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West Virginia's Journal of Science and Research

SPRING 2019

WEST LIBERTY UNIVERSITY

Joseph Horzempa

West Liberty researcher's work revolves around the mystery of one pathogen's red blood cell invasion

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ABOUT
West Virginia Science & Research, a division of the West Virginia Higher Education Policy Commission, provides strategic leadership for the development of competitive academic research opportunities in science, technology, engineering and mathematics. The office directs the National Science Foundation's Established Program to Stimulate Competitive Research (EPSCoR) in West Virginia, coordinates scientific research grants to academic institutions from federal and state agencies, and conducts outreach activities to broaden the public's understanding of science.

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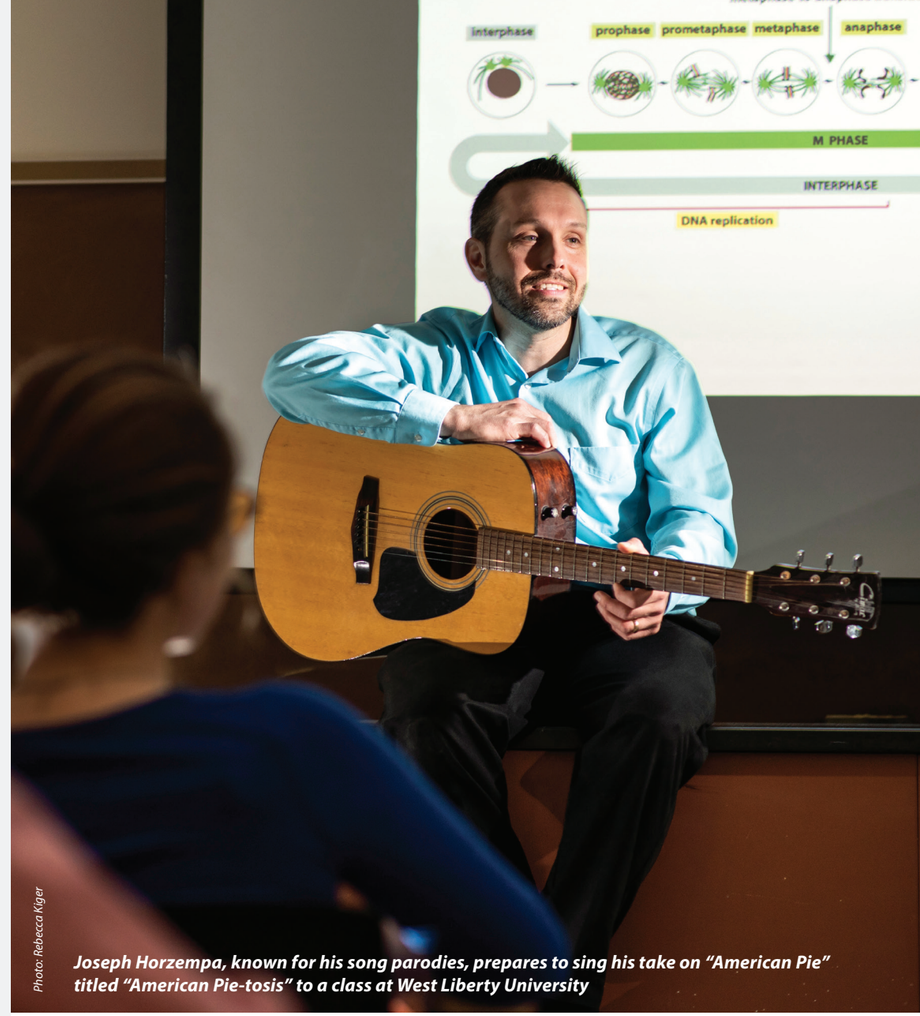

Photo: Rebecca Kiger

Joseph Horzempa, known for his song parodies, prepares to sing his take on "American Pie" titled "American Pie-tosis" to a class at West Liberty University

INSIDE THIS ISSUE

News briefings

WVSU hosts Appalachian Freshwater Initiative meeting featuring WVU spatial analysis professor

West Virginia State University's newly opened Integrated Research and Extension Building served as the host venue for WV EPSCoR's Appalachian Freshwater Initiative Group 3 General Meeting on March 1. WV EPSCoR is administered through West Virginia Science & Research, a division of the Higher Education Policy Commission.

During the daylong meeting, Michael Strager, professor of spatial analysis with the West Virginia University Davis College of Agriculture, presented a seminar entitled "Valuing West Virginia Water Resources with Ecosystem Services."

"In West Virginia, we don't value water as much as we can and should," Strager said. "Because of the 2014 water crisis, most people are now aware of how inconvenient it is to not have water to clean, cook or bathe with. The incident has raised great awareness of the importance of keeping our water resources safe."

Since West Virginia is a headwater state, where many of the major river systems in the Mid-Atlantic Highlands originate, much of the water flows out of state. As a birthplace for rivers, West Virginia has an inherent responsibility to provide high quality water and sufficient supply for downstream communities that include instate and out of state users and consumers, Strager said.

During his presentation, Strager outlined an approach using ecosystem services - the benefits that humans freely gain from the natural environment - to better highlight and measure the hidden benefits of healthy watersheds and promote multi-functionality and sustainability in water management.

WVSOM researchers publish six articles to national journal

Faculty, students and alumni from the West Virginia School of Osteopathic Medicine (WVSOM) recently contributed to a national research journal.

The six publications were featured in the March 2019 issue of The Journal of the American Osteopathic Association (JAOA). Although members of the WVSOM community have published research in the JAOA previously, the special issue is the result of the school's participation in the journal's "Engage Initiative," in which osteopathic medical schools are encouraged to contribute multiple research items to highlight commitment to scholarly activity.

Jandy Hanna, WVSOM's associate dean for research and sponsored programs, said the contributions are based on the theme of building on the school's mission through the integration of education and scholarly activity.

"Students are encouraged to be involved in research and scholarly activity projects, preparing them to think critically, work with and educate future patients, and practice self-directed learning," she said.

Marshall University named a research university by Carnegie classification

For the first time in its history, Marshall University has been selected as an "R-2" research institution by the Carnegie Classification of Institutions of Higher Education.

Research expenditures have increased 25% over the past two-and-a-half years from $23 million to $31 million, and is expected to climb further.

"Marshall's attainment of this classification recognizes the significant accomplishments of the university in research and post-graduation education," said John Maher, Marshall's vice president for research.

Marshall was previously classified as a M1: Master's Colleges and Universities – Larger Programs, but with increased research productivity and Carnegie's inclusion of additional doctorates, Marshall's designation improved.

Photo courtesy of Marshall University

FROM THE DIRECTOR: Jan R. Taylor

West Virginia research has come into its own over the last five years and it's now time for us to celebrate


Taylor

As West Virginians, we are not great at embracing good news. Maybe it's the off-color jokes about our home or the very real struggles witnessed every day, but our minds are too often conditioned into skepticism. The issues of today will still be there tomorrow, and we need to accept these problems as part of life. Yet, our very own higher education institutions have quietly been striving to improve, especially when it comes to their research infrastructure. That effort has paid off in recent years and now, dare I say, we need to celebrate it.

In the last five years, our state's two largest post-secondary institutions, West Virginia University (WVU) and Marshall University (Marshall), saw their standings with the Carnegie Classification of Institutions of Higher Education, or the Carnegie Classification, improve immensely. WVU moved up one class to the highest possible ranking of "R1: Doctoral University - Very high research activity" in 2015 and maintained that ranking in 2018. Marshall, for the first time in its history, attained "R2: Doctoral University - High research activity" in 2018. These are great achievements. Not only should the administrations, faculty, researchers, students and alumni of both institutions be proud, but so should every West Virginian. Research is about problem solving. More research brings a greater likelihood of assisting with problem solving. These classifications also should allow for even more collaboration with our primarily undergraduate institutions who offer their own accomplishments with opportunities to build upon.

Curbing negative thought processes can be done. There is good news coming out of the Mountain State, and we shouldn't be afraid to shout it from the rooftops.

Jan R. Taylor
West Virginia Science & Research Director and NSF EPSCoR Project Director
West Virginia Higher Education Policy Commission

The Science & Research Council was established by the West Virginia Legislature in 2009. The goal of the Science and Research Council is to increase the capacity of the state and its colleges and universities to attract, implement and use cutting-edge, competitive research funds and infrastructure. Members provide expertise and policy guidance regarding federal and state programs including EPSCoR, the Research Challenge Fund, and the former Research Trust Fund. Representatives of government, industry, business and academia make up the council.

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Francisella tularensis LVS colonies growing on chocolate II agar

Photo: Rebecca Kiger

West Liberty researcher’s work revolves around the mystery of one pathogen’s red blood cell invasion

Written by **Angela Sundstrom**
Photos by **Rebecca Kiger**

Sometimes the opportunity you are most unsure of leads to the greatest discovery.

Joseph Horzempa, associate professor of biology at West Liberty University, experienced this when presented with a post-doctoral research opening at the University of Pittsburgh Medical Center.

“To be honest, I didn’t want to do a post-doc,” Horzempa said. “I just wanted to get a job. All of my friends had jobs and I’m still in school for a hundred years and ready to move on with my life.”

At the urging of his doctorate program mentor, Horzempa took a chance and found a rewarding experience that would eventually reveal to him a subject for future research: *Francisella tularensis*.

Francisella tularensis is a gram-negative bacteria most commonly found in rabbits, rodents and hares and has several ways of spreading such as through infected ticks bites or exposure by inhalation. *Francisella* causes an ailment known as tularemia. According to the Centers for Disease Control and Prevention (CDC), tularemia is a potentially serious illness with symptoms including sudden fever, joint pain and progressive weakness. Due to *Francisella’s* infectious nature, the CDC also states this pathogen can be used as a bioterrorism agent.

Photo: Rebecca Kiger

Horzempa

Horzempa’s current research focuses on three primary areas: red blood cell invasion, novel antibiotics and vaccine development. *Francisella’s* mechanism for red blood cell invasion is particularly unique.

“It’s interesting because there aren’t too many bacteria that do invade red blood cells,” Horzempa said. “Red blood cells are incapable of engulfing or even endocytosing, picking up small particles, let alone large particles like bacteria so *Francisella* is actually doing something to manipulate the red blood cells, to allow the bacterium to gain entry into the intracellular space.”

Treatment of *Francisella* begins with novel antibiotics, another focus of the Horzempa laboratory, while he and his team also search for antibiotic alternatives, including immunostimulatory compounds in plants, fungi and marine life.

In October 2018, Horzempa and his West Liberty-centric team of fellow biology researchers, one graduate student and one undergraduate student attended the International Tularemia Conference in Montreal, Canada to present their research. Horzempa headlined a lecture titled “Hidden in Plain Erythrocyte.”

“Erythrocytes are red blood cells so it was a pun about being hidden in plain sight. Yeah, like a dad joke. I’m also pretty good at dad jokes.”

That tendency to mix the facts with a sense of humor has served Horzempa well both in the laboratory and the classroom. As a former member of his college marching band, he often incorporates music into lectures, writing song parodies including a “Piano Man” knock-off about *bacterial peptidoglycan* and a rap featuring *bacterial flagella*.

“I think it’s wonderful, incorporating the arts. It makes it fun. It makes the students engaged. It keeps them engaged. It keeps them wanting to come to class.”

Above: Horzempa and undergraduate student, Umesh Nepali, investigating antimicrobials derived from natural products

Horzempa's philosophy of never turning away an interested student researcher has led to an average of approximately 25 undergraduates working in his lab each academic year.

"That's probably the best part of the job is getting the students involved. Watching them learn science by doing science. Seeing how excited they get when they make a discovery or achieve a goal in the laboratory. I really, really enjoy that."

With success at the undergraduate level, Horzempa and his colleagues saw an opportunity to expand into graduate education by offering a Master of Arts/Master of Science in Biology. The first class graduated in May 2019.

Experiential, hands-on learning has an advocate in Horzempa. Not to discredit lecture-based classes, which he emphasizes provide necessary theories and techniques as well as critical thinking skills, but Horzempa has a favorite metaphor for why research experiences are important.

"If you wanted to learn how to play baseball, do you think you would learn how to play baseball better by sitting down through a series of two or three hour lectures a couple times a week or do you think you would learn how to play baseball better if you just went out in the field and started playing?"

Horzempa was awarded West Virginia Professor of the Year in 2018, an honor he said only reinforces his approach to education.

"If anything, it made me want to keep on trying harder, working hard and working with these students and getting them to where they want to be."

Horzempa, a native of Pennsylvania, earned his bachelor's and master's degrees in biology from California University of Pennsylvania and his doctorate in biology from Duquesne University. The common theme throughout his life has been an abundance of mentors, and he believes in paying that forward.

"I don't take those student/faculty interactions lightly. My door is always open. It doesn't matter if I'm in the middle of writing a grant and the deadline's hours away, they come in and they have a question, all eyes on them."

Photo: Rebecca Kiger

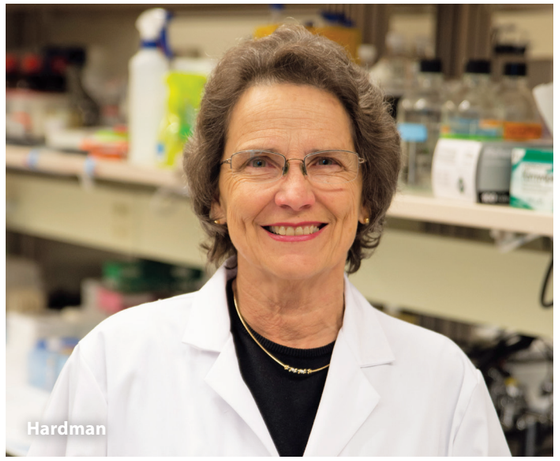
Marshall scientists tie walnuts to gene expressions related to breast cancer

Written by **Sheanna Spence**

New research from Marshall University links walnut consumption as a contributing factor that could suppress growth and survival of breast cancers.

Led by W. Elaine Hardman, a professor in the Department of Biomedical Sciences at the Marshall University Joan C. Edwards School of Medicine, a Marshall University team revealed that consumption of two ounces of walnuts a day for about two weeks significantly changed gene expression in confirmed breast cancers. This pilot, two-arm clinical trial is the latest of a series of studies at Marshall University related to dietary walnut links to tumor growth, survival and metastasis in breast cancer. The work is described in a March 10 paper published in the journal Nutrition Research.

"Consumption of walnuts has slowed breast cancer growth and/or reduced the risk of mammary cancer in mice," Hardman said. "Building on this research, our team hypothesized that walnut consumption would alter gene expression in pathologically-confirmed breast cancers of women in a direction that would decrease breast cancer growth and survival."



Hardman

Photo courtesy of Marshall University

> **"Consumption of walnuts has slowed breast cancer growth and/or reduced the risk of mammary cancer in mice."**

In this first clinical trial, women with breast lumps large enough for research and pathology biopsies were recruited and randomized to walnut consuming or control groups. Immediately following biopsy collection, women in the walnut group began to consume two ounces of walnuts per day until follow-up surgery. Pathological studies confirmed that the lumps were breast cancer in all women who remained in the trial.

At surgery, about two weeks after biopsy, additional specimens were taken from the breast cancers.

Changes in gene expression in the surgical specimen compared to baseline were determined in each individual woman in walnut-consuming (n = 5) and control (n = 5) groups. RNA sequencing expression profiling revealed that expression of 456 identified genes was significantly changed in the tumor due to walnut consumption. Ingenuity Pathway Analysis showed activation of pathways that promote apoptosis and cell adhesion and inhibition of pathways that promote cell proliferation and migration.

"These results support the hypothesis that, in humans, walnut consumption could suppress growth and survival of breast cancers," Hardman said. "Additional research through a larger-scale study would be needed to clinically confirm that walnut consumption actually does reduce the risk of breast cancer or breast cancer recurrence."

The study was funded, in part, by the California Walnut Commission, which did not influence the development of the study or analyses of the data, and The National Institutes of Health.

Study shows D&E students can distinguish 'real' from 'fake' science-related content

By **Linda Howell Skidmore**

Davis & Elkins College (D&E) students demonstrate a proficiency in differentiating between "real" and "fake" science-related internet and social media content, according to a small independent study conducted by two D&E biology professors. The results also indicate that the students' accuracy in evaluating the sources has little to do with their major, but is influenced by class level or experience with primary literature.

An article on the study conducted by Biology Professors Shawn Stover and Michelle Mabry has been accepted for publication in the Journal of College Science Teaching.

Stover and Mabry's study was conducted over a three-semester period - spring and fall of 2017 and spring 2018 - and involved 134 D&E students. Each student was presented with five examples the professors garnered from social media and the internet with the true names of businesses and products changed.

Results demonstrated no significant differences between majors. However, upperclassmen had significantly higher scores than underclassmen. Additionally, students who had some experience analyzing primary literature had significantly higher composite scores than students with no experience.

Above: WVSU students Bikash Deo, Menuka Bhandari and Andrielle Kemajou

WVSU students win at biennial research symposium

By **Matt Browning**

Three West Virginia State University (WVSU) graduate students won awards for their agricultural and environmental research poster presentations at the Association of 1890 Research Directors (ARD) 19th Biennial Research Symposium.

WVSU students swept their category, taking first, second and third places for Outstanding Achievement in Renewable Energy, Natural Resources and Environment for Graduate Student Competitive Poster Presentations.

"The ARD Symposium is an opportunity for the 1890 land-grant universities to show the collective talents of faculty and students, and West Virginia State University is not only here as a participant, but we were also successful at winning three awards," said Vice President for Research and Public Service Orlando F. McMeans. "This shows that Yellow Jackets are competitive with their peers from around the world and will succeed in whatever they endeavor. I am proud of all of our students who presented at the ARD Symposium. Go State!"

Andrielle Kemajou won first place for her poster presentation, entitled "Water Chemical Dynamics During Seasonal Changes in an Industrialized Appalachian River." Menuka Bhandari won second place for her poster presentation, entitled "Uncovering the Genetic Components for Acidity Tolerance in Arabidopsis by Genome Wide Association Study." Bikash Deo won third place for his poster presentation, entitled "Understanding Lipid Metabolism in Bioenergy Crop in Response to Coal Mine Soils."

Photos courtesy of West Virginia State University

WVU to offer new neuroscience major

By **Katlin Swisher**

This year, West Virginia University became the first university in the state to offer an undergraduate neuroscience major. The program, housed in the Eberly College of Arts and Sciences, is a dual effort between the departments of psychology and biology.

"Before, if there was a West Virginia high school student who wanted to study behavioral neuroscience, there was nothing for them in the state," said Kevin Larkin, chair of the Department of Psychology. "There are a lot of developing programs in the area, and we wanted to have one available in the state. We have the expertise and the classes already, so it was the next logical step."

The study of neuroscience seeks to understand how the nervous system functions in health and disease, and it is a rapidly growing field within the science, technology, engineering and mathematics disciplines. Neuroscience is a focus area of the Departments of Biology and Psychology as well as in the WVU Health Sciences Center and the Rockefeller Neuroscience Institute, which offers expanded opportunities for collaboration among the units.

"Students choosing to take part in the new neuroscience major will not only have access to some of the most cutting edge research the university offers, but will be well-suited to enter one of the most exciting careers upon graduation," said Kris Martens, coordinator of the neuroscience major and a teaching assistant professor in the Department of Psychology.

Two areas of emphasis are available: behavioral neuroscience or cellular neuroscience. Students will be prepared for a wide range of careers in the biological sciences including medicine, biotechnology and bioengineering, genetics and genomics, and other neuroscience-related technical fields in government and private industry.

WVU’s Ye awarded NSF CAREER grant to develop new techniques to secure cyber space

Written by **Mary C. Dillon**

Yanfang (Fanny) Ye, assistant professor of computer science and electrical engineering at West Virginia University (WVU), has been awarded a prestigious CAREER award from the National Science Foundation in support of her work to enhance the security of cyberspace. The award comes with $500,000 in funding over five years.

As the Internet becomes increasingly ubiquitous, it offers a low-risk harbor for cyber crime and illegal activities such as hacking and online scams. Cyber crime is increasingly enabled by an online underground ecosystem that is made up of anonymous forums and so-called dark web platforms that allow cyber criminals to exchange knowledge and trade illicit products and services.

“To better protect the trust of legitimate institutions and users within cyberspace, and to disrupt or mitigate the harm of illegal markets, there is an urgent need to gain deep insights into the online underground ecosystem and understand its intricate relationships,” Ye said. “The goal of this project is to design and develop an integrated computational framework for in-depth investigation of the online underground ecosystem in an effort to help secure cyberspace by producing data-driven interventions of cyber crimes.”

To achieve this goal, Ye will first design methods and develop algorithmic and scalable techniques to automate the analysis of online underground markets. She will then develop a novel framework for cross-market user identification and profiling resulting in the design of an innovative model for structural analysis of cyber criminal social networks to gain deep insights into the organization and operation of cyber criminals in the ecosystem.

The broader impacts of this project include benefits to scientific communities and society as a whole by developing interventions into online crime to secure cyberspace for its users. The establishment of a cyber security lab through this project will enhance education and workforce training in cyber security. The project integrates research with education through curriculum development, the participation of underrepresented groups, and student mentoring activities for WVU’s newly established cyber security degree program.

Ye has extensive experience in the cybersecurity industry. Before joining WVU, she was the principal scientist in Comodo Security Solutions, Inc., a provider of computer software and SSL digital certificates in the U.S., and deputy director at Kingsoft Internet Security Corporation, the second biggest Internet security company in China. Ye proposed and developed cloud-based solutions for mining big data in the area of cybersecurity.

Photos courtesy of West Virginia University

Alderson Broaddus student’s research project hits close to home

Written by **Dionne Allen**

Forty-five minutes from Brendan Wilson’s hometown, the Toledo water crisis of 2014 still affects the residents of Wauseon, Ohio. Wilson enrolled at Alderson Broaddus University to further his education and play football, and to hopefully take home a remedy to the problem plaguing the Lake Erie area: a toxic algae bloom wreaking havoc on water quality for residents and wildlife.

In preparation for his senior research project, Wilson is investigating how nutrient concentration of phosphorus, nitrogen, and the concentration of suspended solids are impacted by grass filter strips in the Lake Erie Basin.

“The title of my research is The Efficacy of Nutrient Filtration in Water by Grass Filter Strips,” explains Wilson. “Currently in Lake Erie, algae blooms, caused by an excess of nutrients in the water, are deteriorating the quality of the water and are forming dead zones. Those same algae have affected the quality of the water for the city of Toledo and have caused the city to shut the water off due to the danger of the quality.”

Wilson went on to explain the direct affect this type of pollution had on his own family, stating that his grandmother lived in Toledo where bottled water had to be hauled to her home. The algae bloom left residents with contaminated water that wasn’t safe for drinking or bathing. The freshwater wildlife could not even survive the bloom. Seeing this firsthand, Wilson understood the problem and was determined to get his hands dirty to find a solution.

“My research plan to explore the possibility of using grass filter strips on the edge of agricultural fields will hopefully improve the quality of the water that flows through the Lake Erie Basin to the lake itself,” said Wilson. “I chose agricultural fields because agriculture has been targeted as a key contributor to the issue and also because agriculture dominates the landscape of the Lake Erie Basin.”

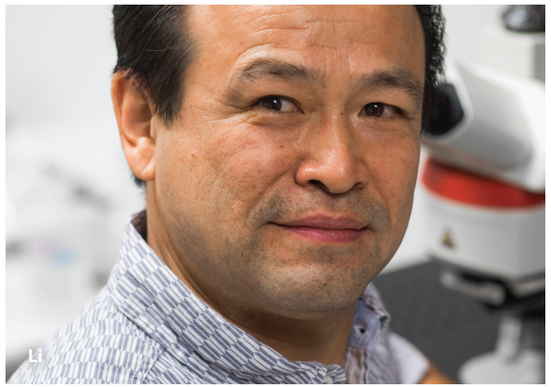
The idea of the grass filter came from his recent internship last summer with the USDA in Fulton County, Ohio, just a few minutes from his home. During his placement, grass filter strips were being used to guard against soil erosion, trapping runoff containing sediment, pesticides, and other pollutants.

“The concept behind the filter strips is the same concept of a riparian buffer where shrubs, trees, and grass filter water naturally so that when it hits the watershed, the water is the quality it should be,” said Wilson. “Where I live in Ohio, there’s a big issue of runoff from commercial and agricultural sources. It’s appealing to see the concept of grass to help filter water. Many times, grass is used to hinder soil erosion, but I want to look at it to see if it can act as a riparian buffer to absorb some of the nutrients so that the toxins aren’t hitting lake Erie, causing more and more algae blooms.”


Tu

WVU physicist named Cottrell Scholar

Weichao Tu, an assistant professor of physics at West Virginia University, was named a 2019 Cottrell Scholar. She received $100,000 in funding alongside the award to further her development of a new space science learning module. Tu is one of 24 educators chosen to receive this award, which emphasizes the importance of integrating research and education.


Li

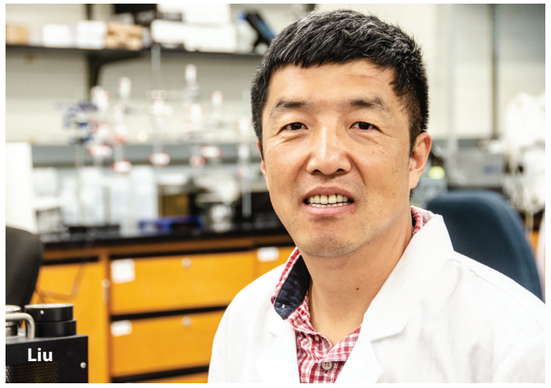
Marshall researcher awarded NIH grant

Wei Li, an associate professor in the department of biomedical science at the Marshall University Joan C. Edwards School of Medicine, was recently awarded a $434,461, three-year National Institutes of Health (NIH) Research Enhancement Award (R15) to further his research on thrombosis. This is the second R15 award Marshall has received since August 2018.


WVSU ACS student members

WVSU students win ACS award

The student chapter of the American Chemical Society (ACS) at West Virginia State University has received an Outstanding Chapter Award for its 2017-2018 activities. The group has also received a Green Chemistry Award for the ninth consecutive year. Members have been praised for their outreach and educational efforts promoting chemistry to area youths.


Liu

WVU's Liu named American Ceramic Fellow

Xingbo Liu, Statler Endowed Faculty Chair in Engineering at West Virginia University, has been named a Fellow of the American Ceramic Society. Liu, who has done extensive research in solving various energy problems through electrochemical applications including fuel cells, sensors and batteries, was highly recommended and his selection unanimously approved.

Photos courtesy of West Virginia University, Marshall University, and West Virginia State University

COMMENTARY: Ann Chester

Health Sciences & Technology Academy: a West Virginia STEM success story


Chester

Photo courtesy of Ann Chester

The Health Sciences & Technology Academy (HSTA) is a one-of-a-kind mentoring program started in West Virginia that helps underrepresented high school students enter and succeed in STEM-based undergraduate and graduate degree programs.

Since its inception in 1994, the program has grown from nine teachers serving 44 students in Kanawha and McDowell Counties to a network of 80 teachers serving 800 students in 26 counties across the state. HSTA participants are primarily students who have grown up in rural communities and are first in their families to attend college. More than half are financially disadvantaged, and one-third are African American. The vast majority of HSTA graduates obtain a college education and many earn advanced degrees.

Implemented through West Virginia University in partnerships with Marshall University, Glenville State College, West Virginia State University and West Virginia's other public institutions of higher education, HSTA's main goals are to increase college attendance in Appalachia, improve STEM education in public schools, empower communities through youth leadership, and increase the number of healthcare providers and STEM educators in underserved communities.

To realize these goals, HSTA created a mentorship structure that supports student success and addresses individual educational and social needs. HSTA students engage in a rigorous academic program within the nurturing environment of a small after-school club. They apply learned concepts to real-life issues under the mentorship of teachers, community members, researchers, and their fellow students. The curriculum connects learning to students' personal experiences. It rewards participants and teachers with generous incentives that recognize their accomplishments, and it offers, through the support of the West Virginia Legislature and state colleges and universities, substantial tuition waivers to successful participants who go on to attend an in-state institution for an undergraduate or STEM-based graduate degree.

A distinctive piece of HSTA is its students' development of research projects that examine and address STEM and health issues faced by their communities. These projects form the core of the HSTA experience and turn the students into community advocates even as they prepare to move on to college.

> ***"A distinctive piece of HSTA is its students' development of research projects that examine and address STEM and health issues faced by their communities."***

HSTA's accomplishments in West Virginia are exceptional. As of May 2018, HSTA graduates had earned 741 bachelor's degrees, 229 master's degrees, and 107 terminal degrees. An amazing 99% of HSTA graduates matriculate to college, 91% graduate from college, 87% of these students graduate with a 4-year degree or better, and 85% stay in West Virginia to work.

Ann Chester is assistant vice president for education partnerships at West Virginia University Health Sciences, director of Health Sciences & Technology Academy, director of Health Careers Opportunity Plan and deputy director of the Center of Excellence in Women's Health.

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