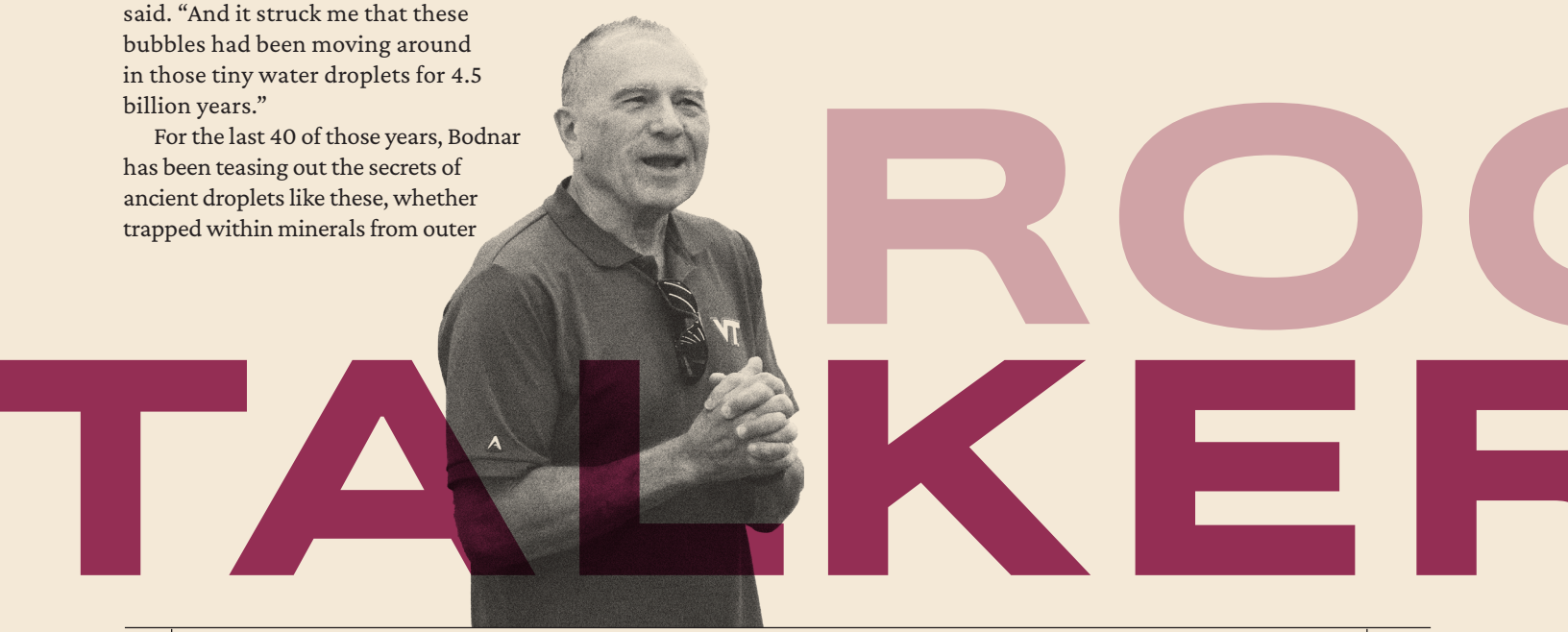
"If we find precursors of life in one of these, this could provide evidence that we're not alone," said Bodnar, who is the C.C. Garvin Professor of Geochemistry in the Virginia Tech College of Science.

Along with providing clues to extraterrestrial life, Bodnar's study of fluid inclusions reveals more about what is going on beneath the Earth's surface. His work has led to new methods to predict volcanic eruptions and find new deposits of "critical minerals," identified by the U.S. government as being vital to national security and economic prosperity.

For example, lithium, an indispensable component of electric-vehicle batteries, and rare earth elements needed for wind turbines, are largely produced outside the United States. To meet the growing demand for clean energy technologies and address supply chain vulnerabilities, the U.S. Department of Energy is ramping up America's domestic production and supply of battery-grade lithium and searching for domestic sources of rare earth elements.

"When we analyze the fluid inclusions, we can learn about the temperature and pressure conditions at which the mineral deposit formed. This allows us to infer how deep beneath the surface it formed," Bodnar said. "Then we can look for similar geological conditions elsewhere to find new deposits."

Matching up mineral formation conditions with appropriate environments has seen Bodnar crisscrossing the globe, embarking on



"Almost every day, I come into the lab and see something that no one has ever seen before. I talk to my minerals — tell me, tell me where you come from, tell me where you were formed."

collaborations with researchers from Australia to South America to Japan. He has been elected fellow of the Society of Economic Geologists, the Mineralogical Society of America, the American Association for the Advancement of Science, the Geochemical Society, Geological Society of America, the Geological Society of London (UK), and the European Geochemical Union. He was also elected an honorary member of the Italian Mineralogical Association and the Geological Society of India. Bodnar received an honorary degree from the University of Naples, Italy, as the only geoscientist to be awarded an honorary degree by the university in its history.

Bodnar's active work with Italian scientists involves analyzing rocks ejected from the infamous Mount Vesuvius. By investigating the conditions in the magma chamber associated with historical eruptions, Bodnar's team can fill in the blanks to reveal trends over time — and predict the strength and timeline of future eruptions. He has been working on similar explorations for Kilauea Volcano in Hawaii and White Island Volcano in New Zealand.

But the best part? The thrill of discovery.

"Almost every day, I come into the lab and see something that no one has ever seen before. I talk to my minerals — tell me, tell me where you come from, tell me where you were formed," Bodnar said.

And, evidently, they tell him. VT

Patricia Dove: Scientific advice for the nation

A dozen years before Robert Bodnar and Shuhai Xiao were elected as members of the National Academy of Sciences, Patricia M. Dove, also of the Department of Geosciences, blazed the trail for them.

Dove, who grew up in the central Virginia county of Bedford, arrived at Virginia Tech in 2000, having been recruited from Georgia Tech to return to her alma mater in Blacksburg. In 2012, she was elected to the National Academy of Sciences (NAS), the most prestigious scientific organization in the United States.

Dove takes seriously her charge as a member of the NAS to provide independent, objective advice to the nation on matters of science and technology. Since joining the academy, she has participated or chaired multiple NAS committees and provided leadership as the elected Secretary and then Chair of Class I, Mathematical and Physical Sciences (2018–2024). This group of about 700 members represents the most fundamental science disciplines with renowned experts from math, astronomy, physics, chemistry, geology, and geophysics. Currently, Dove is serving in yet another elected role as Chair of the Geology Section (2024–2027).

In collaboration with Senator Mark Warner, Dove is also a founding member of the board of directors that organized and launched the Virginia Academy of Science, Engineering, and Medicine (VASEM) in 2013. Similar to the objectives of the NAS, VASEM's mission is to provide the Commonwealth with independent and objective advice to legislators and state leaders on matters of importance in medicine, engineering, and technology. Dove is the most recent past president of VASEM, serving from 2016–2019.

Dove is a double Hokie, having earned a bachelor's degree in agronomy in 1980 and a master's in geological sciences in 1984. She then earned her doctoral degree from Princeton University and completed a National Science Foundation Postdoctoral Fellowship at Stanford University.

Her interdisciplinary research is focused on understanding mineral reactions in natural and engineered environments. Dove, who is the C.P. "Sally" Miles Professor of Science, is particularly known for the studies in biomineralization – the processes by which organisms grow minerals within tissues to produce skeletons and other structures. With an affiliate appointment in chemistry, and funding from the U.S. Department of Energy, Dove's graduate students investigate novel questions into how animals, including you and I, grow crystals within their body. The resulting biominerals are as diverse as life itself and form biomaterials such as skeletons, grinders, lenses, and gravity sensors.

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← Scan to watch: "Bob Bodnar & The Role of Fluids in Earth's Processes"

Colin Roberts focuses career goals on improving mental health in the Black community

By Lindsey Byars

As a high school senior in 2020, Colin Roberts thought leaving Virginia for college was how he would make a name for himself. His mother encouraged him to apply to Virginia Tech in addition to other schools, and after considering financial aid packages, it was obvious Virginia Tech was the best choice.

"Tech gave me enough money to attend, which I'm really very grateful for," Roberts said.

At Virginia Tech, Roberts excelled as a student in the College of Science majoring in psychology and minoring in human-computer interaction, but he takes an active role in extracurricular activities. Roberts was the president of the Class of 2024, co-director of community engagement for Students of Hip-Hop Legacy, liaison for the Student African American Brotherhood group, and an active member of Alpha Phi Alpha fraternity, where he served as director of education and Alpha Ball chairman.

Roberts' campus involvement and service to others has not gone unnoticed. He was recognized with the Community Builder Award at the Black Excellence Gala in 2023, the National Pan-Hellenic Council Member of the Year award in 2024 from the Southeastern Greek Leadership Association, and a nomination for a 2023–24 Aspire! Award from Student Affairs.

▼ As the undergraduate class president of the Class of 2024, Colin Roberts delivered an address at the 2024 commencement ceremony.

"I feel like I've definitely left my mark here at Virginia Tech. I feel like I've made a name and path for myself, and that's what I want to do with the rest of my life, make my own legacy and make my own path."

— Colin Roberts

He is also one of the first recipients of the Preston and Catharine White Endowed Diversity Scholarship. Roberts had the opportunity to thank the Whites for their generosity at the launch of Virginia Tech Advantage, a universitywide, multiyear commitment to offer a broad educational experience to undergraduate students from Virginia who demonstrate financial need.

Roberts plans to continue his education by focusing on a master's degree in human-computer interaction with aspirations to create his own programs, consisting of websites or apps, focused on mental health in the Black community and encouragement for young Black people to pursue degrees in STEM fields.

"I feel like I've definitely left my mark here at Virginia Tech," said Roberts. "I feel like I've made a name and path for myself, and that's what I want to do with the rest of my life, make my own legacy and make my own path."

▲ Roberts co-directed community engagement for Students of Hip-Hop Legacy, liaised for the Student African American Brotherhood group, and was an active member of Alpha Phi Alpha fraternity, where he served as director of education and Alpha Ball chairman.

▶ Students from left: Holly Stewart, Nicole Raphael, Harris Babin, and Michael Wall.

Students get up-close lessons in economics and more at SXSW conference

By Lon Wagner

Sometimes the best way to learn is to get out of the classroom. For a dozen students taking a special studies course called The Economics of Start-Ups, that meant traveling 1,273 miles away from their classroom to the SXSW Conference and Festivals in Austin, Texas.

During regular weekly classes, taught by adjunct faculty member Thomas Debass, the course in the Department of Economics in the College of Science focused on economics entrepreneurship and venture capital.

For four eye-opening days during Virginia Tech's spring break, the students saw firsthand how the lessons from their class manifest themselves in society. Jadrian Wooten, director of undergraduate studies and a collegiate associate professor of economics, said hands-on experiential learning trips such as the one to SXSW complements what the students hear in the classroom.

"These types of experiences are great options for students who may not be able to devote months to an internship, a study abroad trip, or undergraduate research," Wooten said. "I am hopeful that we can continue to expand and enhance these opportunities in future semesters."

Gifting the advantage

Knowing that learning experiences like this will help students achieve their goals after graduation, the university through Virginia Tech Advantage is committed to making such opportunities available to all students.

"It was amazing. I got to listen to industry leaders, and well-known speakers who provided very useful insights on the future of the start-up market, investing and AI technologies' role in start-ups."

– Aiden Keesee, a senior from Dayton, Virginia

Photo courtesy of Holly Stewart.

This is your brain on science

By Clark DeHart

In March, a group of students from Pulaski County came to the Virginia Tech campus for "Brain Day," when they had hands-on demonstrations that showed them the power of the brain and how substances affect it.

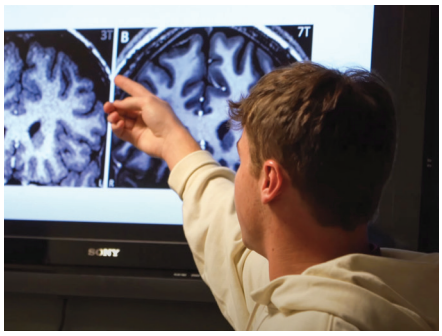
Brain Day is an immersive outreach program designed and implemented by Assistant Professors Samantha Kempker-Margherio and Aparna Shah in the Virginia Tech Department of Psychology and the Department of Neuroscience.

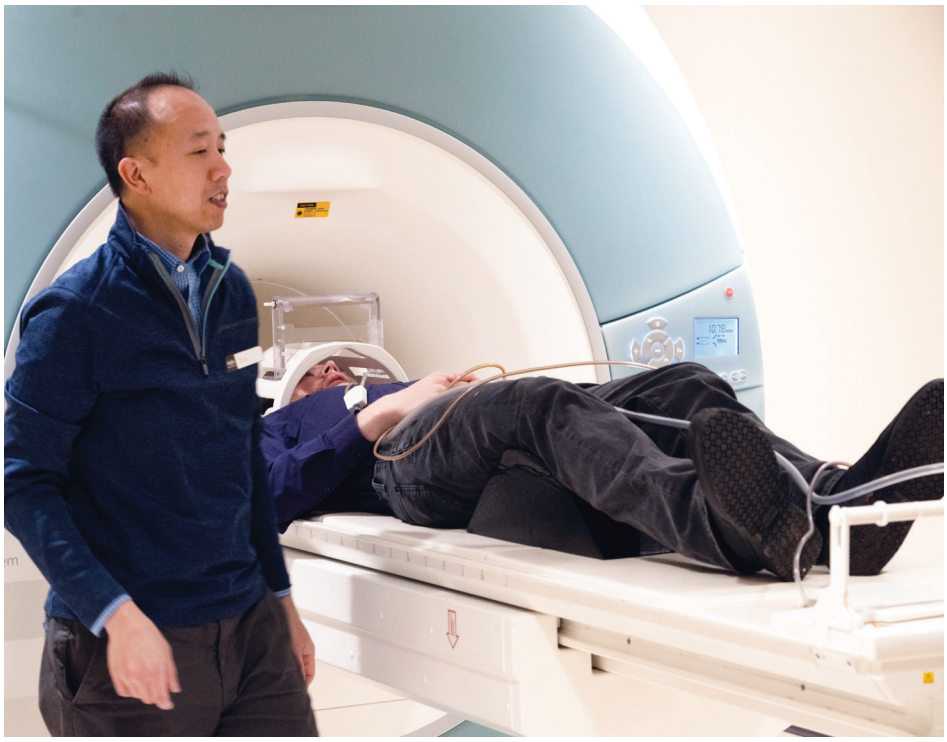
The event featured three different rooms with interactive lessons: a broad overview about the brain; research methods that enable scientists to better understand the brain; and how different substances can affect the brain's decision making.

Sara Bannwart, a student, explained: "We did a 'Just Say Know' presentation, a different, more scientific approach to telling children why you should not do drugs and why they are harmful to your brain and your body."

↓

Scan to watch: "Brain Day encourages students to make healthy decisions"





▸ Ninth graders from Pulaski County run the functional MRI (fMRI) machine computer during the "Brain Day" program at Fralin Biomedical Research Institute at VTC.

▸ Senior Project Associate Duy Phan (at left) puts undergraduate student Aidan Fishenden (at right) into the fMRI machine to demonstrate how magnetic resonance imaging technology creates scans of the brain.

Thwarting quantum hackers of the future

Travis Morrison received an NSF CAREER award to secure online transactions from quantum computer hacking.

By Kelly Izlar

By exploiting the laws of physics at the quantum level, a fully developed quantum computer would provide the key to dismantle most digital security. With help from a National Science Foundation Faculty Early Career Development Program (CAREER) award, mathematician Travis Morrison is anticipating quantum attacks to better defend against them.

Today, sensitive data such as online bank accounts and medical records are protected by cryptography — algorithms that safeguard data through encryption.

But it's not just about keeping information secret.

"The cryptographic protocols we have in place also verify the authenticity of the person who sends a message and preserves message integrity so no one can tamper with it," said Morrison, assistant professor in Virginia Tech's Department of Mathematics.

If these protocols were to fail, it would be impossible to secure online connections.

To avoid this scenario, the U.S. National Institute of Standards and Technology launched an international competition in 2017 that challenged cryptographers to devise encryption techniques that could fend off a cyberattack from a powerful quantum computer.

The institute has begun the process of standardizing these algorithms — the final step before making these mathematical tools available so that organizations around the world can integrate them into its encryption infrastructure.

Morrison's CAREER project focuses on improving one of the contenders — an isogeny-based cryptosystem that's designed to give a recipient confidence that a message came from a known sender.

With a long-term goal of making sure the scheme can withstand attack, Morrison is doing everything in his power to break it.

"My goal is to come up with the fastest attack I can," Morrison said. "If this attack breaks the scheme, that's too bad for isogeny-based cryptography. On the other hand, if I can't break it, then perhaps this is evidence that the scheme is secure."

The research component is complemented by educational activities where undergraduate mathematicians can get hands-on experience implementing cryptosystems and algorithms that could destroy them.

This research and the course work move the field forward, leading to more secure cryptosystems and a new generation of quantum-ready cryptographers.

▼ Travis Morrison

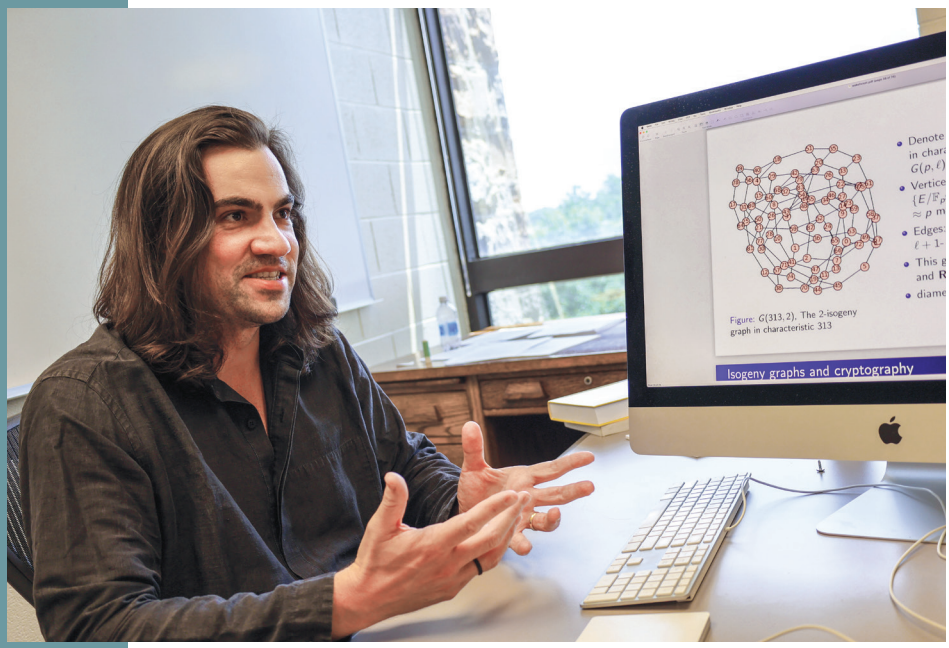


Photo by Spencer Coppage for Virginia Tech.

◀ From left: Katherine Adams and Robin Panneton

New center inspires instructional innovation

By Lon Wagner

Psychology faculty Robin Panneton and Katherine Adams had been thinking for some time about how to make the very popular introduction to psychology course better for students — not to mention more viable for those teaching it.

Students from majors all over the university take the introductory course, and enrollment swells to more than 1,000 students in the fall semester and more than 800 in the spring. Teaching that many students can exhaust faculty, plus talking to a group that large began to not feel effective.

As Panneton and Adams were exploring more creative methodologies, they saw a call for proposals from the College of Science's newly announced Center for Advancing Undergraduate Science Education, dubbed CAUSE. Instructors, professors of practice, collegiate faculty, tenure-track, and tenured professors were invited to submit proposals for projects that would enhance the learning experience of undergraduate and graduate students enrolled in existing courses offered by the college.

"We want to encourage faculty to continuously innovate," said Estrella Johnson, associate professor of mathematics and the college's assistant dean for inclusion and diversity. "Today's students do not learn the same ways that students learned two decades ago, and not all of today's students learn best in the same manner."

Johnson pushed the College of Science to create CAUSE to develop a central place to improve science education through research and practice. With approximately 425 teaching faculty within the college, the center will be a vital resource for faculty across all ranks and positions. Through an array of activities, including informational sessions, workshops, and speaker series, the center will foster a supportive community.

Panneton and Adams will break the material into 10-minute recorded segments, with a quiz, a video from the instructor, and a personal check-in from the faculty member.

Though they still have several issues to overcome, the end goal is to enable students to learn the material more deeply and enjoy the process along the way.

"If we teach more broadly and inclusively more students are going to do well," Panneton said. "It isn't grade inflation. They are literally doing better because we are taking the time and the effort to get the information out in different ways." VT

In addition to Panneton and Adams, three other grants were awarded from the College of Science:

Jason LeGrow

Travis Morrison

Jason LeGrow and Travis Morrison, Mathematics: Automated Evaluation in Cryptography, to develop question banks for integration into the platform Canvas.

Rachel Arnold

Rachel Arnold, Mathematics: Developing a teaching handbook for implementing research-based instruction in introductory proof courses.

Jill Sundie

Alec Smith

Jill Sundie and Alec Smith, Academy of Integrated Science and Economics: Developing a set of new, high-impact instructional elements appropriate for both large and small class sizes.

The Hall of Distinction

In 2024, the College of Science welcomed two new members to its Hall of Distinction. Hall of Distinction members represent an array of professionals, including scientists, doctors, policy makers, and business leaders. They are graduates and supporters of Virginia Tech who exemplify traits such as loyalty, trust, leadership, integrity, talent, dedication, and enthusiasm. With an insatiable thirst for learning, scientific exploration, and discovery, they embody the university's spirit of *Ut Prosim*, or That I May Serve.

The Hall of Distinction honors alumni and friends of the college who have achieved excellence in their professional careers and have shown remarkable service and philanthropy to civic groups and the university, including the College of Science. Hall of Distinction members truly embody the values that have shaped Virginia Tech's legacy for more than 150 years.

David Armistead earned his bachelor's and master's degrees in chemistry from Virginia Tech in 1977 and 1979, respectively. Subsequently, he pursued a doctorate degree in synthetic organic chemistry at the University of South Carolina, followed by a prestigious National Institutes of Health Postdoctoral Fellowship at Yale University.

Armistead's career, spanning 35 years, has been marked by significant contributions in drug discovery, business development, and corporate strategy. Beginning his journey in medicinal chemistry at Merck and Co. in 1986, he co-founded Vertex Pharmaceuticals in 1989, pioneering structure-based drug discovery. Later, he played crucial roles in cofounding Kinetix Pharmaceuticals, focusing on selective kinase inhibitors, and CGI Pharmaceuticals, later acquired by Gilead Sciences. Joining Third Rock Ventures in 2006, he co-founded Blueprint Medicines, dedicated to revolutionizing cancer treatment through genomic subsets.

Beyond his professional achievements, Armistead holds over 70 U.S. patents and serves on various biotech companies' Scientific Advisory Boards. He is also a member of the External Advisory Board for the Virginia Tech Center of Drug Discovery (VTCDD). Alongside his wife, Armistead generously supports the Armistead/Stansfield Endowed Scholarship Fund, aiding undergraduate students from underrepresented populations in Southwest Virginia. They have also established the David and Sharon Armistead Endowed Professorship at Virginia Tech, supporting interdisciplinary life sciences research associated with VTCDD. Together, they also support the Beyond Boundaries Scholars Program and are members of the university's Legacy Society and 1872 Society.

Scott Keeney, hailing from New York City, earned his bachelor's degree in biochemistry from Virginia Tech in 1987. He pursued further education, obtaining a doctorate degree in biochemistry from the University of California, Berkeley in 1993, followed by a postdoctoral fellowship in biochemistry at Harvard University.

Recognized as a distinguished geneticist and molecular biologist, Keeney is renowned for his groundbreaking work on homologous recombination during meiosis. His notable discovery of Spo11 as

Photos courtesy of David Armistead and Scott Keeney.

◀ David Armistead (left) and Scott Keeney (right)

the protein responsible for making the DNA double-strand breaks that are essential for recombination initiation has significantly contributed to understanding genome integrity during sexual reproduction.

Since 1997, Keeney has served as a faculty member in the Molecular Biology Program at Memorial Sloan Kettering Cancer Center, alongside his role as an investigator at the Howard Hughes Medical Institute since 2008. He leads a dynamic research lab dedicated to unraveling the intricacies of chromosomal recombination during the meiotic cell division. Using yeast and mice as model organisms, he and his team investigate the molecular mechanisms underlying the regulation and repair of double-stranded DNA breaks, crucial for genetic information exchange between homologous chromosomes. By identifying these fundamental mechanisms, Keeney aims to shed light on the failures in recombination observed in conditions such as Down syndrome and certain cancers.

Keeney is a member of the American Academy of Microbiology, American Academy of Arts and Sciences, and the National Academy of Sciences.

CMDA for the win

Justin Dean, a junior in the computational modeling and data analytics (CMDA) program, captured the first place award at the Dr. Wayne Scales Undergraduate Research and Creative Scholarship Symposium held in late February. The symposium was a pre-conference event at Virginia Tech's annual Uplifting Black Men Conference.

Dean's research project, titled "Developing a Python-Based Workflow for Analyzing ASPECT Models of Deep Melt Generation," focused on measuring evidence of the earth splitting apart.

▼ Justin Dean

Chemistry's Daniel Crawford receives Virginia's Highest Faculty Honor

T. Daniel Crawford

T. Daniel Crawford, University Distinguished Professor of Chemistry in the College of Science at Virginia Tech and director of the Molecular Sciences Software Institute in Blacksburg, has received a 2024 Outstanding Faculty Award from the State Council of Higher Education for Virginia (SCHEV).

The award has been the highest honor for the Commonwealth of Virginia's faculty since 1987. It recognizes exceptional faculty who exemplify the highest standards of teaching, scholarship and service.

"I am tremendously honored to be selected for this award alongside past recipients from the Virginia Tech Department of Chemistry, including Timothy Long and the late Jim Wightman," said Crawford, who is the Ethyl Corporation Chair in Chemistry

"When I recognized nearly 25 years ago how naturally teaching couples to research, I knew I'd found what I wanted to do for the rest of my life," he said.

Crawford's research focuses on developing quantum mechanical models of molecular properties. He has published 150 peer-reviewed papers and given nearly 230 lectures in 26 countries.

New Roundtable Members

The Virginia Tech College of Science Roundtable Advisory Board is a group of key volunteers consisting of alumni and friends of the college. This group serves at the discretion of the Dean and, through the knowledge and experiences of its members, helps support key priorities across the college.

Members apply their knowledge, experience, expertise, influence, and financial support for the Dean, faculty, staff, researchers, and students in achieving and promoting the programs, goals, and objectives of the college and the university at large. Areas of activity fall under advice, access, and advocacy.

LORRAINE FEURY

What was your favorite class at Virginia Tech, and what did you like about it?
World History in Burruss Hall. This class taught me the importance of storytelling and how any hero can be viewed as a villain in someone else's story.

How did your field of study here affect your career path?
I earned B.S. degrees in mathematics and sociology. I was paving my foundation for data science before I knew its name. These degrees drive my passion of helping people become more aware of the different ways analytics is already a part of their day-to-day life.

What made you decide to give back to the college/university by joining the Roundtable?
Your network is your net worth. The activities, memories, and accomplishments across academics and student groups happened due to the amazing faculty and staff that helped me out. I want to give back to encourage the next generation of Hokies that *Ut Prosim* is a motto we all live by and to extend our service to our communities.

TED KING

How did your field of study here affect your career path?
After finishing my degrees at Virginia Tech, I interned in a fiscal management program for two years at the Atomic Energy Commission in the Washington, D.C. area. I then decided to attend law school at the University of Virginia. Over the next 40 years, I was a practicing attorney with a major corporate law firm in Baltimore and then served behind the scenes as legislative counsel and policy analyst with the Maryland General Assembly. In each of these endeavors, the critical thinking skills, attention to detail, and ability to analyze multiple sides of an issue — all of which were part of my educational journey at Virginia Tech — positioned me for a successful and enjoyable career.

What made you decide to give back to the college/university by joining the Roundtable?
I am very cognizant of what an enormous benefit I received from the educational experience I received and how it positioned me for success in life. Being in the position to "give back" and to help others very much appeals to me. It is my hope that they too will then express their gratitude for the doors that Virginia Tech opens for them and will be moved also to "give back" — both to Virginia Tech and to society at large.

Did you have a research experience here that was meaningful to you?
In the early 1970s there was a lively debate ongoing in the Blacksburg area about whether the town should break away from Montgomery County and become a separate independent city so that it could better align its political, governmental, and economic interests with the preferences of the town, particularly with regard to funding for the local schools. Professor Charles Goetz, the advisor for my master's degree economics thesis, was affiliated with the Center for the Study of Public Choice and had a strong interest in local government policy. Since I also had a keen interest in this subject, we settled on a study to define and analyze "Some Economic Implications of City Status for Blacksburg, VA."

> "I want to give back to encourage the next generation of Hokies that *Ut Prosim* is a motto we all live by and to extend our service to our communities."
>
> **– Lorraine Feury**

Photos courtesy of Lorraine Feury and Ted King.

ASHLEY FLORA

What was your favorite class at Virginia Tech, and what did you like about it?
Pathogenic bacteriology, Dr. Melville. This class steered my career into becoming a medical laboratory scientist and eventually to my first job working in a microbiology lab in a hospital.

What made you decide to give back to the college/university by joining the Roundtable?
I love Virginia Tech. I moved from upstate New York to attend Virginia Tech, and I have never left the area. This is home. I want to continue to support the college and engage with College of Science students, especially those interested in compliance or medical laboratory science.

Did you have a research experience here that was meaningful to you?
I did my undergraduate research in human nutrition, performing many simple laboratory tasks such as making solvents, washing glassware and running the autoclave. But my favorite was running PCR gels on diabetic mice. My undergraduate research experience absolutely prepared me for my career. Some of my favorite memories at Virginia Tech took place in that lab.

"Members of the Roundtable Advisory Board excel in their careers and make significant contributions to their communities and Virginia Tech. They embody the true spirit of Virginia Tech's motto, *Ut Prosim*, That I May Serve."

– Kevin Pitts, Dean, College of Science

ROBERT GARNETT

What was your favorite class at Virginia Tech, and what did you like about it?
Seminar in Global Political Economy, taught by Scott Nelson. It was a small format, which allowed for intimate dialogue on current and historical issues driven at their heart by political economy. The work was challenging, but incredibly rewarding, and now looking back about 20 years, still highly relevant given current social, political, and economic conflicts in the Middle East and Europe.

How did your field of study here affect your career path?
Political science established an analytic rigor that has been the foundation supporting much of my professional contributions in my career. While I later added an MBA from William & Mary, I find my draw on analytical reasoning to be a common thread I pull on more than anything else. My undergraduate studies established and fed a continual curiosity in understanding the drivers of change, problem solving, and strong communication skills.

What made you decide to give back to the college/university by joining the Roundtable?
Giving back to a university that has given me so much has always been an objective of mine. The opportunity to give back to the College of Science via the Roundtable gives me immense pride and joy in supporting the dean and the college's staff in executing on their vision. I couldn't be more excited about the direction they are leading and to be a part of the process. I am adamant that Virginia Tech represents one of the best educational values in the country and supporting the school's ability to deepen this value and broaden awareness is tremendously exciting.

Photos courtesy of Ashley Flora and Robert Garnett.

‘You are smart enough to be here’ and other physics lessons from the 2024 College of Science commencement speaker

By Kelly Izlar

As a kid, Alma Robinson did not want to be a teacher when she grew up. Now an award-winning advanced physics instructor, Robinson has shaped her highly-acclaimed teaching career around lessons and experiences that challenge assumptions — her students’ and her own.

LESSON 1: You are smart enough to be here

Throughout her decades of teaching, Robinson worked with many students who struggled with physics.

One student stands out in her memory.

“On paper, this student wasn’t as qualified as their peers,” Robinson said. “But they were willing to work, and that made all the difference.”

In the first year, the student built a physics foundation and the confidence to ask questions. At the end of the fourth year, the student was the physics valedictorian.

Robinson tells this story to all students who worry that they won’t be able to hack it.

“You are smart enough to be here because you are smart enough to get help,” Robinson said. “Struggling with a concept doesn’t mean you don’t belong here or won’t be successful.”

LESSON 2: Find your learning community

During Robinson’s office hours, one student turned to another and said: “You know what I’ve learned this semester? Physics is a social endeavor.”

Robinson almost fell out of her chair: “I’ve done my job.”

The world of professional physics is an active, tight-knit community. Physicists learn from each other and publish research together. Teaching is no different. Robinson is still discovering new ways to engage physics students thanks to collaborations with her colleagues.

LESSON 3: Teach science, learn science

In one class, Robinson’s students helped elementary school students understand a complex concept called electromagnetic induction.

“They’re fifth graders. How are we supposed to teach them about this if we can’t use calculus?” one senior engineering major asked.

After developing and teaching the lesson, the same student came back with a revelation: He himself didn’t truly understand the concept until he had to teach it to fifth graders.

“If you can’t explain your knowledge to your peers — or really anybody — then what is that knowledge, really?” Robinson said.

LESSON 4: Teach students, love your job

When Robinson, who didn’t want to be a teacher, actually tried teaching — she loved it. But over time, she came to an even deeper epiphany. Teaching and learning are about connecting.

“I’m not just teaching physics,” Robinson said. “I’m teaching students.”

▼ Alma Robinson

Photos by Spencer Coppage for Virginia Tech.

New Science Hokies

On May 10, 2024, after officially being conferred their degrees in the University commencement earlier that day, the College of Science held two celebratory ceremonies for the graduates of its eight departments, two academies, and one school. On that spring day, nearly 1,200 newly minted Hokie scientists became Virginia Tech alumni.

Giving Day 2024

FEBRUARY 21–22, 2024

The College of Science extends its deepest gratitude to all alumni and friends for their generous support on Giving Day. We would like to give special recognition to those listed below, whose sponsorship of challenges inspired others to participate and give back.

Academy of Data Science, including Computational Modeling and Data Analytics:
Linda Patterson '76 and Wesley Patterson '77
Mark Scheffel '78 and Nancy Scheffel
Tom Woteki '68, '72, '74 and Cathie Woteki '72, '75

Academy of Integrated Science, including Science Technology and Law:
Linda Patterson '76 and Wesley Patterson '77

Department of Biological Sciences:
Dr. Gilbert L. Button '69

Department of Chemistry:
Jason Rolland '01 and Jennifer Rolland '02

Department of Economics:
Kyle Pedrotty '03

Department of Geosciences:
Dean Snidow '06 and Kelli Snidow

Department of Mathematics:
Patricia Caldwell '71

Department of Physics:
John Fernando '89

Department of Psychology:
Patricia Caldwell '71

Department of Statistics:
Jennifer Van Mullekom '95, '98 and Bill Van Mullekom '96

School of Neuroscience:
Jeanine Matte '71

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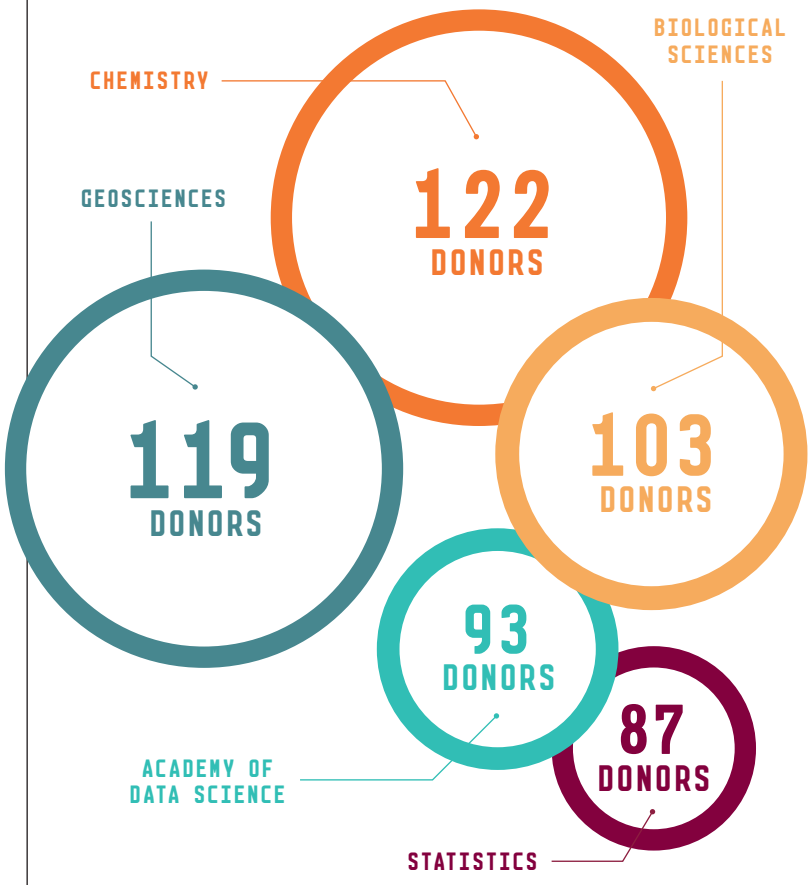

Get ready for Giving Day 2025, Feb. 19–20. Mark your calendars!

Photo (on right) by Ray Meese for Virginia Tech.

OUR SCIENCE WILL NOT BE ECLIPSED

On Monday, April 8, the College of Science along with the Department of Physics hosted a solar eclipse watch party on the Drillfield. Although cloud cover made a strong showing, so did students, faculty, and staff, who came together to witness an unforgettable cosmic event as a Hokie family.

College of Science Administration (0405)
Suite 4300, North End Center
300 Turner Street NW
Blacksburg, Virginia 24061

◂ Pi Day 5K 2024

▸ Alumni Weekend 2024

MARK YOUR CALENDAR FOR THESE UPCOMING EVENTS:

Oct. 26, 2024	Homecoming Tailgate
Nov. 2, 2024	Virginia Tech Science Festival
Feb 19–20, 2025	Giving Day
Mar. 14, 2025	Pi Day 5k (virtual)
Jun. 5–8, 2025	Alumni Weekend

For more information, visit *science.vt.edu*.

Keep in touch with the Virginia Tech College of Science

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