the NEURON

the west virginia journal of science and research

Winter 2016

Zachary Loughman
West Liberty University

Photos by George Vopal

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West Virginia native has interest in other state inhabitants

Zachary Loughman cares a great deal about creatures in West Virginia that most people tend to not think twice about – at least not beyond the interest of children playing in a stream or fishermen seeking bait. Known as crawfish, crawdads, freshwater lobsters or even mudbugs, it turns out that crayfish are an important asset to the state's freshwater ecosystems.

Loughman, an associate professor of biology at West Liberty University, focuses his research on these freshwater crustaceans that resemble small lobsters–and he's gaining national recognition for it. Many basics of crayfish biology are widely understood, but nuances about each species and the implications these small animals have on their surrounding habitats have been largely overlooked by scientists in the past.

"I've had a lifelong fascination with creepy crawly creatures, so studying crayfish is an awesome culmination of my interests," Loughman said.

The road to becoming a researcher wasn't the easiest, though. Loughman admits he wasn't the best student as an undergrad - struggling with math, physics and chemistry classes. As in many classic stories, though, lows tend to turn into highs, and when he made it to graduate school for his Master's at Marshall University and Ph.D. at Indiana State University, he hit the ground running.

about the division of science and research

The Neuron is produced by the WV Higher Education Policy Commission's Division of Science and Research. The Division coordinates federal and state scientific research grants, including WVEPSCoR, to academic institutions in West Virginia and conducts outreach activities to broaden the public's understanding of science, technology, engineering and mathematics (STEM). Visit **www.wvresearch.org** for more information.
Editor, Amanda Ramey (amanda.ramey@wvresearch.org).

This material is based upon work supported by the National Science Foundation under Award No. OIA-1458952.
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He said, "My favorite part of my career is teaching. It's extremely rewarding to guide students, and I think I may have more patience for those who are struggling because of what I had to overcome in my own studies."

His abilities as a teacher even earned him statewide recognition as the West Virginia 2014 Faculty Merit professor of the year.

Not only does he teach, though, he discovers. And not only does he discover, but he brings his students with him to the field – giving them an experience that many in today's world don't have.

Loughman, along with his colleagues, has discovered and named five species of crayfish, one of which he named *Cambarus pauleyi* after his graduate advisor at Marshall, Dr. Thomas Pauley.

As one of only a handful of scientists in the country studying crayfish, Loughman received funding for a five-year project in 2006 from the West Virginia Department of Natural Resources to complete a survey of the state's crayfish – which are considered to be a keystone species. To accomplish this, he visited over 2,100 streams and each of the state's 55 counties along with Dr. Stuart Welsh from the U.S. Geological Survey Cooperative Unit at West Virginia University. While attempting to identify crayfish based on a 1995 book, they realized several specimens didn't match up with descriptions in the book.

Students, Zachary Dillard and Katie Scott with Zachary Loughman

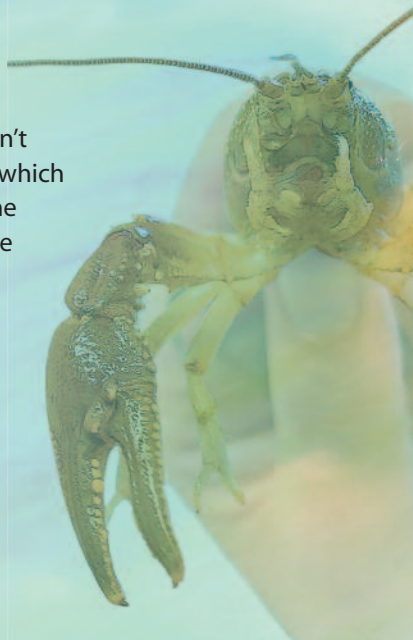
A likely reason is that crayfish, West Virginia's largest invertebrate, have very small ranges that can easily go unnoticed because of their introverted predisposition.

"They are digging all the time, creating burrows and habitats. As they do this, they will use a burrow for about a month or two and then go onto another one. It's just their nature." Loughman explained. "When they leave, small fish often occupy those burrows to find refuge from predators."

Losing crayfish populations would cause the burrows to be lost, which could possibly lead to several sport fisheries crashing given that bass, walleye and catfish depend on abandoned burrows when they are young. They also depend on crayfish for food when they're adults. Therefore, the loss of crayfish could directly impact tourism in areas dependent on those fisheries.

Loughman said the good news is that, overall, most crayfish species are doing fine in West Virginia, though a few species are in trouble and are threatened with extinction if conservation action doesn't occur. In fact, the U. S. Fish and Wildlife Service noted work that Loughman and his lab completed, which in turn led to the petitioning of two crayfish species occurring in West Virginia to be included on the endangered species list. A recent *Science* magazine article featuring Loughman discusses a grant he received from the federal agency to complete a status survey to document the Guyandotte River Crayfish and Big Sandy Crayfish to see if they're deserving of this federal protection. Details of the findings are in the August 28, 2015 issue of *Science* in an article titled, "The missing mudbug."

In addition to Loughman's continued professional growth and national recognition, the Biology Department at West Liberty is growing along with him. In addition to the school's Ecology and Evolution, Pre-Vet and Environmental Stewardship majors, a new major, Zoo Science, has Loughman excited. Not only is it only one of a handful in the country, but he hopes it will give rise to a new generation of conservation biologists who will be educated in West Virginia.



WVU astronomer explains mysteries of **'Fast Radio Burst' discovered** with the **Green Bank Telescope**

Maura McLaughlin, professor of physics and astronomy in the Eberly College of Arts and Sciences at West Virginia University (WVU), was part of an international team of astronomers who has uncovered the most detailed record ever of a Fast Radio Burst (FRB). FRBs are brief, yet brilliant, eruptions of cosmic radio waves that have baffled astronomers since they were first reported nearly a decade ago. As only a handful of FRBs have been documented previously, the results of their research are published in the prestigious journal, *Nature*.

Although FRBs appear to come from the distant universe, none of these enigmatic events have revealed more than the slimmest details about how and where it formed–until now.

The team pored over 650 hours of archival data from the National Science Foundation's (NSF) Green Bank Telescope (GBT) in West Virginia to find that the burst originated inside a highly magnetized region of space, possibly linking it to a recent supernova or the interior of an active star-forming nebula.

"This is the first Fast Radio Burst detected with the Green Bank Telescope, and the data were recorded in an unusual mode and at a unique frequency compared to previous bursts, offering new information about the origins," McLaughlin said.

The astronomers found the newly identified FRB, dubbed FRB 110523, by using highly-specialized software. Although this software decreased the time required to analyze the data, it still yielded more than 6,000 possible FRBs, which were individually inspected by McLaughlin's mentee and Carnegie Mellon graduate student Hsiu-Hsien Lin until only one candidate remained.

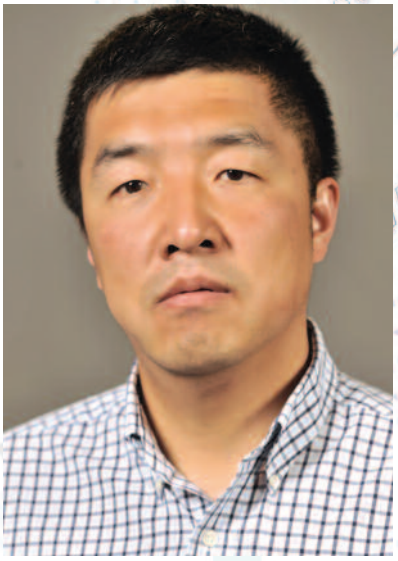
This one signal, however, was exceptional and contained more details about its polarization, or orientation of the wave, than any previously identified as this study includes detection of both circular and linear polarization.

The researchers found that the:

- Radio light from the FRB exhibited Faraday rotation, a corkscrew-like twisting that radio waves acquire by passing through a powerful magnetic field.
- Measurement of the dispersion delay suggests the FRB originated as far as 6 billion light-years from Earth and rules out models for FRBs involving stars in our galaxy, meaning that it must have originated in another galaxy.
- The signal passed through two distinct regions of ionized gas on its way to Earth, making it possible for the astronomers to determine their relative locations and isolate these regions to either be a nebula surrounding the source or the environment near the center of a galaxy.

"This burst should be the first of many detections of FRBs with the GBT," promises McLaughlin.

WVU's close relationship with the GBT, the world's largest fully steerable radio telescope, has helped make this discovery possible. WVU, the National Radio Astronomy Observatory (NRAO) and the NANOGrav Physics Frontiers Center will be collaborating in an NSF-funded project detecting low-frequency gravitational waves. K-12 teachers and their students will help in this endeavor, in an effort to spark more interest in science.



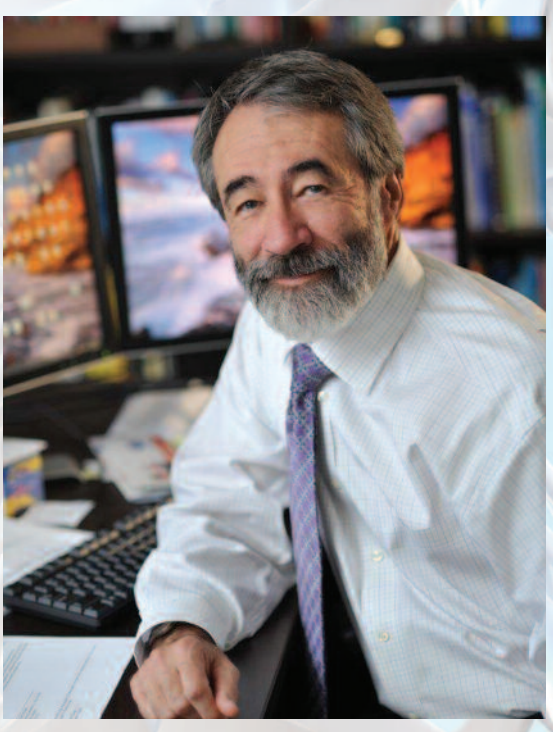
WVU's Liu to receive prestigious award for materials development

Xingbo Liu, professor and associate chair of research in the Department of Mechanical and Aerospace Engineering at West Virginia University (WVU), has been selected as one of four recipients to receive The Minerals, Metals, and Materials Society (TMS) 2016 Brimacombe Medalist Award.

The award is presented to mid-career professionals with sustained excellence and achievement in business, technology, education, public policy or science related to materials science and engineering. Liu was recognized for his significant contribution on research and development of high temperature materials and coatings for energy conversion, and extensive service to TMS.

The award will be presented at the organization's annual conference in February in Nashville, Tennessee.

Recently named a Fellow of ASM International, the world's largest association of metals-centric materials scientists and engineers, Liu began his professional career at WVU as a postdoctoral researcher in 2000 and joined the faculty in mechanical and aerospace engineering in 2002. He has received several honors from the scientific community including the TMS Early Career Award in 2010, the R&D 100 Award in 2011 and the Innovator of the Year award from TechConnect WV in 2013. He was also named the Statler College of Engineering and Mineral Resources Outstanding Researcher in 2008, 2009, 2011 and 2015 and Researcher of the Year in 2011 and 2015.



Marshall dean chosen as member of **CHEST Scientific Program Committee**

Dr. Michael Prewitt of the Marshall University College of Health Professions has been chosen as a member of the Scientific Program Committee for the American College of Chest Physicians (CHEST).

Prewitt, dean of the college and a registered respiratory therapist, said he has been appointed to serve for a one-year term and could be eligible to serve as many as three additional one-year terms, for a total of four years.

"CHEST is a global leader in strengthening patient outcomes through innovative clinical research, chest medicine education and team-based care. I am honored to be chosen to serve on their Scientific Program Committee, which will allow me to represent the educational interests for members of our college and assist in the advancement of resources for CHEST's 18,700 members from around the world," Prewitt said.

Dr. Mark J. Rosen, medical director of CHEST, said members of the committee are chosen based on recommendations received from other members.

"Dr. Prewitt was an ideal fit for this leadership position due to his extensive background in respiratory care," Rosen said. "We are pleased to welcome him to our Scientific Program Committee and we look forward to working with him in the future."

RCBI awarded $4.9 million to expand **apprenticeship model nationwide**

The U.S. Department of Labor (DOL) has awarded the Robert C. Byrd Institute for Advanced Flexible Manufacturing (RCBI) $4.9 million to expand its model apprenticeship program nationwide.

The National Advanced Manufacturing Apprenticeship Program at RCBI will broaden its existing innovative apprenticeships and promote advanced manufacturing pre-apprenticeships for under-represented groups such as women, transitioning military personnel and disadvantaged youth. It will provide standardized, industry-endorsed, online instruction and on-the-job learning for companies in multiple states.

This effort will make apprenticeships more affordable to employers and more accessible to employees and individuals considering careers in manufacturing.

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Through the five-year initiative, RCBI and its partners will deliver apprenticeship training nationwide in core advanced manufacturing areas of manual and computer-controlled machining and create new registered apprenticeships in additive manufacturing (better known as 3D printing), composites and robotics. RCBI will continue to work with a variety of industries, including automotive, aerospace, robotics, defense and related industries.

"This award recognizes a unique approach to apprenticeship building in West Virginia – praised by the DOL – that has the potential to be replicated across the nation and to address the growing skills gap in manufacturing," said Charlotte Weber, RCBI Director & CEO.

RCBI's apprenticeship training model focuses on advanced manufacturing, enabling workers to earn a wage while improving their job skills. This collaborative model leverages the unique expertise and resources of multiple public and private entities from across the nation, including RCBI; Marshall University Research Corporation; the U.S. Department of Labor; the National Institute for Metalworking Skills; Tooling U-SME; America Makes; General Electric, Aurora Flight Sciences, Swanson Industries; the National Coalition of Advanced Technology Centers; West Virginia Women Work; Troops to Technology; Job Corps; Workforce Investment Boards; universities and local community and technical colleges.

"Training programs like the ones this grant will support at RCBI are a critical part of building the highly trained workforce we are working hard to create in West Virginia," said West Virginia Governor Earl Ray Tomblin. "Advanced manufacturing is growing exponentially across the country and in West Virginia, and I'm glad we will be able to provide more employers with people who have the skills required for the jobs of today and tomorrow."

Marshall receives money from NSF to support **high-performance networking for research**

Marshall University has been awarded nearly $500,000 by the National Science Foundation (NSF) to improve campus-wide computer networking in support of research.

The project will improve and expand Marshall's research by offering high-performance, end-to-end network connectivity between research facilities. This is the third NSF grant for cyberinfrastructure awarded to the university and builds on other federal awards, including a telehealth grant from the Federal Communications Commission.

This grant will fund a dedicated research network, a dedicated data transfer node to offer a high-speed storage server with adequate data storage, and an improved high-performance network supporting 10-40 Gb/s connectivity between research facilities.

The collaborative grant was received by a team that includes Dr. Jan I. Fox, senior vice president for information technology/chief information officer; Edward Aractingi, assistant vice president for information technology/deputy CIO and faculty members Dr. Philippe Georgel of the Department of Biological Sciences and Dr. James Denvir of the Department of Microbiology at the Joan C. Edwards School of Medicine. Several of the university's other schools and departments also are collaborating on the project.

According to Fox, the advances will help the university better respond to its community-based research projects and its expanding engineering research applications.

"Advanced cyberinfrastructure allows Marshall University to compete for the best faculty and grants to help us answer research, environmental and health issues that plague our communities," she said.

Aractingi added, "Scientific research is increasingly in need of more computational resources like higher network speeds and larger data storage. This project is a clear example of how researchers and technology teams at Marshall collaborate to create an optimized network infrastructure supporting scientific initiatives. The optimized high-speed, end-to-end network is an important enabler for collaborative research across disciplines and institutions."

Georgel said the advanced computer networking capabilities also will benefit the Appalachian freshwater research in Marshall's College of Science and help improve water quality by facilitating the early detection of sources of water pollution.

"This award complements our work to improve the quality of the region's water supply by providing the significant computing power needed to retrieve the large amounts of data we receive from probes we use to monitor contaminates in the local watershed," he added.

"Advanced cyberinfrastructure allows Marshall University to compete for the best faculty and grants to help us answer research, environmental and health issues that plague our communities."

Dr. Jan I. Fox

FSU awarded grant for **solar energy project**

A $10,000 grant from Dominion Foundation will help Fairmont State University's (FSU) College of Science and Technology launch a solar energy program that has on-campus and community outreach components.

The overarching goals of the project, titled "Solar Powered Learning, Research and Outreach" led by Dr. Don Trisel, dean of the FSU College of Science and Technology and Dr. Erica Harvey, a faculty member in the College of Science and Technology, are to provide hands-on learning and Science, Technology, Engineering and Math (STEM) research opportunities for university and high school students in the region. A primary goal of the effort is to raise awareness among students and the community about the viability of solar energy.

"It's a very good project. We're excited about the partnership with FSU," said Mark Barnes, director of Gas Operations for Dominion Hope in Clarksburg. "As a diverse company as Dominion is, it's important that we support ventures like we have here at Fairmont State. It is important that the business community support student ideas."

"It is important that the business community support student ideas."

Mark Barnes, director of Gas Operations for Dominion Hope

A small solar array will be installed on campus, along with a cell phone and laptop charging station. Students will assist in the planning and preparation for these solar stations and then will observe and analyze their energy production. The project will create cross-discipline learning applications and research opportunities for students in physics, computer science, electrical engineering technology, mechanical engineering technology, chemistry and environmental science.

"We are thankful for this funding opportunity from Dominion Foundation and for their ongoing support of Fairmont State," Trisel said. "We are helping to train the future scientists and engineers that companies like Dominion will want to employ. We might also be able to excite some high school students about the possibilities of conducting research and contributing to society. Perhaps some of these students will consider a career in STEM fields."

Harvey said the project provides a wonderful opportunity for FSU students to mentor K-12 students in real research. As the headquarters for the West Virginia Brigade, FSU students will recruit high school students for the West Virginia Brigade of the "Solar Army," a nationwide search for new photoelectrocatalysts that can split water with sunlight to produce hydrogen gas for fuel. "Hydrogen gas has potential as a green fuel because when burned in the presence of oxygen, the only waste product is water," Trisel said.

"I love the idea that a West Virginia student could potentially discover a useful new material for solar energy conversion," Harvey added.

Originally funded by a National Science Foundation Center for Chemical Innovation grant to a group of universities led by researchers at Caltech, the Solar Army engages students in the preparation and testing of combinations of cheap, non-toxic, earth-abundant metal oxides for photoelectrocatalytic activity. FSU will become a public example of the benefits of exploring alternative and diverse energy sources.

"I love the idea that a West Virginia student could potentially discover a useful new material for solar energy conversion."

Dr. Erica Harvey

WVSU hosts **computational science expert**

Last fall, West Virginia State University (WVSU) welcomed Dr. Robert Panoff, founder and executive director of The Shodor Education Foundation, Inc. (National Computational Science Institute), to discuss computational thinking and modeling, and how to incorporate such ideas into curriculum, at the university's Stinger High-Performance Computer (HPC) facility.

Computational science combines realistic mathematical models with scientific computing methods to study systems of real-world scientific interest, usually through computer simulation and modeling.

"The goal is to get modeling and simulation into the fabric of the university experience not just with research but also education," said Panoff. "Modeling and simulation, especially computational modeling, is not just content. It is also a mechanism of teaching."

Effective use of models and computation allows both teacher and student to go beyond closed-end, simplified or abstract problems to tackling real-world problems instead.

"What computation is enabling us to do is expand the experiences of observation into areas that were not otherwise accessible," said Panoff. "It would take years or tens of years to do what we can with more immediacy."

Taking examples from across mathematics and the sciences, Panoff's discussion focused on how computational explorations – through dynamic, visual and interactive models and tools – support the excitement of discovery, the power of inquiry and the joy of learning.

Panoff's talk was hosted at the Stinger HPC Computational Science Center. In 2012, WVSU acquired this HPC system, nicknamed after the school's Yellow Jacket mascot, to provide faculty and students a platform for computational science. It features an HPC cluster and a high-definition visualization display, or VizWall.

"The system increases the speed performance at which our research faculty, students and staff can process data," said Dr. Ulises Toledo, WVSU's Associate Vice President of Administration for Research and Public Service. "The combined processing power of Stinger, including its recent hardware upgrades, is equivalent to 180 desktop computers."

"The Stinger HPC currently hosts a wide range of software and services related to computational sciences, including bioinformatics, computational genomics, mathematics and chemistry," said Dr. Sridhar A. Malkaram, Assistant Research Professor in Bioinformatics at WVSU, who is managing the HPC facility. "The cluster computing and parallel processing capabilities of the system are suitable for computational tasks that otherwise are not practically feasible on ordinary desktop workstations."

WVSU is currently planning a more intensive workshop on computational science to take place next summer.

Research team **publishes study** in prestigious journal about **linking cell signaling mechanism** to **obesity**

Researchers with the Marshall University Joan C. Edwards School of Medicine and the Marshall University Institute for Interdisciplinary Research (MIIR) have identified a mechanism for blocking the signal by which the cellular sodium-potassium pump amplifies oxidants (reactive oxygen species). These oxidants lead to obesity and metabolic syndrome.

Their research, "pNaKtide Inhibits Na/K-ATPase Reactive Oxygen Species Amplification and Attenuates Adipogenesis," was published in October in *Science Advances*.

Joseph I. Shapiro, M.D., dean of the school of medicine and the study's senior author, says the study is a true collaborative effort.

"I am extremely proud of this work, as the studies were conceived of, performed and analyzed entirely at Marshall University," Shapiro said. "This work was based on two important components. We employed a peptide, pNaKtide, which was derived from the novel hypothesis developed by Marshall's MIIR director, Dr. Zijian Xie. Specifically, Dr. Xie has shown that in addition to its well-described role as an ion transporter, the sodium pump also regulates signal transduction and oxidant amplification. We also exploited work from Marshall's SOM vice-dean for research, Dr. Nader Abraham, who has demonstrated a key role for oxidant stress in adipocytes in the development of obesity. The studies, which address a critical problem in the Appalachian population we serve, were performed entirely by our research staff at Marshall University."

First author Komal Sodhi, M.D., assistant professor of surgery and pharmacology at Marshall, says the research examined a peptide (pNaKtide) designed to block the sodium potassium Na/K-ATPase signaling cascade, which altered the phenotype of adipocytes (fat cells) in a cell culture system.

"We found this decreased the development of obesity and metabolic syndrome in mice subjected to a high-fat diet," Sodhi said. "The studies performed strongly supported this idea and suggest that if this is confirmed in humans, the Na/K-ATPase might ultimately be a therapeutic target for clinical conditions like obesity and metabolic syndrome, which are particularly relevant to West Virginia where more than a third of the population is currently obese."

Shapiro said while there are years of work ahead for researchers to determine the impact on humans, they believe they have hit on a feasible strategy for treating obesity and metabolic syndrome.

Funding for this study was provided by the National Institutes of Health, BrickStreet Foundation and the Huntington Foundation, Inc.

WVU to make **fifth-straight** appearance at **Robo-Ops Challenge**

Students from West Virginia University (WVU) will once again get to show off their robot-building skills when they make their fifth straight appearance at the Revolutionary Aerospace Systems Concepts-Academic Linkage Exploration Robo-Ops Challenge. The competition, sponsored by NASA and organized by the National Institute of Aerospace, will take place in June at NASA's Johnson Space Center (JSC) in Houston, Texas.

The WVU team, led by advisor Powsiri Klinkhachorn, professor of computer science and electrical engineering, finished second in 2015 after winning the competition in 2014. He said weight was a factor in 2015 because rovers are weighed prior to the competition and that determines teams' starting times. Teams with lighter-weight rovers have the advantage of seeing where other teams are collecting samples and can get theirs more quickly.

"Our goal for this year will be to create a robot that is 8-10 kilos lighter than last year," said Klinkhachorn.

The competition challenges teams to build a planetary rover prototype and demonstrate its capabilities to perform a series of competitive tasks. The rovers compete on a planetary analog environment under the supervision of NASA judges. Up to three members of the team (plus the faculty advisor) travel to JSC for the on-site testing with the remaining team members staying behind at the local university to conduct mission control-type tasks.

The rovers are tele-operated by the university team and must negotiate a series of obstacles while accomplishing a variety of tasks including negotiating specified upslopes and downslopes, traversing sand and gravel pits, picking up specific rock samples and placing them on the rover for the remainder of the course and driving over rocks of specified diameter.

Joining WVU in the competition will be teams from California State University at Long Beach, University of Buffalo, University of California at Berkeley, University of Maryland, University of Oklahoma, University of Utah and University of Wyoming. Maryland is the defending champion.

The teams each receive a $10,000 stipend from NASA/NIA to partially offset the cost of rover hardware and transportation costs to attend the event. Additional support for WVU's team is provided by the NASA West Virginia Space Grant Consortium, the Benjamin M. Statler College of Engineering and Mineral Resources and the Lane Department of Computer Science and Electrical Engineering.

Academy connects girls to STEM career possibilities

Last summer, girls from West Virginia and surrounding states visited WVU Tech for the first-ever STEM Summer Academy for Girls. The program immersed attendees in a week of STEM programming including courses in biology, robotics, engineering, chemistry, computer science and pharmacology. Students participated in a variety of competitions and heard from guest speakers, including WVU Tech Campus President Carolyn Long and Robin Anglin-Sizemore, science coordinator at the West Virginia Department of Education's Office of Secondary Learning.

Some attendees participated in a competition where they worked with a budget to purchase materials like cardstock, glue and tape to build a pair of shoes then tested their engineering designs on a runway.

Fourteen-year-old Piper Martin is in ninth grade this year at George Washington High School, but she already has her eye on college. She attended the academy to explore new fields and get a feel for what life in college is like.

"Usually in school you get sort of a brief introduction to careers, but I like learning more in depth about all the careers, especially in biology, because that's where I want to go," she said.

Designed as a means of demonstrating the application of STEM fields to everyday life, the academy took a unique approach to helping students process the program's educational offerings. To see more photos from the academy that show some of the projects, go to https://www.flickr.com/photos/tech-relations-communications/album.

Students even participated in a weeklong project where they were asked to give a presentation on what they learned. Dr. Afrin Naz, WVU Tech professor of computer science and the academy's organizer, said the competition served to boost teamwork skills and bring the concepts and lessons students learned together in a cohesive way.

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Marshall to help bring Science Olympiad to West Virginia

Marshall University's College of Science is bringing the Science Olympiad to West Virginia for its second year. The opportunity is for students in grades 6 through 12.

The Science Olympiad will take place on Saturday, Feb. 20, 2016 at Marshall. Teams will compete in a series of 23 challenges, including those in life and social sciences; earth and space science, physical science and chemistry; technology and engineering and scientific inquiry. Topics include entomology, fossils, crime science, bridge building and experimental design. Winners of the competition will travel to the University of Wisconsin-Stout for the national tournament in May.

Dr. Jennifer Mosher, assistant professor of biological sciences at Marshall who, along with co-director Melissa Fox, is coordinating the West Virginia event, said that in most cases, individual schools can form teams of 15 students for the competition. However, in the case of more rural locations, a team of students may represent several schools.

"Last year's event was a great experience for the students who participated," Mosher said. "This year we hope even more students will compete in our state."

For more information, visit Marshall's Science Olympiad website at http://www.marshall.edu/so/ or contact Mosher at mosher@marshall.edu.

WVU study found elevated levels of emissions from Volkswagen vehicles

As reported in national media last fall, the United States Environmental Protection Agency said that a West Virginia University (WVU) study raised significant questions about emissions levels from light-duty diesel Volkswagen vehicles during on-the-road testing.

Results of the study conducted by WVU's Center for Alternative Fuels, Engines and Emissions (CAFEE), found that nitrogen oxide emissions – one of the top six common air pollutants – from two Volkswagen light-duty diesel engines exceeded the EPA's Tier 2-Bin 5 standard. One vehicle exceeded the standard by a factor of 15 to 35 and the other by a factor of 5 to 20.

Daniel Carder

"CAFEE's faculty, engineers, technicians and graduate students are conducting high-level research on emissions reduction," said Daniel Carder, CAFEE's interim director. "This study shows how data-driven, independent research can have real-world impact."

In 2014, the International Council on Clean Transportation contracted WVU to perform on-road emissions testing in order to study off-cycle emissions performance and fuel economy from three diesel light-duty vehicles under typical driving conditions in the U.S.

Arvind Thiruvengadam, research assistant professor of mechanical and aerospace engineering in the Statler College of Engineering and Mineral Resources, carried out the testing.

Arvind Thiruvengadam

In-use emissions testing is conducted by using a portable emissions measurement system and small generator or battery pack used to power the instruments. The system is a scaled-down version of laboratory-grade measurement equipment, the size of a couple of shoe boxes.

The PEMS is capable of characterizing carbon dioxide, carbon monoxide, oxides of nitrogen and hydrocarbon emissions from the tailpipe of a vehicle. In addition, the data broadcasted by the electronic control unit of the engine is also collected.

The test vehicle is driven like normal day-to-day operation or on specific routes of interest to evaluate the effect of traffic, road conditions, atmospheric conditions and terrain on emissions.

The test plan covered a wide variety of topological, road and ambient conditions as well as traffic densities over three major urban areas along the west coast – specifically San Diego, Los Angeles and San Francisco.

"Real-world emissions evaluation is very important, because it provides a unique window into the operation of sophisticated engine controls, after-treatment technology and software strategies of modern vehicles during normal day-to-day operation that is seldom available from a controlled laboratory environment," Thiruvengadam said.

As part of the project, the California Air Resources Board performed traditional laboratory testing to assess compliance with certification standards. The findings from in-use testing and laboratory testing were disseminated publicly.

WVU **engineering senior** wins state **innovation award**

A senior from West Virginia University's Statler College of Engineering and Mineral Resources has created a device that uses electromagnetic waves to detect underground objects, including utility lines, landmines or other metallic or non-metallic objects.

Because of the device, Samantha Melroy, a mechanical engineering major from Lincoln, Nebraska, was named Student Innovator of the Year by TechConnect West Virginia, a statewide economic development organization that works to foster and promote innovation-based business and entrepreneurial activities.

Melroy cited deaths related to landmine excavation as the impetus for her creation.

"Over half the people injured or killed from landmines are children under the age of 18," Melroy said. "This technology will be light enough to be placed on something like a quad copter and other various objects to detect underground landmines, allowing for safe excavation while keeping the technology intact."

Melroy added that the technology can also be used to find underground utilities, which are oftentimes incorrectly mapped, leading to millions of dollars in damage. It could also be used in exploring other planets.

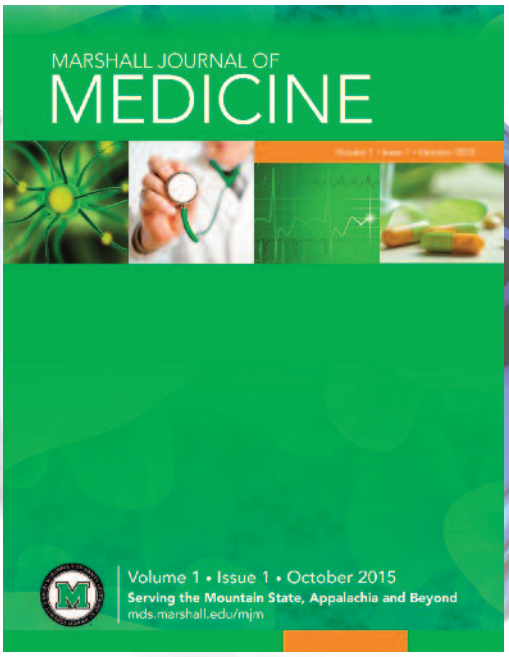
Through her startup company, Terra Response, LLC, Melroy is working on a lightweight prototype for her device that will be easy to use and comfortable to carry and hopes to have the product to market in the next few years.

The Spirit of Innovation Awards are designed to celebrate success and showcase innovation in the state.

Marshall **launches medical journal**

The Marshall University Joan C. Edwards School of Medicine has launched its first scholarly medical journal. The Marshall Journal of Medicine is a peer-reviewed, open-access online journal designed to shed light on medical issues and conditions of priority to West Virginians and the Appalachian region. The first issue featured submissions from physicians, medical faculty and residents from both Marshall University and West Virginia University.

"This journal is another step toward establishing a culture in our School of Medicine that prioritizes research," said Joseph I. Shapiro, M.D., dean of the School of Medicine. "Showcasing research that is focused on better health outcomes for our region goes hand-in-hand with our overall mission of fostering a skilled physician workforce to meet the health care needs of West Virginia and central Appalachia."



"We are thrilled to have a new open-access venue to share Appalachian-focused, scholarly work on the global scale," said Darshana Shah, Ph.D., associate dean for faculty affairs and professional development and editor-in-chief of the journal. "Working with our colleagues on the main campus through the Digital Scholar Platform has allowed us to produce a dynamic, content-rich publication that we all should be proud of."

As an open-access publication, the Marshall Journal of Medicine facilitates online collaboration among researchers and allows them to build on the findings of others without restriction in order to accelerate discovery, Shah said. The first issue can be viewed at mds.marshall.edu/mjm.

Nearly **all jobs** are **influenced by STEM**

Steve Hedrick,
President and CEO of MATRIC (Mid-Atlantic Technology, Research & Innovation Center)

The lack of STEM workers in America for the number of available (and future) STEM jobs isn't new news. We know that there aren't enough trained people to fill the number of science, technology, engineering and math jobs that exist in our country. This spans multiple industries, not just one.

The good news? Companies large and small and the government are engaged and are spurring the ground swell of STEM literacy in our nation. From President Obama's "Educate to Innovate" campaign to Dow Chemical's STEMtheGAP™ initiative, we're working to ensure that our youth stay interested in science by doing hands-on learning. Further, programs like the "MATRIC University" focus on those who've already completed their undergraduate work and are working to earn further advanced degrees in areas like chemical engineering, chemistry or computer science.

STEM education isn't a trend; it isn't a fad. It is the key to ensuring that America remains the world's leader in innovation and technology. It leads to the best solutions, the best products, the best technologies. And it leads to a new generation of thinkers who aren't afraid to think outside the box, to push the envelope, to innovate and engage.

However, in our efforts to assure our industrial workforce is as strong as any in the world, we are missing one important piece of the equation.

A recent report from the National Science Board (NSB) tells us that it's not just the STEM fields that need STEM-trained people. Nearly all jobs now need some level of STEM education. Dan Arvizu, chairman of the NSB and director and chief executive at the U.S. Department of Energy's National Renewable Energy Laboratory, said, "We're observing that this term that we use, 'STEM workforce,' is really a nebulous term... As science and technology have kind of permeated all corners of our economy, the distinctions between STEM and non-STEM jobs in the workplace are beginning to blur."

And he's right. So, we must ask ourselves: are we overlooking an important part of our workforce that needs some level of STEM training and education beyond K-12 schooling? We need a citizenry capable of recognizing elements of misinformation as just that: emotion-laden, overly-dramatic and fear-inducing reports that are simply biased against the forward movement of our nation. We need our citizenry to demand information based in sound science to allow them to make informed decisions, not the least of which is the ability to cast their ballots at polling places to vote the right people into office…those who have balanced views and will serve their constituency well by supporting legislation based in sound science, not emotion.

I challenge you to ask yourself: Are we equipping all of our youth with the tools and education they need to effectively understand and participate in our economy and our democracy? Are our future accountants and journalists and marketers ready for their futures? Are we ensuring that our future voters are armed with STEM knowledge so they can elect government representatives who utilize sound science as a basis for their vote and not emotion?

The future for West Virginia and America is wonderfully bright, but only if we take full advantage of the opportunities before us. We should all look forward toward our futures, our children's futures and our grandchildren's futures. Let's give them the very best opportunity to take our state, region and nation to heights we can only dream of. Let's enable them to do exactly what most all of us truly want to do: make a lasting difference.

Division of Science and Research
West Virginia Higher Education Policy Commission
1018 Kanawha Blvd E Suite 1101
Charleston WV 25301-2800
304.558.4128
www.wvresearch.org

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FROM THE DIRECTOR:
Recognizing quality research in West Virginia

At the beginning of December, we announced the recipients of our state-wide scientific research grants. I'm proud of the work that the faculty at our state colleges and universities are doing (and are planning to do) and was privileged to be able to read through several deserving proposals. I am highlighting them here, in case you missed the news.

A $45,000 Innovation Grant was awarded to Joanna Webb from West Virginia Wesleyan College (WVWC) so that she may acquire an Anasazi 90-MHz Permanent Magnet FT-NMR Spectrometer that will enhance educational opportunities at WVWC. The purpose of the Innovation Grant award program is to foster creative improvements to scientific equipment and facilities, curriculum, classroom instruction or delivery.

Six Instrumentation Grants were awarded to faculty members at colleges and universities statewide. This program is designed to encourage undergraduate students to continue careers in science, math and engineering and gives faculty members the opportunity to purchase modern instruments. Primarily undergraduate colleges and universities in the state are eligible to apply. The following faculty members were recipients.

- **Tesfaye Belay** from Bluefield State College received $19,500 for the acquisition of NanoDrop and Proflex PCR System for instructing forensic science and research.
- **Tracey DeLaney** from WVWC received $8,500 to purchase instructional radio telescopes.
- **Rico Gazal** from Glenville State College received $14,020 for plant-water instrumentation for courses in forest ecology and forest management.
- **Kenan Hatipoglu** from West Virginia University Institute of Technology received $20,000 to develop an integrated electro-mechanical energy conversion system.
- **Stephen Kuehn** from Concord University received $20,000 for upgrades to Concord's microanalysis facilities.
- **Sara Souther** from WVWC received $20,000 for increasing retention in the sciences through early student engagement in biological research.

We congratulate the winners!

Jan R. Taylor, Ph.D.
Director of Science and Research
West Virginia Higher Education Policy Commission

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