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NEURON

Volume 20 Issue 2

Science, Technology & Research in West Virginia



MARSHALL UNIVERSITY

Digital Defenders

Marshall University is building a cybersecurity workforce to protect American infrastructure and boost West Virginia's economy

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ABOUT

STaR Division: Science, Technology & Research at the West Virginia Higher Education Policy Commission provides strategic leadership for the development of competitive academic research opportunities in science, technology, engineering and mathematics (STEM).

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FROM THE INTERIM DIRECTOR

Making an Impact

Cybersecurity reinforces need for innovation

In this edition of the Neuron, we highlight some of the science, technology and research initiatives and collaborations that are making an impact in West Virginia.

Our feature article shines a spotlight on Marshall University's Institute for Cyber Security. The interconnected nature and ongoing digital evolution of today's world has led to increased security concerns for many. Academic programs, such as Marshall's, are playing a critical role in preparing future professionals with the required skills to address threats and safeguard digital systems. As cybersecurity threats continue to grow in sophistication so will the significance of cybersecurity programs.

In turn, reinforcing the need for innovative and proactive cybersecurity solutions to help protect individuals and groups in this advancing and ever-changing digital environment.

Also included in the Neuron are the 2024-2025 Instrumentation and Innovation grant awardees, Chancellor's STEM Speaker Series, National EPSCoR Conference, and West Virginia Science and Technology (S&T) Plan. Funded through the Research Challenge Grant, STaR awarded five Instrumentation Grants and one Innovation Grant

representing six of West Virginia's higher education institutions.

Together with West Virginia State University Space Club, the Chancellor's STEM Speaker Series showcased Kerri Phillips, West Virginia native and Chief Scientist of the Air and Missile Defense Sector (AMDS) at the Johns Hopkins Applied Physics

Laboratory, as the keynote speaker. Additionally, West Virginia was represented at the National EPSCoR Conference, including original research poster presentations from five West Virginia undergraduate students.

Lastly, the Science and Research Council kicked off the revision of the Science & Technology Plan which aims to engage a variety of West Virginia entities to identify strategic

goals, congruent to the current economic conditions, that promote growth in STEM workforce, research, industry and other areas of opportunity in West Virginia.

It's an exciting time for research in the Mountain State. Let's continue working together to seize these opportunities.

Dr. Janet Rorrer

Interim Senior Director of Science & Research, West Virginia Higher Education Policy Commission



Rorrer

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News briefings



Pile

Marshall School of Pharmacy faculty member selected for prestigious mentorship program

Dr. Thomas Pile, a clinical assistant professor at the Marshall University School of Pharmacy, has been chosen as one of five participants for the National Association of Chain Drug Stores (NACDS) Foundation's 2024-2025 Faculty Scholars Program.

The 18-month research mentorship program connects faculty members with seasoned research experts, transforming research ideas into published manuscripts through NACDS Foundation starter grants. Pile, who serves as the school's associate director of experiential learning, will investigate the relationship between and the impact of continuous glucose monitors and oral diabetes medication compliance among people living with diabetes.

WVU researchers' measure to better assess children with traumatic injuries named a top study of 2024

West Virginia University pediatric trauma specialists and statisticians have formulated a measure to more accurately assess children with traumatic injuries to ensure they receive the most effective life-saving treatment.

"This tool we've evaluated is not only accurate in predicting which pediatric patients are going to benefit from going to a Level 1 trauma center, but it's also simpler than ones that have been previously proposed so a paramedic can use it in the back of an ambulance," said Tanner Smida, an MD/PhD student from Finleyville, Pennsylvania, whose studies focus on emergency medicine.

Smida, along with Dr. James Bardes, associate professor of trauma, acute care surgery and surgical critical care, and Dr. Patrick Bonasso, assistant professor and pediatric trauma director, both in the WVU School of Medicine Department of Surgery, came up with the concept for the study to augment the triage of children whose injuries occur in rural areas far from a trauma center. The formula for assessment, however, can be used in any setting to determine the need for critical care.

The Journal of Trauma and Acute Care Surgery, which published the paper, selected the study as one of the best of 2024. The work evolved from Bardes' previous studies on adults with traumatic injuries,

particularly those in rural states. Brad Price, chair and associate professor of management information systems and supply chain in the WVU John Chambers College of Business and Economics, was also a study co-author.

The team of WVU researchers evaluated the reverse shock index or rSIM score, which includes the ratio of systolic blood pressure to heart rate, and the motor skills component of the Glasgow Coma Scale or GSC, a tool to assess level of consciousness.

To conduct the study, Price said researchers looked at the National Trauma Data Bank to understand the relationship between rSIM scores, pediatric mortality and hospital resource utilization nationwide. Their approach investigated patients ages 1 to 16 and accounted for information such as age, gender and injury severity.

Results were able to accurately predict a patient's chance of survival, along with the need for blood transfusion, intensive care unit admission or surgery, Smida noted.

Bonasso said he would like to see the next phase of the study involve educating pre-hospital providers, particularly those in West Virginia and the region, on how to use the tool. He also expects to see other researchers use the WVU team's findings in their own studies.

Within the next few months, the WVU team will partner with the pediatric trauma clinical collaborative ATOMAC+ Pediatric Trauma Research Network for an expanded study.

News briefings



Nimmakayala

U.S. Department of Defense awards \$400,000 to WVSU for plant science research

West Virginia State University was awarded a \$400,000 grant by the U.S. Department of Defense to support a plant science initiative led by Dr. Padma Nimmakayala. This funding will help the university study how plants cope with harsh conditions like drought, salty soil and exposure to heavy metals.

The grant will support the purchase of a high-tech machine called the Plant-Ditech functional phenotyping system. This tool enables researchers to observe how plants respond to various conditions without harming them. Additionally, the university will use the funds to acquire controlled-environment growth chambers to test how plants cope with stress.

WVU Tech professor helps tackle \$500 million virus plaguing the pork industry

Naresh Ramesh, Ph. D., is an assistant professor at WVU Tech working to solve a \$500 million problem in the United States and revolutionize our perception of vaccines.

Ramesh is part of an international team researching one of the most transmitted viruses among pigs – the porcine reproductive and respiratory syndrome virus (PRRSV). According to Ramesh, PRRSV poses a significant economic risk to the pork industry and causes substantial loss of livestock globally.

Industry analysts estimate the infection costs between \$500 and \$600 million in lost or nonviable livestock. Once a sow is infected and loses a pregnancy, the sow will likely become infertile. The meat from infected pigs is also no longer fit for human consumption.

The most frustrating part about PRRSV, Ramesh says, is the unpredictable response infected pigs have to vaccination.

That is where Dr. Ramesh and a team of seven other researchers developed a new approach to dealing with the infection. He says the key could be reinforcing areas within the DNA, creating fetal resilience to PRRSV infection and vaccination.

"In our most recently published

study, we're exploring the effect of a mutation in the DIO2 gene and fetal viability in PRRSV infection," said Ramesh. "To our knowledge, this is the first examination that studies how a targeted gene mutation correlates with fetal viability upon infection during gestation."

Vandalia Health Neuroscience Institute receives state funding

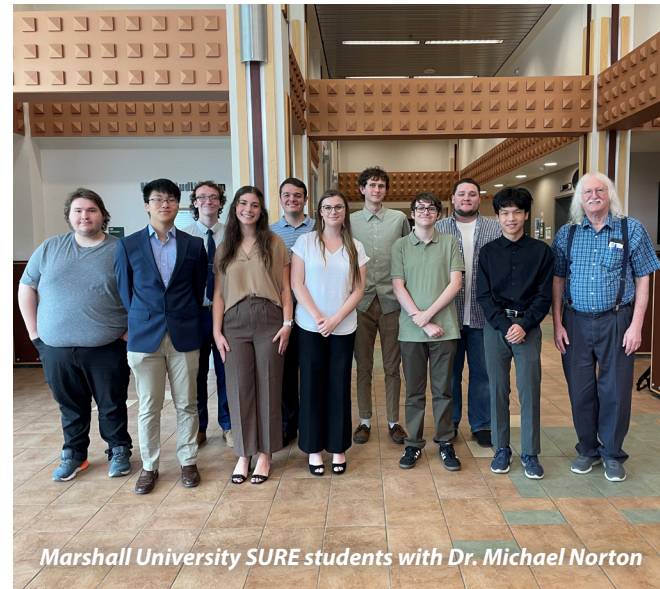
Vandalia Health received \$5 million from former Governor Jim Justice towards construction of the Vandalia Health Neuroscience Institute (VHNI).

Neurologic disorders are a significant health challenge in West Virginia. Despite the high prevalence of these conditions, specialized neurological care is limited. Many patients face long wait times and often must travel out of state to receive the necessary care. VHNI aims to change this by offering state-of-the-art advanced diagnostic testing and treatment options to improve outcomes and quality of life while reducing costs.

The Vandalia Health Neuroscience Institute will be a new facility located on Morris Street in downtown Charleston, directly across from the CAMC General Hospital main entrance.

Research Challenge Fund

Established by the State Legislature in 2004 to support research and development projects at institutions of higher education in West Virginia

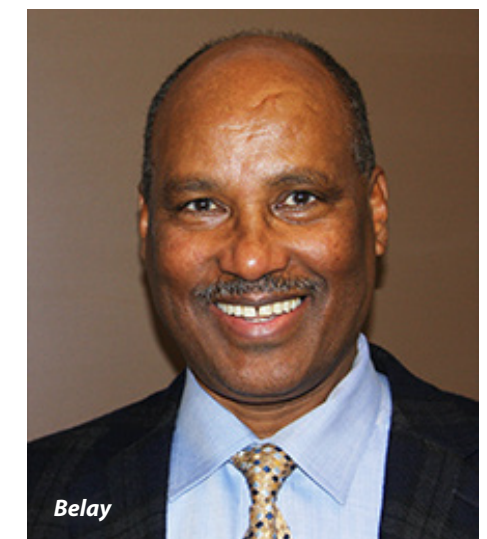
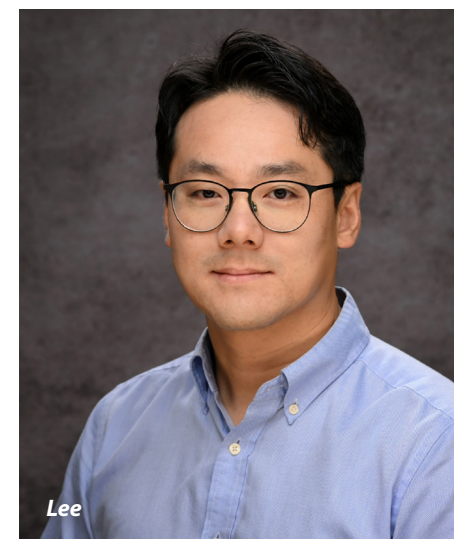
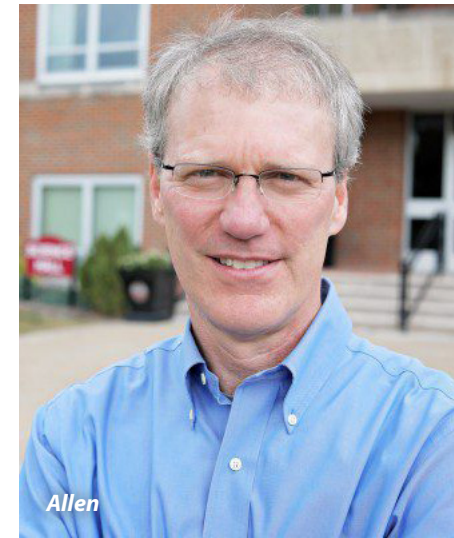


SURE programs celebrate 2024 success and plan for 2025 summer research

Summer Undergraduate Research Experiences (SURE) continued in 2024. Students gained hands-on experience in academic research across the state. The participating student numbers included: 11 at Fairmont State University, 10 at Marshall University, 10 at Shepherd University, 11 at West Liberty University, 12 at West Virginia State University, 46 at West Virginia University, 7 at West Virginia University Institute of Technology, and 8 at West Virginia Wesleyan College. Students interested in summer 2025 SURE programs should seek more information from their institution's faculty representative.

Planning process underway for new state Science & Technology Plan

The West Virginia Science & Research Council approved the planning process for the next Science & Technology Plan (S&T Plan). The S&T Plan provides strategic goals aimed to develop West Virginia's science, technology, engineering, and mathematics (STEM) talent pipeline, expand the research enterprise, catalyze more innovation and entrepreneurship activity, and support the growth of high-tech companies in targeted platforms. The proposed actions build upon existing initiatives and collaborative efforts among higher education, industry and government. The plan is expected to be ready by summer 2025.



Faculty at six West Virginia colleges and universities receive state funding to upgrade scientific equipment and enhance curriculum

Faculty at six West Virginia colleges and universities were awarded approximately \$137,000 in state-funded grants to purchase scientific equipment and enhance student opportunities on their campuses.

Instrumentation and Innovation Grants are primarily supported by the Research Challenge Fund, established by the West Virginia Legislature in 2004 to build research capacity and competitiveness at the state's colleges and universities. It is managed by STaR and matching funds are usually provided by the college or university.

Dr. Joseph Allen, distinguished professor of geology and chair of the Department of Physical & Environmental Sciences at Concord University, was awarded \$40,000 for a benchtop powder X-ray Diffractometer.

Dr. Derek Dewig, assistant professor of exercise science

at Fairmont State University, was awarded \$20,000 for Wireless Electromyography (EMG) System and Nerve Stimulation Unit.

Dr. Brooke Comer, assistant professor of environmental science and sustainable agriculture at Shepherd University, was awarded \$18,200 for Soil Respiration and Light Radiation instruments.

Dr. Lee Gwonjin, assistant professor in the Department of Biology at West Virginia State University, was awarded \$20,000 for Growth Chamber for Plant Stress Tests.

Dr. Nicole Garrison, assistant professor of biology at West Liberty University, was awarded \$18,500 for Electrofishing Backpack and Gel System.

Dr. Tesfaye Belay, biology professor at Bluefield State University, was awarded \$20,000 for Fluorescence Microscope.

NSF EPSCoR

*National Science Foundation
Established Program to Stimulate
Competitive Research*

A program that enhances research competitiveness of targeted jurisdictions (states, territories, and a commonwealth) by strengthening STEM capacity and capability through a portfolio of investments from talent development to local infrastructure



Grant No. OIA-2242771



STEM Speaker Series hosted Dr. Kerri B. Phillips at WVSU on October 24

The STEM Speaker Series took place on Thursday, October 24 at the Fannin S. Belcher Theater, John W. Davis Fine Arts Building on the campus of West Virginia State University. **Dr. Kerri B. Phillips** presented, "A Mountaineer's Journey: How Country Roads Paved My Way to Aerospace Leader."

Phillips is the Chief Scientist of the Air and Missile Defense Sector (AMDS) at the Johns Hopkins Applied Physics Laboratory, where she advises on strategic technical direction, science and technology initiatives, and novel applications of technologies to address critical warfighting needs.

Phillips earned dual bachelor's degrees in aerospace and mechanical engineering and a Ph.D. in aerospace engineering from West Virginia University and a master's degree in systems engineering from Johns Hopkins University. She grew up in Weirton, West Virginia, where she attended Weir High School.

The STEM Speaker Series began in 2014 with a goal of communicating science, technology, engineering and math (STEM) research to all West Virginians. This event is sponsored by STaR Division: Science, Technology & Research at the West Virginia Higher Education Policy Commission and is supported by the National Science Foundation under Award No. OIA 2242771.



Above, left to right: Dr. Suzanne Strait, Abigail Collins, Alexander Cunill, Juan Gerardo Flores-Iga, Nathan Lyttle, Erica Edinger, and Dr. Janet Rorrer.

WV-NFNT attends national NSF EPSCoR conference in Nebraska

The National Science Foundation (NSF) Established Program to Stimulate Competitive Research (EPSCoR) held its 28th national conference October 13-16 in Omaha, Nebraska. Representatives from the West Virginia Network for Functional Neuroscience and Transcriptomics (WV-NFNT) were in attendance for a keynote from NSF Director Sethuraman Panchanathan, networking with officials from other EPSCoR states, and two days of poster presentations, including five West Virginia students.

WV-NFNT External Advisory Board convenes

The External Advisory Board (EAB) met in October with the WV-NFNT leadership team. The EAB includes: Drs. Sijung Yun (Johns Hopkins), Hongkui Zeng (Allen Institute), Colin Saldanha (American University), Barbara Shinn-Cunningham (Carnegie Mellon), and Ana Cristina Lima (Oregon Health Sciences University). During the meeting, Dr. Eric Horstick and Dr. Nadja Spitzer updated the group on the research happening while Dr. Juliana Serafin presented the outreach and education initiatives. The EAB was impressed by the strong progress already made and looked forward to the next meeting.

WV-NFNT hires three new researchers

The hiring of additional team members contributing to the WV-NFNT continues with the addition of three new researchers.



Dr. Sadia Akter is an Assistant Professor of Biomedical Sciences at Marshall University School of Medicine. She earned her Ph.D. in Bioinformatics from the University of Missouri-Columbia, where she also completed postdoctoral training in Bioinformatics and Computational Biology. Before

joining Marshall University, Dr. Akter worked as a Scientist at Washington University School of Medicine in St. Louis and the University of Chicago. She is a Fellow of the American Medical Informatics Association (FAMIA) and a Fellow of the NIH's AIM-AHEAD Artificial Intelligence/Machine Learning Research initiative.



Dr. Cheyenne Tait studies the small but intricately complex brains of invertebrates: fruit flies and sea slugs. She obtained her bachelor's degree in Ecology and Evolutionary Biology from Princeton University as a Questbridge College Match Scholar. While obtaining her Ph.D. at the University of Notre

Dame, she got her start in neurophysiology, digging into fruit fly olfactory preference using single neuron recordings and whole brain calcium imaging. Most recently, she used in-situ hybridization and confocal microscopy to map the brains, neurons, and hormones of nudibranch sea slugs at the University of Massachusetts Amherst. Dr. Tait's research program at Marshall University will target mechanisms of innate choice behaviors in invertebrates.



Dr. Shahrzad Latifi joined the West Virginia University (WVU) faculty as a tenure-track assistant professor. Dr. Latifi holds a Master's in Neurobiology from René Descartes University (Paris, France) and a Ph.D. in Neuroscience and Brain Technology from the Italian Institute of Technology (Genoa, Italy). After

completing her postdoctoral research in the Department of Neurology at UCLA, she joined WVU's Department of Neuroscience in 2023 as a Research Assistant Professor and Director of In Vivo Imaging and Network Analysis for the CoBRE Behavioral Core. Dr. Latifi's research leverages cutting-edge technologies to track brain network activity and applies connectomics-based approaches to study mesoscale brain networks, with a focus on disorders such as stroke. More recently, her work has expanded to integrate AI and machine learning models to predict and decode complex motor behavior from mesoscale brain signals.

NSF INCLUDES

A comprehensive national initiative to enhance U.S. leadership in science, technology, engineering and mathematics (STEM) discoveries and innovations focused on NSF's commitment to broadening participation



Grant No. HRD-1834586



Above: Rimsha Kingson, Marshall psychology student

First2 Network conference held in November

First2 Network's (First2) Empowering Systemic Change: Collaborations to Improve and Sustain STEM Student Success Fall Conference and Higher Education Administrators Workshop was held November 1-2, 2024 in Morgantown. The conference brought together 77 stakeholders in a hybrid format that gave attendees the opportunity to join both virtually and in-person.

Attendees participated in interactive workshops, panels, and discussions that focused on fostering a culture of learning and collaboration among students, faculty, staff, administrators, and other stakeholders invested in improving STEM student success.

Of the 36 attendees who completed a conference evaluation, 75 percent of respondents strongly agreed that they are enthusiastic about participating in the First2 Network and 72 percent strongly agreed that they are committed to contributing to the work of institutional teams. In addition, 75 percent of respondents strongly agreed that they will be able to apply what they learned in their ongoing involvement in the First2 Network and 72 percent strongly agreed that the conference included meaningful sessions.

The First2 Network Spring Conference will be held at the Four Points Sheraton in Charleston May 15-17. This will be an in person event that will also be a co-conference with the WV Jobs Network. Visit first2network.org for updated information and links to agendas and hotel bookings.

First2 Network announces new Board of Directors

The First2 Network is excited to introduce its new Board of Directors. The Board first met in October 2024 with the initial goal to have a set, recurring meeting schedule as well as to elect officers, to approve bylaws and to submit a 501(c)(3) application. This is an important step towards long-term sustainability for the First2 Network as a non-profit organization.

Board of Directors members include: Dave Mohr, education policy advisor to the West Virginia Legislature; Deana White, chemical engineer, First2 Industry Advisory Board Member, WV Alliance for STEM and the Arts CEO; Travis Miller, educational consultant, First2 Industry Advisory Board member; Adam Smith, senior research chemist, Chemours, First2 Industry Advisory Board Member; and Tyler Davis, senior data analyst, iRobot, Former First2 Network student leader, founder of First2 Network Alumni Group. All Board members were first generation students themselves.

Appalachian Regional Commission (ARC) POWER Grant awarded

Fairmont State University and partner organizations including Glenville State University, Preston County Economic Development Authority, Barbour County Development Authority, Little Kanawha Development Corporation, Mtn Craft, High Rocks Educational Corporation, and public schools in Braxton, Upshur, and Calhoun counties have been awarded \$1,990,600 from the Appalachian Regional Commission (ARC) to initiate a Regional Career Services and Workforce Development Collaborative to improve the STEM workforce pipeline in North Central West Virginia.

First2 recruiting team members for regional STEM workforce collaborative

If you are passionate about transforming the science, technology, engineering, and mathematics (STEM) workforce pipeline, or know someone who is, there are two new positions available in North Central West Virginia.

Fairmont State University, Glenville State University and regional partners are building a Regional Collaborative to improve the science, technology, engineering, and mathematics (STEM) workforce pipeline in North Central West Virginia. This initiative is funded in part through an Appalachian Regional Commission (ARC) POWER Grant with the goal of building an industry-education network and facilitating projects to increase job awareness and preparedness among students and jobseekers.

The Collaborative is currently recruiting two Core Executive Team members. The Core Executive Team is in charge of establishing and managing the Regional Collaborative and providing needed support for Collaborative activities. Led by Cliff Jackson, Fairmont State Director of Workforce and Economic Development, the CET will include the three additional strategic roles at Fairmont State and Glenville State. This group will support the grant by developing relationships with industry partners and West Virginia government; organizing the Collaborative's work to create and maintain a database of regional STEM industries and work-based learning opportunities; building strong relationships with academic units to help identify opportunities for interaction with industry; directly supporting students and other jobseekers; and advancing relationships with K-12 and youth-serving organizations to support Collaborative efforts to improve STEM career awareness.

To apply, visit schooljobs.com or the Fairmont State University official website.

Digital Defenders

Marshall University is building a cybersecurity workforce to protect American infrastructure and boost West Virginia's economy

By Angela Sundstrom

Cybersecurity influences every aspect of modern life. It's that reminder email received every few months to update your password or the voice in your head saying not to open the link from that surprise text message. Those best practices allow regular people to seamlessly move through their day in an increasingly technology reliant world. However, not everyone follows such precautions and, even if they do, the strategies constantly evolve. That is why trained cybersecurity professionals are needed to safeguard our online lives.

Marshall University (Marshall) has created a name for itself in cybersecurity over recent decades. Students have assisted in the rescue of 80 human trafficking victims that lead to 30 arrests and won the 2020 National Cyber League championship. Both Cyber and Forensic Science are named in the school's strategic plan as "Areas of Distinction." Now, the program moves into the next phase with its success leading to unprecedented investment in an era when cybersecurity is more important than ever.

Educating the next generation of analysts

Marshall University has offered a cyber-related degree since the early 2000s. **John Sammons**, associate director & professor at the Marshall University Institute for Cyber Security (MU ICS), has been there since nearly the beginning. His journey began by filling a recently vacated digital forensics position, but the gig was only supposed to be for one semester.

"That was 19 years ago," Sammons said. "I've always loved to teach. I got here and just fell in love with it. I have not looked back since and it's been an awesome ride."

Around 2004, cybersecurity was only an emphasis within

the computer and information technology program at Marshall with approximately six students and one faculty member. By 2013, that grew 330 percent and the school introduced the digital forensics and information assurance bachelor's degree. Marshall now offers the cyber forensics and security undergraduate program as well as a graduate degree in cybersecurity. The cyber forensics and security undergraduate degree was designated a Center of Academic Excellence for Cyber Defense by the National Security Agency and the U.S. Department of Homeland Security.



Sammons

"On the forensic side, students are taught introduction to digital forensics, applied forensics, mobile forensics, network forensics, multimedia forensics, and more. On the cybersecurity side, we teach network penetration

and attack. We teach network defense, web application penetration testing, and open-source intelligence," Sammons said.

This union between cybersecurity and forensics is a unique pairing. Many schools do not offer such a hybrid program. Sammons refers to it as a "Swiss Army knife" curriculum, providing students with a variety of skills so life after graduation offers flexibility.

"What we think makes our degree a little bit different is what we call practitioner focused," Sammons said. "It's very



Above: Alexandria Royal speaking with Marshall cybersecurity students. Below, left to right: Current students Noah Quesenberry, Austin Woodrum, and Alexander Lambert. (Photos by Austin O'Connor, Marshall University)





Above: Artist rendering of the proposed Marshall University Institute for Cyber Security (MU ICS) building on 4th Avenue in Huntington, W.Va. (Photo courtesy of Marshall University)

much designed to teach students how to apply science and technology to solve investigative or cybersecurity problems. That's how we structured it, just with the goal in mind of trying to meet that skills gap in the workforce, to try to get practitioners out there to help fill that monstrous void that exists."

Students are taught both how to defend a network and then how to attack it.

"One of the things we firmly believe is that to properly defend, you have to know how the bad guys are going to attack," Sammons said. "We teach them offensive security, so we actually show them how to hack into computers. Of course, we do that ethically bounded. There are guardrails and they understand the legal and ethical requirements around using those tools for anything other than good."

Immersive experiences such as these have enabled Marshall graduates to be as competitive as possible in the job market. One of the examples Sammons often cites is a recent student who, by the time she walked across the

"One of the things we firmly believe is that to properly defend, you have to know how the bad guys are going to attack."

- John Sammons

graduation stage, had job offers from NASA, Honda and Publix. "We have folks working all over the place. Our folks are being very well received in the job market."

Other graduates have found employment at a variety of well-known names like Best Buy, Walmart, and CrowdStrike as well as government entities such as the U.S. Department of Defense (DoD) and Federal Bureau of Investigation (FBI) plus major defense contractors like Booz Allen Hamilton and Lockheed Martin.

"It's a very intense, demanding field and students interested in entering such a field need to be ready to

work hard. It's ever-changing," Sammons said. He describes three ever-evolving, overlapping wheels that cybersecurity professionals need to know: technology, "good guy" tactics and "bad guy" tactics.

"That's one of the things that we struggle with the most is the speed of change," Sammons said. "We tell them in our classes, 'We're teaching you what it is as of this minute, but this could be out the door by lunch.' It's out of our control. Every time Microsoft patches their software or a new piece of software or hardware rolls out, it can radically change what we know about it in terms of the potential evidence that it can hold or how to secure it."

Growth and innovation

With such attention in recent years, it was time for the Marshall University Institute for Cyber Security (MU ICS) to hire an overseer. Enter current Executive Director **Alexandria Royal**. Royal manages priorities and budgets while collaborating with industry and government entities to assure continued support. She was previously the senior technical advisor at United States Cyber Command's Joint Force Headquarters-Department of Defense Information Networks (JFHQ-DODIN). Her transition has been smooth thus far.



Royal

"One of the things I've noticed most working in academia is that everyone just wants everyone else to succeed, which is wonderful," Royal said.

The new MU ICS building will be one of her priorities. It will be located at the corner of Hal Greer Boulevard and 4th

Avenue, directly across from Old Main on Marshall's campus in Huntington. This space will house not only industry partners, but also government. Cybersecurity classes, which are now spread around campus, will be taught out of there as well as some labs.

"The goal is to have a live state-of-the-art security operation center that can emulate one within DoD, when needed, to give students real world experience working on what could be real world events in IT," Royal said.

The new MU ICS building will be a core piece of the Innovation District, a \$200 million investment in several blocks adjacent to campus. This infrastructure is designed

to drive economic development by connecting industry and academic experts with state-of-the-art facilities and resources to cultivate a highly skilled workforce statewide. Currently, this includes the Brad D. Smith Center for Business and Innovation, completed in January 2024, as well as future projects like the Marshall Advanced Manufacturing Center and the Innovation Resource Hub.

The new MU ICS building will also serve as the physical location for the National Cyber Defense Center (NCDC). The NCDC is a partnership between Marshall, West Virginia University, U.S. Cyber Command, and JFHQ-DODIN. The NCDC expands the DoD's ability to examine critical cybersecurity issues and create solutions to strengthen national security while helping shape the future cyber workforce for DoD through research, training, and collaborative initiatives. The partnerships between the DoD, industry and academia, will enable opportunities such as promoting STEM careers within the DoD, the exchange of expertise among partners, and deep research on issues associated with protecting and operationalizing the security and defense of the nation's critical infrastructure.

"This will strengthen our partnerships, whether it be industry or federal government," Royal said. "Partners interested in protecting and defending critical infrastructure can talk to the National Cyber Defense Center and work best postured. The NCDC serves as the arbiter to a lot of the great resources that we have between the two universities."

In this case, critical infrastructure means focusing on aviation and water treatment plants.

"We have the PLCs, the programmable logic controllers, of a water treatment facility. The systems that they are run on are managed in a very different way than a lot of our basic level IT systems. So, we are teaching students the differences in protecting them but also upgrading them," Royal said.

MU ICS is also building microcredentials. These mini-courses will allow interested individuals - especially those working in aviation, water treatment, and digital evidence collection - the chance to learn the same basic skills as students, but in a more condensed fashion. This type of outreach will be a hallmark of MU ICS, helping locals learn about or enhance their knowledge of cybersecurity and incorporate it into their jobs. Students will also be able to gain experience through on-the-job placements as interns and, eventually, full-time employees. Royal aims to build a robust network of internship opportunities. She wants to see local communities benefit from their cybersecurity resources, especially in protecting critical infrastructure.

"My long-term goal is to up-level the cybersecurity posture and discipline for the University students, faculty, staff, and,



Above, left to right: Marshall cybersecurity students Tyler Fultz, Abrianna Angus, and Kaylin Hayes (Photo by Austin O'Connor, Marshall University)

eventually, the state," Royal said. "That is something that the National Cyber Defense Center will accomplish through collaboration between Marshall and WVU."

Safeguarding an increasingly connected world

Securing our networks has never been more important. There are very real issues that today's cybersecurity students will immediately be forced to confront in the field.

"It's a massive, monstrous national security concern,"

Sammons said.

Both Sammons and Royal can attest to this through their own law enforcement and national security backgrounds. Sammons, a Marshall alum himself, was a detective with the Huntington Police Department for a decade before becoming involved in cybersecurity. Royal has been in the Air National Guard for nearly 16 years, mostly as an intelligence professional.

Countries, and increasingly private companies, are waging

cyber battles against adversaries aiming to compromise or influence their networks. Those adversaries can vary widely from one highly skilled individual to the organized campaign of a foreign government. For example, hackers linked to the Chinese government accessed at least three telecommunications companies – including AT&T and Verizon - at the end of 2024. Russia has been accused of attacking Ukrainian infrastructure, including an attack in December that temporarily halted access to documents as important as birth certificates and property ownership. Americans are now very aware that controversy can arise even from popular apps like TikTok when they are owned by foreign companies. The legal ramifications, however, are still very much an international gray area.

"Nation states are finding out that's below the threshold for conflict," Sammons said. "In other words, if China were to come here and physically take over a power grid, that could be an act of war, right? But they're finding out now that doing this through the computer, there is a much higher threshold for what is going to trigger a response. The entire international community is trying to figure out those norms of what is and what is not acceptable. Those boundaries are still being determined. It is of the utmost importance for any number of reasons. It is critical for everyday Americans, for the security of the United States, for the economy. All of it."

"If it touches the internet, it's vulnerable."

- Alex Royal

Our dependence on technology is another degree of concern. From sunrise to sunset, daily tasks are immersed in technology. Most people carry a smartphone with them holding their personal information and location. A scroll through social media often presents examples of misinformation and disinformation lurking among photos of friends and family. The entire economy is reliant on technology.

Sammons, however, points out that this is also an economic development opportunity for West Virginia. The state has always been important to critical infrastructure, supplying coal that keeps power plants operating. The same can be true for cybersecurity, Sammons said, with Marshall's Innovation District and MU ICS leading the way.

Royal agrees that, even if a person does not want to enter the cybersecurity field professionally, having a basic

FAST FACTS

- **\$45 million** for new Marshall University Institute for Cyber Security building
- Undergraduate degree designated as **Center of Academic Excellence in Cyber Defense** by National Security Agency
- 2020 **National Cyber League Champions** and Top 8 finishes the four years prior
- Program graduates working for U.S. Department of Defense, NASA, FBI, NSA, Booz Allen Hamilton, Binary Defense, West Virginia State Police, Alaska State Police, West Virginia Fusion Center, CrowdStrike, Best Buy, Publix, AT&T, Dell SecureWorks and more

level understanding about cybersecurity is beneficial for everyone.

"If it touches the internet, it's vulnerable," Royal said. "Knowing that what I connect to it and the security posture I put in, even in my own home, that is something that I want everyone to have a base level understanding of."

Unfortunately, the best way to understand a threat is often through experience.

"A lot of people - and I would say previously myself included - until it affects you, you really don't understand how catastrophic it can be," Royal said.

No one aspires to have their identity stolen or bank account hacked, but mistakes happen. Cybersecurity professionals are there to help, but it takes a collected effort to secure assets in this technological age. That's why partnerships, according to Royal, will be central to the MU ICS and its mission.

"When everyone cares as a person, then it helps the entire nation."

Commentary Dave Dampier



The world today is filled with information technology (IT) that is becoming more and more sophisticated by the minute. And while information technology has made our lives easier in many ways, it's also opened new avenues of vulnerabilities.

In warfare, offense is much easier than defense. An attacker only must find one vulnerability in a defensive perimeter to exploit, and they can win the day. The defense has to block 100 percent of the vulnerabilities in their perimeter to guarantee a successful defense. The same is true with information technology. A successful perimeter defense requires either complete removal of vulnerabilities in the perimeter or ways to make it so difficult to get in that an attack is discovered and thwarted before it can be successful. This requires defense in depth, which provides another technique for warfighters.

Defense in depth in an IT infrastructure is provided by multiple levels of firewalls, information protection

networks, more commonly known as demilitarized zones, and a staff of cybersecurity personnel constantly monitoring the network for active attacks.

"And while information technology has made our lives easier in many ways, it's also opened new avenues of vulnerabilities."

- Dave Dampier

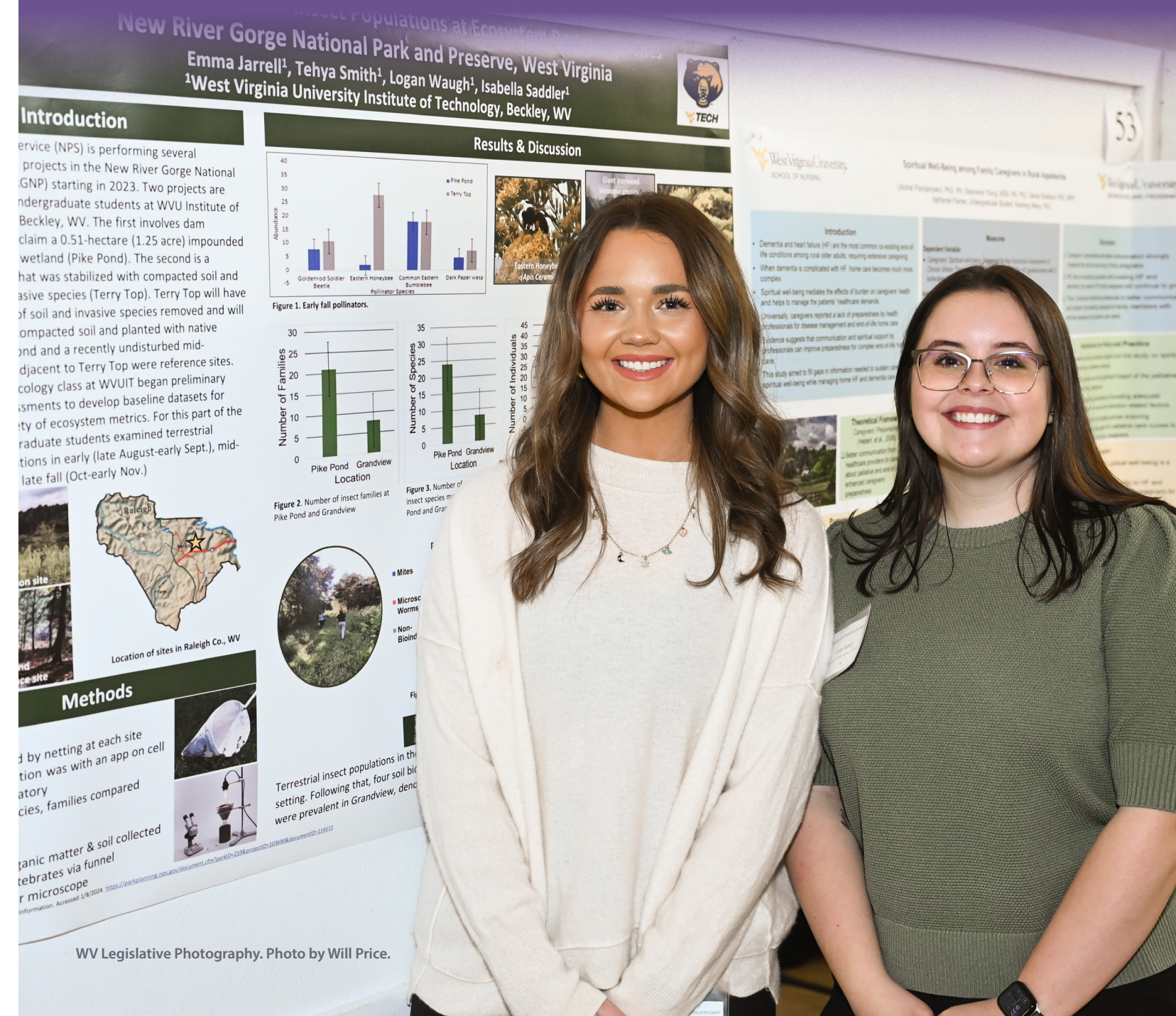
Marshall University, since October 2021, has endeavored to build a capability to train and equip cybersecurity professionals with the skills and experience necessary to be able to defend information technology against all attackers. The educational programs that are located in the College of Science and the College of Engineering and Computer Sciences are educating students to enter the workforce and go to work immediately to defend their employers' technology. Additionally, the Institute for Cyber Security at Marshall is conducting research and development to provide workforce training for existing professionals as well as working with community colleges and other universities to help them develop curriculum and programs to help produce cybersecurity professionals. These educational endeavors, plus the collaboration and partnership of the private and government sectors, are building our future. We must all work together to be successful.

Dr. Dave Dampier has been the dean of Marshall University's College of Engineering and Computer Sciences since August 2020, and from October 2021 to July 2024, served as the interim executive director of the Institute for Cyber Security at Marshall. Prior to Marshall, he was the chair of the Department of Information Systems and Cyber Security at the University of Texas at San Antonio from 2017 to 2019. Prior to that, he served at Mississippi State University as professor of Computer Science and Engineering, and as director of three different research centers related to cybersecurity: the National Forensics Training Center, the Center for Cyber Security Research, and the Distributed Analytics and Security Institute. From 1977 to 2000, Dr. Dampier served in the U.S. Army, culminating his service as an Army scientist working at the Army Research Laboratory and the National Defense University.

Undergraduate Research Day at the Capitol

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