the
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Dr. Marcia Harrison
Marshall University

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Marshall professor bridges Earth and space

Have you ever watched a plant grow? Everyone has to some extent - but usually over weeks, months or years. It could be said that Marshall University's Dr. Marcia Harrison digs a little deeper. Harrison is a professor in Marshall's Department of Biological Sciences, and she keeps a close watch on exactly how plants grow.

Harrison said, "When plants fall down they can't get up - at least not right away."

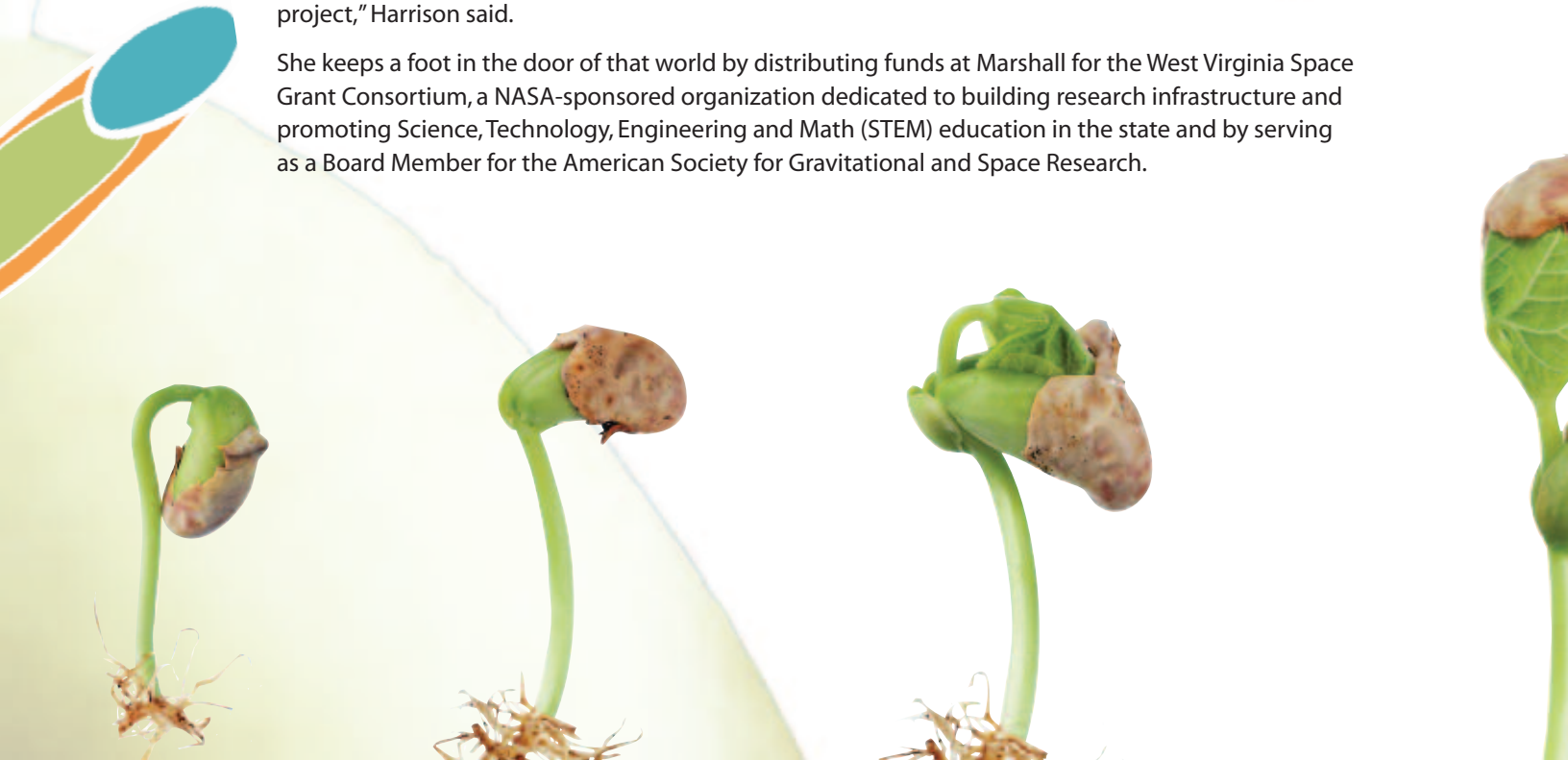
She said that when plants experience a change in orientation to gravity, a complex, dynamic pattern of growth alterations occur that cause the lower side of the stem to grow faster than the upper side. This causes upward tissue curvature in a process called gravitropism. That is, roots grow in the direction of gravitational pull (downward) and stems grow in the opposite direction (upwards). For a visual, Harrison suggests thinking of a potted plant. When laid onto its side, the growing parts of a plant's stem begin to display negative gravitropism - growing upwards.

Harrison's research career has revolved around how plants respond to gravity and interaction of other factors – including space. Before joining the faculty at Marshall in 1987, Harrison worked as a NASA Research Associate at Washington University in St. Louis where she studied the factors that affect how plants respond to a change in orientation. This research is important because it baselines how plants grow on Earth in order to predict what will affect plant growth on the international space station.

A traditional analysis of gravitropism involves manually measuring growth along the curving organ or angle measurements based on the position of the tip relative to the plant stem's base. Because, according to Harrison, more mathematical approaches are needed to reveal the location of differential growth that contributes to stem curvature, she took time lapse videos of plants during the growth process in her office and lab in the Science Building at Marshall. In collaboration with Dr. Scott Sara of the Marshall Mathematics Department, they used those images to mathematically define the regions of plant growth and curvature in the curving stem.

"Ironically, my experience with NASA is what led me to be fascinated with plant gravitropism, but I actually became interested in plant hormones and growth in high school as part of my science fair project," Harrison said.

She keeps a foot in the door of that world by distributing funds at Marshall for the West Virginia Space Grant Consortium, a NASA-sponsored organization dedicated to building research infrastructure and promoting Science, Technology, Engineering and Math (STEM) education in the state and by serving as a Board Member for the American Society for Gravitational and Space Research.



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.
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In addition, Harrison is the Principal Investigator of a National Science Foundation (NSF) grant at Marshall that engages undergraduate students in year-long research projects that connect math with biology in order to enhance their overall skills at problem solving, experimentation and communication with one another. Teams of two to four students work together under the direction of faculty from both the mathematics and biology departments.

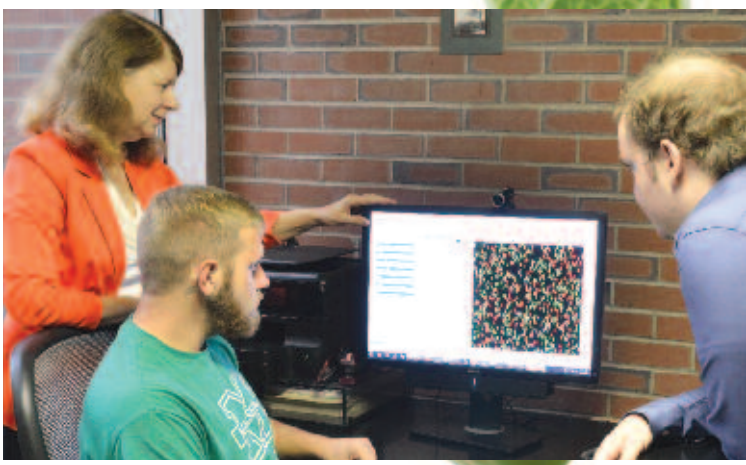
One team that's engaged in this project right now is studying something that could have even more real-world implications than they could have originally anticipated given the recent world-wide Ebola scare. Marshall Mathematics students Roger Estep and Robert Hughes, both originally from Elkview, W.Va., are working with Marshall Mathematics professor Dr. Anna Mummert to investigate the characteristics of influenza pandemics that occur with multiple peaks of infection. Harrison is working with the team to adapt its research as a classroom case study. Jessica Shiltz, the biology student who was originally on the team, has graduated and is currently pursuing a Master's in Public Health in Epidemiology at WVU.

The case study will allow future science students to learn about the effect of key properties of an outbreak, such as the number of new infections produced by one individual who is affected by the flu at the start of the outbreak, the attack rate in general and the total number who eventually become infected. Control measures, such as vaccination and antivirals, are also incorporated into the model and their effect on the timing and severity of the peaks of infection can be investigated as a class exercise.

Harrison is also the Principal Investigator of the NSF-funded MU-ADVANCE program. She said the program has proven to be an innovative networking effort between female STEM faculty and administrative partners at Marshall and that the program has been instrumental in developing sustainable university-level best practices for recruitment, new faculty orientation and faculty retention.

She said, "It's exciting to be part of a unique project like MU-ADVANCE where we can see that we're helping Marshall become an even better place to teach students and do research."

For more about Harrison, including links to her YouTube time lapse plant videos, visit **wvresearch.org**.



Harrison, Estep and Hughes look at a graphic of a flu outbreak scenario in Harrison's office.

Cover and the above photos by John Sibold

WVU creates **Energy Institute** to **generate energy research** and **collaboration**

Recognizing the role and importance energy plays in the world, and especially the state, West Virginia University (WVU) has created the WVU Energy Institute to establish a powerful network of expertise in energy research and education. Brian J. Anderson, a top energy researcher at WVU, will head the institute.

"Access to affordable, clean energy is one of the most complex and far-reaching issues of our time. Energy is a key driver of our state's economy and economies around the world. It affects the health and quality of life of the world's citizens," WVU President Gordon Gee said.

The institute will connect WVU's existing energy efforts and respond to new opportunities, Anderson said. It will enable faculty to conduct research and pursue larger and multidisciplinary problems, solutions and funding opportunities. The four main areas of focus will be fossil energy, sustainable energy, energy policy and environmental stewardship.

This work is vital, Gee said, because "WVU has built up tremendous momentum in the area of energy research. It permeates so much of what we do here, from educating our students to making new discoveries in faculty laboratories to the way we manage and build our facilities. The Energy Institute will allow us to take that expertise beyond our campus to benefit the state, the nation and the world."

Anderson, the GE Plastics Material Engineering Professor of Chemical Engineering at WVU, was chosen to lead the institute because of his expertise in energy research. For the past year, Anderson has been the coordinator of strategic research in energy for WVU's Research Office. He has conducted extensive research in the areas of natural gas hydrates, thermodynamic modeling and sustainable energy and development in the area of geothermal systems.

In addition to furthering faculty research opportunities, the Energy Institute will help WVU make connections both within the university and with agencies and institutions outside the university.

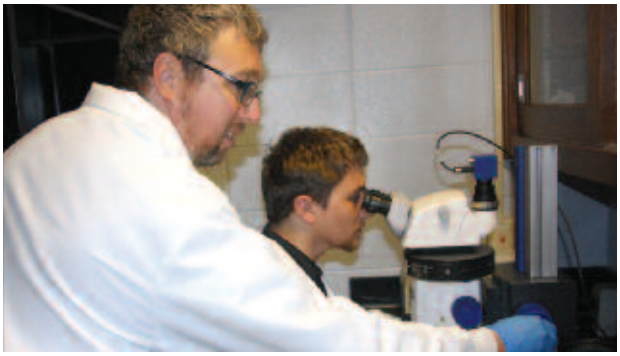
"Through the Energy Institute we can link all of the diverse work being done by researchers on campus," said WVU Provost Joyce E. McConnell. "It is not enough to identify the problem and find solutions. These discoveries can upend existing paradigms, so we must also address the implications of these solutions. WVU is unique because we have the expertise to address each piece in that chain, from the classroom and the laboratory to the policies that will shape the future."

WVU has more than 150 faculty members and nearly 20 centers and initiatives working on energy-related issues.

"The **Energy Institute** will allow us to take [WVU's] expertise beyond our campus to benefit the **state,** the **nation** and **the world.**"

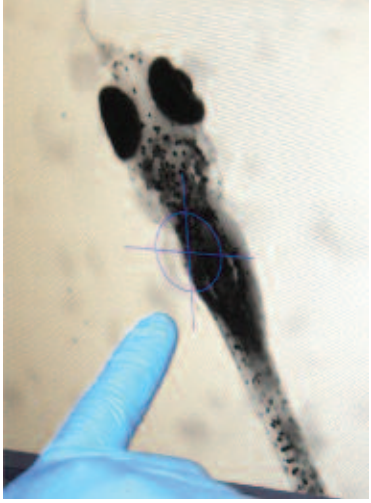
WVU President Gordon Gee

Bluefield researcher receives $30,000 grant to expand BSC's **biomedical research capabilities**



Pictured above: Walters, Professor of Biology (right) and BSC student Christian Pritchard utilize the College's microbiology lab's new microscope to observe glowing intestinal cell activity during the digestion of high fat diets fed to larval zebrafish.

Pictured at right: Walters uses the microscope's software to illustrate the anatomy of the larval zebrafish, which are only 3 millimeters long.



Dr. James Walters, Assistant Professor of Biology at Bluefield State College (BSC), was selected to receive a $30,000 West Virginia-Idea Network of Biomedical Research Excellence (WV-INBRE) grant to understand how dietary fat and cholesterol impact human health.

"The grant is designed to help newer faculty in support of their teaching and research initiatives, including the purchase of laboratory supplies," Dr. Walters explained. "The grant also provides support for students who are learning biomedicine, preparing them for careers in a very rewarding field."

Walters said that all of the research conducted in the BSC lab is done by undergraduates. He said, "They are in the lab every day and are an active part of this research process."

MIIR and MU medical school to partner in **drug development venture**

The Marshall Institute for Interdisciplinary Research (MIIR) and the Marshall University (MU) Joan C. Edwards School of Medicine recently announced they will be partnering with an international biosciences company to develop potential anti-cancer drugs.

Under the agreement with Shanghai-based HD Biosciences Co. Ltd., the three partners will share the costs and risks of discovery and development of these new drugs. They also will jointly own any intellectual property and commercialization rights to products developed through the collaboration.

According to Dr. Zijian Xie, MIIR's director, getting new drugs from the research laboratory to clinical trials—where it is determined if the treatment is safe and effective for humans—is an expensive and time-consuming undertaking.

"Normally, it would take tens of millions of dollars and as long as a decade to translate the technology MIIR and the school of medicine have developed over the last several years into viable drug candidates," he said. "This joint effort with HD Biosciences will significantly shorten the process because of its expertise in drug discovery and, ultimately, will reduce the risk for all the partners.

He continued, "In short, this represents a bold approach that will not only advance MIIR's mission of innovation, discovery, enterprise and advancement, but it will also create new business opportunities and add value for all of us."

Dr. Joseph I. Shapiro, dean of the school of medicine, said the partnership was formed with the goal of bringing new treatments to cancer patients as quickly as possible.

"We couldn't be happier to work with HD Biosciences. Our venture allows lab-based scientists and clinical researchers to share ideas, move them forward at a quicker pace and ultimately provide better patient care," he said.

Dr. Xuehai Tan, president and CEO of HD Biosciences, added, "We are very pleased to have established this collaboration with Marshall University. This agreement is another example of our company's strategy and commitment to long-term growth. We will contribute with our extensive capabilities in preclinical drug discovery and new drug development in the Chinese market, and our ability to create value for the company and our partners. The university, on the other hand, is well versed in translational medicine, clinical trials and the U.S. Food and Drug Administration guidelines."

Local innovation celebrated in Huntington

The West Virginia Makes Festival, an event designed to celebrate creativity and innovation in all forms, took place in early October in downtown Huntington. A design challenge during the festival, sponsored by the Robert C. Byrd Institute for Advanced Flexible Manufacturing (RCBI), Advantage Valley, the City of Huntington and Marshall University, rewarded a few lucky makers who submitted creative, new inventions to a panel of judges.

The event kicked off National Manufacturing Day 2014.

"Advantage Valley was pleased to partner with RCBI in this new event to help spur innovation and creativity across the region," said Chris Slaughter, chairman of Advantage Valley. "Our region offers leading-edge training and equipment in the area of 3D printing and showcasing these additive manufacturing assets as part of National Manufacturing Day is well timed."

RCBI Director Charlotte Weber said, "RCBI is excited to encourage and reward the inventors and makers who can, and will, benefit from the resurgence of manufacturing."

Photos by John Sibold

WVSU increases **bioenergy research**

West Virginia State University (WVSU) will increase its bioenergy research portfolio with a nearly $300,000 capacity-building grant from the USDA's National Institute of Food and Agriculture (NIFA). The project will advance the development of mixed microbial cultures that can convert organic wastes into useful products for the chemical industry and build the biomass conversion technology infrastructure at WVSU.

Organic wastes from agricultural, industrial and municipal sources can be used as renewable resources for the production of many bioproducts, including bioenergy and "platform chemicals" such as carboxylates that are used for industrial chemical manufacturing.

Carboxylates are important chemical compounds used by industry to create a variety of commercially useful products such as solvents, adhesives and food preservatives. Mixed cultures of bacteria that possess extraordinary metabolic abilities can be used to perform these chemical transformations.

A team of WSVU researchers, led by biology professor Dr. David Huber, will use anaerobic digester technology to study the efficiency of engineered microbial cultures in creating industrially-useful carboxylate platform chemicals.

Officially titled, "Bioengineering the carboxylate platform in thermophilic anaerobic microbiomes," the project will be carried out by a multidisciplinary team at WVSU including Dr. Michael Fultz, assistant professor of chemistry, Dr. Sridhar Malkaram, bioinformatics research associate and Dr. Marek Krasnansky, assistant professor of physics.

WVSU is one of 18 institutions eligible to compete in the NIFA grant program, exclusive to the nation's 1890 land-grant universities.

BRAIN research at WVU awarded $1.5 million from NIH

In its first wave of funding awards, a new presidential project aimed at revolutionizing our understanding of the human brain has pledged its support to a group of researchers led by West Virginia University (WVU) faculty working to change the future of brain imaging. WVU was awarded more than $1.5 million from the National Institutes of Health (NIH) through the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative.

The WVU team is developing a wearable, mobile molecular positron emission tomography (PET) imaging device capable of providing unprecedented insight into the metabolism and cellular processes of the brain, all while performing everyday activities, such as walking, playing a piano or socializing. While traditional imaging techniques require a person being scanned to remain as still as possible, the helmet-like tool is wearable while in motion.

"The PET helmet, conceived at WVU and supported in its early stages by the Department of Radiology and the WVU Center for Neuroscience, can open new vistas into neural activity across the brain by permitting brain scans to occur in more natural settings," said George Spirou, Ph.D., director of the WVU Center for Neuroscience.

In addition to allowing freedom of movement, the PET helmet, or Ambulatory Microdose PET, will require far less of the radioactive tracer material currently used in traditional PET imaging.

"Imagine being able to look at the brain of a stroke patient engaging in rehab exercises or to determine how and why an autistic person's brain reacts differently during active social situations," Julie Brefczynski-Lewis, Ph.D., research assistant professor in the WVU School of Medicine Department of Physiology and Pharmacology, explained. "The ambulatory aspect is only part of the story; because it's so close to the head, we will be able to use a much lower and safer dose."

Dr. Brefczynski-Lewis added that the PET helmet will also allow higher resolution imaging of rarer types of brain cells, like the pyramidal cell types implicated in healthy aging and Alzheimer's disease. As the device will be intended first as a research tool, results of future studies will have a direct impact on the understanding and treatment of many neurologic conditions, such as dementias, stroke, traumatic brain injury and depression.

Brefczynski-Lewis demonstrates the mobility of an early version of the PET imaging helmet now in development at WVU.

Fairmont State partners with University of Tenne

FSU team, pictured from left to right: Philip Freeman, Amanda Rinehart, Terri-Lynn Wolfe, Erin Taylor, Shae Strait and Kirk Morphew.

Through a partnership with the University of Tennessee, Knoxville (UT), architecture students at Fairmont State University (FSU) have the opportunity to help Calhoun County maximize a vital asset – darkness.

As part of an economic development research project for the Appalachian Regional Commission (ARC), UT conducted a case study of 10 counties in the Eastern United States. Among those was Calhoun County.

"During our first visit to the county, we had a discussion with local stakeholders about local assets. No one could name any tourism assets until, finally, one local resident mentioned that it was supposed to be really dark and some people said it was a good place to look at the stars," said Dr. Tim Ezzell, Research Scientist for the Political Science Department at UT. "That caught our interest, so we checked some night sky maps and, sure enough, it was about the only truly dark place still left in the Eastern U.S."

For the past two years, a team from UT has been meeting with stakeholders including the Calhoun County Commission and Town of Grantsville .

ARC grants, awarded to both UT and Calhoun County, support the visioning of a Dark Skies Park at Calhoun County Park, near Grantsville.

WVSU study **tracks evolution** of **watermelon**

Scientists at West Virginia State University (WVSU) have traced the evolution of watermelon from a bitter to a sweet fruit. This research marks the first time watermelon domestication has been examined.

"Our research showed how and when bitter watermelons of Africa evolved into a sweet watermelon," said Dr. Umesh K. Reddy, associate professor of biology at WVSU. "We identified genes related to fruit ripening and sucrose accumulation that played major roles in domestication of sweet watermelons."

Led by Reddy and Dr. Padma Nimmakayala, associate research scientist at WVSU, the project identified three important genes that play a major role in making watermelons sweet and introduced the possibility of improving watermelon sweetness comparable to that of grape juice.

"Using the genomic platform we have developed with this project," said Reddy, "we are next working to identify additional genes, such as citrulline and beta carotene, which could have cancer-fighting properties."

Results from the watermelon research have been published in recent editions of the peer-reviewed journals BMC Genomics and G3: Genes, Genomes, Genetics as well as a forthcoming edition of the Journal of Heredity.

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The UT team has a strong background in policy, planning and economic development, but as the visioning grant nears its end, Ezzell said the team needed to find a partner university to start the design phase and to pursue a new planning grant from the ARC.

"For this to work, we knew we needed a really strong and creative design team. We also knew we needed a local partner who understood the local culture and local realities. We contacted Philip Freeman and the folks at Fairmont State, and they have been great to work with," Ezzell said.

"As I see it, both our institutions have an important role to play. Fairmont State will be the design lead, and UT can take the lead on development and policy tasks. I'm hopeful, though, that our roles won't be exclusive. I think we will have a lot to contribute to the design process, and I hope that FSU will help us with tasks like protecting the darkness, promoting the site and small business development."

Philip Freeman coordinates the Architecture program at FSU and jumped at the chance to partner with UT because the project fit perfectly with the architecture program's Community Design Assistance Center (CDAC) and will give a team of graduate and undergraduate students hands-on, real-life design experience.

"FSU's Master of Architecture focuses on the cultural, geographic and historical conditions that distinguish the character of the surrounding environment and its people," Freeman said. "Providing design assistance to benefit economic development in Calhoun County also supports the mission of Fairmont State University, which is to provide opportunities for students to achieve their professional and personal goals and discover roles for responsible citizenship that promote the common good."

Professor earns prestigious **NSF CAREER Award**

ns to more forms of sustainable energy, power companies are oftentimes faced with uncertain load eration. Sarika Khushalani-Solanki, an assistant professor of computer science and electrical engineering iversity (WVU), has earned a prestigious CAREER award from the National Science Foundation (NSF) for distribution systems.

with $400,000 in funding over a five-year period. Khushalani-Solanki's project, formally titled "Stochastic pproaches for Addressing Variabilities in Power Consumption and Generation of Smart Distribution Systems," evelopment of new computer-based methods that can improve both the short- and long-term performance on systems.

Early Career Development, or CAREER, program supports junior faculty who exemplify the role of teacher- utstanding research, excellent education and the integration of education and research within the context heir organizations.

hicles connecting and disconnecting from charging stations and consumer household load behavior can have distribution systems," said Khushalani-Solanki. "Wind and solar variability have also forced researchers to find ns that can redesign the traditional management and analysis of power systems to pay more attention to their data in a random or stochastic sense."

i will develop a unified framework of stochastic and data-driven approaches to generate scenarios to assist power companies y and variability of generation and demand, allowing for increased utilization of sustainable resources and lower costs.

w for better management of plug-in hybrid vehicles, reduced cost for consumers, better renewable sources integration and f smart electric distribution systems," she said.

's Engineers of Tomorrow program, Khushalani-Solanki will engage graduate and undergraduate students in her work in an the recruitment and retention of students from Appalachia, especially women and minorities. The dissemination will be minars, short courses delivered to local utility personnel, videos and tutorials made available through professional societies.

WVU grad student to launch portable energy company

All students in the mechanical and aerospace engineering program at West Virginia University (WVU) take a senior design course to fulfill graduation requirements. Some students use it as a chance to explore the boundaries of their creation while others see it as a way to develop an idea they've been playing with since they began studying.

As Justin Chambers, a 2012 mechanical engineering graduate and current doctoral student in the program, began to think of his senior design project, he thought to both expand boundaries and create a useable product to solve a problem.

The original plan was to develop a portable, efficient wind turbine that military personnel could carry, which would provide energy to power their electronic devices in the field. While working through his project, however, Chambers saw a market for commercial use of his designs.

In 2013, his company, WindPax, was formed. Chambers and his team have developed a line of collapsible, portable and efficient wind turbines that he plans to sell to campers, hikers and others who need power while off the grid.

"I saw a need and knew we could meet it," explained Chambers, a native of Glen Dale, West Virginia. "In our highly connected society, people need power in remote areas."

There are other alternatives for portable energy, but Chambers explained that these are both heavy and unreliable. For example, backup batteries take up space in a hiker's backpack and add weight to the load. They can also lose their charge.

"This is a renewable energy source that can be charged at any time, anywhere," he said.

WindPax uses patent-pending technology to capture wind and provide power to devices. Large wind turbines, which are already well-known sources of renewable energy, spin on a horizontal axis. The turbines designed by Chambers turn on a vertical axis, meaning they can capture wind from all directions.

The turbines are attached to a telescopic stand, which collapses into itself, making the entire package only 14 inches long and 2.5 inches in diameter when put together. Chambers' goal is to start manufacturing and make a public launch in the spring of 2015. Chambers' vision for his company also includes third-world outreach. He sees WindPax as a way to provide affordable, efficient and low-maintenance energy to people who would have no other option.

In March, Chambers won a $2,500 grant at the TransTech Energy Business Development Conference for WindPax. He also won first place at the 2013 and 2014 Technology Entrepreneurship Challenge at WVU. In addition, Chambers won second place in the Division of Science and Research's STaR Symposium competition last year for his video which detailed collaboration between the WVU School of Engineering and the School of Medicine in the emerging field of nano-particle aerosol technology.

Marshall faculty member receives **NASA research award**

Dr. Kumika Toma of the Marshall University College of Health Professions received a research award to study sex and age differences in skeletal muscle responses to weakness and recovery. As part of a NASA-funded project in space biology and medicine, Toma's study is aimed at better understanding how microgravity will impact crew members on extended missions.

Toma, program director for the undergraduate exercise science program in Marshall's School of Kinesiology, said the study will use rats to examine the long-term exposure to microgravity.

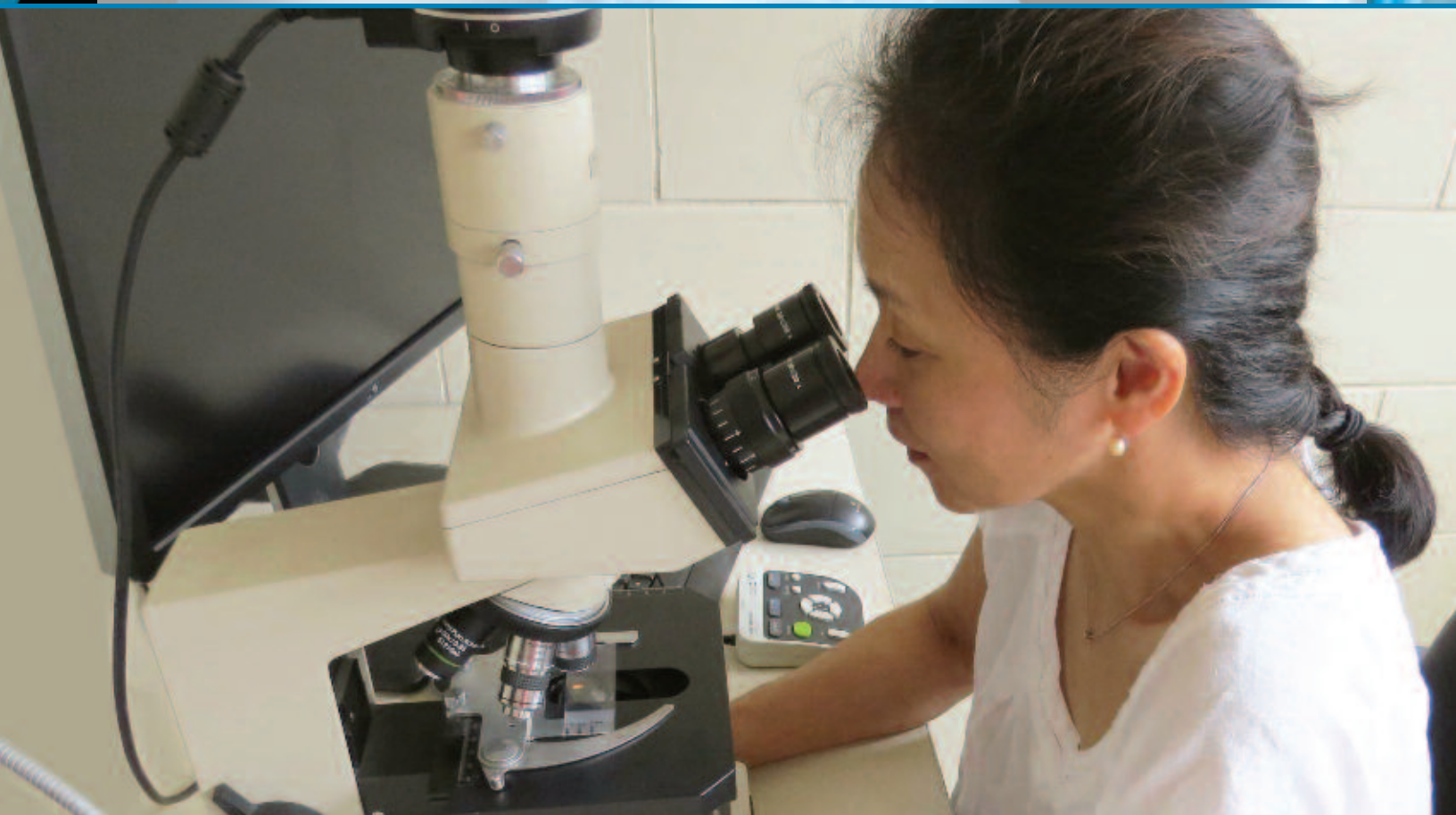
"Seemingly, there are sex and age differences among the degree of muscle weakness and also the degree of recovery," Toma said. "This study uses rats whose hind limbs will be suspended for a week so that they don't use hind limbs. After one week of hind limb suspension, they will be back to their normal activity (recovery). Since the diameter of skeletal muscle is correlated to the muscle strength, I'll be able to see the muscle size differences among sex and age. If there are differences, then, we can develop age- and sex-specific tactics to minimize loss and maximize recovery."

Toma said decreased skeletal muscle size, or what is known as atrophy, due to space flight is well known and research has been conducted to investigate the degrees of atrophy and recovery.

"The principle of skeletal muscle is 'use it or lose it,'" Toma said. "In the environment of microgravity, muscle hardly works because there is no resistance. The skeletal muscle of astronauts is weak and since NASA estimates about nine months of space flight, significant muscle atrophy occurs among Type I muscle fiber and other adverse health effects are a major concern. Given the range of expertise required for a Mars mission, it is anticipated that crew members may be diverse in age and sex. However, there is no systematic study investigating the age and sex differences of skeletal muscle atrophy and recovery."

Dr. William Pewen, associate dean of research for the college, noted, "Future extended missions will require crews with greater breadth and depth of expertise and experience, so we must ensure their ability to perform successfully. At the same time, Dr. Toma's work will add to our knowledge on the loss of function that so many people experience when illness or disability restricts activity - a critical problem right here on the ground."

Toma said because microgravity is the example of extreme disuse, the results from this study will be applicable to anyone who is sedentary or bedridden. She will finish collecting data by next March and after months of data analysis, she will have the initial research report completed by September 2015. Toma said she plans to apply for another grant to extend her research project into the following year.



WVU Tech student takes on **aviation design** at **summer workshop**

WVU Tech senior Thy Dinh, who is a triple-major in electrical engineering, mechanical engineering and mathematics, was one of only 15 students in the nation selected to attend the inaugural Aircraft Readiness Engineering Workshop sponsored by the North Carolina Space Grant Consortium and hosted at North Carolina State University this past summer.

Designed to put students in direct contact with aircraft engineers, pilots and manufacturers, the workshop provided attendees with opportunities to attend lectures and presentations, fly helicopters in a flight simulator and run analytical tests on aircraft materials. Workshop attendees also toured the Cherry Point and New River Marine Corps air stations, visited a flight mishap investigation facility and toured an aircraft operations line to see engineers and maintenance personnel at work.

For Dinh, visiting the investigation facility was particularly impactful. The facility was investigating the crash of a Marine Corps heavy transport helicopter. The incident, which cost the lives of the helicopter's entire crew, is thought to have been caused by an error during a routine pre-flight check.

"As a veteran, that really hit home. It was an experience none of us will ever forget, and it showed that what we do as engineers will affect others, even if we don't see it," he said. "Our men and women in the armed forces risk their lives for our freedom, so it's up to us to engineer something better and consider who's going to be involved directly and indirectly."

For their final project at the workshop, students worked in teams to design and construct an unmanned aerial vehicle. Dinh's team, which included students from Texas A&M and the University of North Carolina, designed a remote-controlled plane to look like an F-22 fighter and dubbed it the Barking Spider. The Barking Spider was the first plane to successfully takeoff and was the victor in a three-plane aerial dogfight staged at the end of the final competition.

"It was exhilarating to see something we built actually take flight. We placed third overall, but our plane outlasted the others and that's a great feeling," said Thy.

He said it was NASA West Virginia Space Grant Consortium's Dr. Majid Jaridi who encouraged him to apply for the workshop.

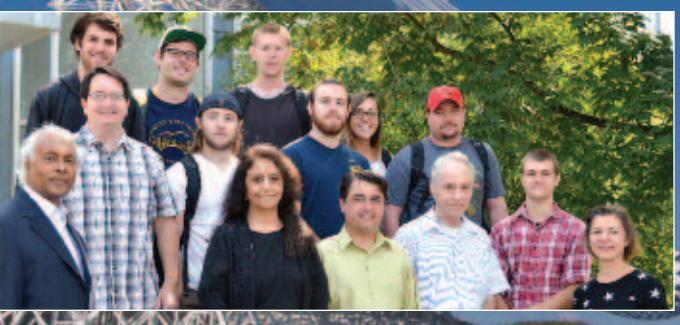
"Last semester, Dr. Jaridi told me that this was an opportunity worth taking. So I took it, and it was the experience of a lifetime," he said.

Green Bank Telescope and WVU **students team up**

Some West Virginia University (WVU) students and officials from the National Radio Astronomy Observatory (NRAO) at Green Bank are teaming up. As part of a senior design class, ten WVU seniors chose to work on Green Bank Telescope (GBT) projects after three NRAO engineers and a scientist spoke to their class.

The GBT projects they'll tackle include an "artificial pulsar" test set for testing advanced pulsar instrumentation, upgrades to the GBT feed arm servo controllers and an upgrade to the key active surface actuator control system, needed to keep the telescope "in focus" at high frequencies.

Nestled in Pocahontas County, the GBT is one of the world's most powerful radio telescopes. Its 100-meter diameter collecting area, unblocked aperture, excellent surface and unique site offer the scientific community unrivaled capabilities across the telescope's full 0.1 -116 GHz (3.0m – 2.6mm) operating range. It is a facility of the National Science Foundation.



The students are electrical engineering, computer science and computer engineering majors and will be organized as interdisciplinary teams that will work under the guidance of NRAO engineers in collaboration with four WVU faculty supervisors.

NRAO scientist Richard Prestage said, "These students will gain important skills to deal with complex projects. The result will be real-world designs, documentation and actual hardware that will be put into use at the GBT."

Marshall event **gets kids excited about water, science careers**

One of the best things about the annual Water Festival at Marshall University (MU) is that it takes place on a big, open field – the perfect setting for 180 elementary-school kids.

And, when the sun is shining and the weather is warm – as it was on Friday, Sept. 26 for the second annual Water Festival at MU – everybody is happy.

"It was a perfect day to be outside learning about water," said Avia Huisman, outreach coordinator for Marshall's College of Science.

Students from Huntington-area elementary schools, along with several teachers and assistants, took part in the festival which was set up on Buskirk Field outside the MU Science Building in the heart of campus. They learned about the water cycle, water conservation, wetlands and wildlife, water safety, water usage and acid rain.

"Events such as the Water Festival are a great way to get children excited about science," Huisman said. "They get to be outside, participating in fun activities, looking at and touching creatures that live in the water, while learning new things from professionals working in a variety of water-related careers. It is a fun event to host, and we are looking forward to doing it again next year!"

In addition to Marshall faculty, representatives from the West Virginia Department of Environmental Protection, West Virginia Division of Forestry, U.S. Army Corps of Engineers, West Virginia American Water and the Division of Air Quality were among those staffing stations the children visited.

Water festivals have a strong history of providing children a fun way of learning about water – where it comes from, where it goes and why it's important to everyone's health and well-being.

The goal of this event was to provide children in the Huntington area the opportunity to benefit from the learning opportunities that a water festival provides. A secondary goal was to give students a broader understanding of the types of science careers available to them.

Shepherd professors bring **STEM** and **middle school girls together**

"Girls are being discouraged, maybe not overtly, but hinted at that they can't do these topics."

Dr. Jordan Mader

Organizers of a Shepherd University math and science camp, called Seeding Your Future, hope the middle school-age girls who attended the event are now inspired to consider careers in the science, technology, engineering and math (STEM) fields.

Dr. Sytil Murphy, assistant professor of physics, and Dr. Jordan Mader, assistant professor of chemistry, received a grant from the NASA West Virginia Space Grant Consortium to put on the camp which occurred at the beginning of October. Shepherd matched the grant with about $6,000 in cost sharing that consisted mostly of donated faculty time.

Murphy and Mader said the need for more professionals in the STEM fields provides opportunity for young women as they consider what career to pursue.

"Girls are being discouraged, maybe not overtly, but hinted at that they can't do these topics," Mader said.

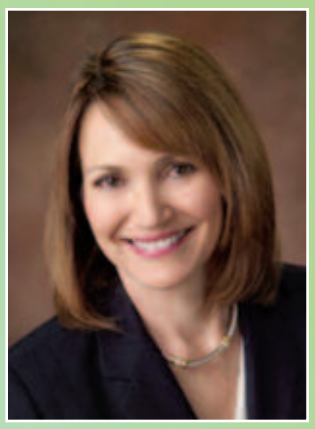
Topics covered at the Seeding Your Future event included:

- Edible chemistry: how food is made
- Water bugs and stream pollution, learning about aquatic insects
- Can You Dig It, an archaeological exploration using cool math tricks

Mader and Murphy said they were glad to have a chance to work with younger students.

"Seeing that sort of look of wonder, that ah moment, when somebody realizes that science is not just an old man with crazy hair in a white lab coat bubbling some colorful liquids," Mader said. "It is kind of an awesome moment just to see that look of wonder on their faces."

If we want to **close** the **gender pay gap**, we need to get **more women** in **STEM**



Anne Barth, Executive Director, TechConnect West Virginia

Several recent news reports about the gender pay gap are cause for concern. In 2013, among full-time, year-round workers, women were paid 78 percent of what men were paid. This is across all occupations and in every state, although the gap is smaller in some states than others. In West Virginia, women were paid 70 percent of what men were paid, making our state the third worst in the nation for the gender pay gap. If we want to close that gap, we need more women in STEM fields: Science, Technology, Engineering and Math. We need more women working for tech companies, writing code, developing technologies, working for manufacturers and holding tech positions in all other types of companies.

STEM jobs pay on average 26 percent more than other jobs, they tend to be more recession proof and they are on the rise. In the next four years, STEM jobs are expected to grow at twice the rate of other jobs. And the top ten paying majors
for the graduating class of 2013 were all STEM fields.

Recruiting more women in STEM will not only help lessen the pay gap and improve the financial status of women, it will also address a critical and growing skills gap in American industry and manufacturing. With the pending retirement of the baby boomers and upticks in manufacturing, forecasters are warning of workforce shortages.

Another reason to encourage more women to pursue tech jobs in STEM fields is that we're missing out on the untapped potential of half of the population. Women bring a different perspective to technology, and their innovations can help drive our economy forward.

If we're serious about increasing the number of women working in tech careers, we have to steer more girls and young women toward STEM, starting in grades K-12. New programs at the national and state level are encouraging girls to think about science, math and engineering in new ways. By targeting STEM programs with girls in mind, it will be easier for them to imagine a future in STEM for themselves.

For example, Morgantown, West Virginia, entrepreneur Lynn Dombrowski created STEMPLOY LLC to connect women to STEM fields. Part of STEMPLOY's mission is expose girls to STEM careers during middle school, when it's most critical to capture their interest. STEMPLOY offers summer camps and special activities throughout the school year to engage and inspire students in STEM fields.

In addition, BridgeValley Community & Technical College has hosted "Introduce a Girl to Engineering" for the last several years, and at Elkview Middle School, the "Robo Roses" build their own robots and compete in the First Lego League Championship.

Private companies like GoldieBlox market toys for girls that spark interest in engineering and boost their confidence at an early age. The firm's clever videos target girls with images and ideas that appeal to their sense of creativity and curiosity.

These are just a few examples, and clearly much more needs to be done to encourage women in STEM jobs. What's happening in your community to encourage girls to pursue a career in a STEM field? Let's work together to support this initiative at all levels.

Learn more at **www.techconnectwv.org**.

In West Virginia, women were paid 70 percent of what men were paid, making our state the third worst in the nation for the gender pay gap. If we want to close that gap, we need more women in STEM fields: Science, Technology, Engineering and Math.

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FROM THE DIRECTOR:
A call to support our entrepreneurs

According to Webster's Dictionary, an entrepreneur is defined as, "one who takes the initiative to create a product or establish a business for profit; generally, whoever undertakes on his own account an enterprise in which others are employed and risks are taken."

I'd like to make a note of the fact that this definition doesn't include a reference to someone who has already achieved a certain level of education or other success. Simply put, it's someone who takes initiative – whether that is a well-established scientist, businessperson or student.

While I believe that many people in our state do have a natural entrepreneurial spirit, we need to encourage more of them to pursue their passions – particularly those who are in the science and research fields. There is a "next step" of moving research into action, and many people who have great ideas are missing out.

The first West Virginia Makes Festival, hosted by the Robert C. Byrd Institute for Advanced Flexible Manufacturing last month, is a great example of this encouragement. Hobbyists, inventors, enthusiasts and students from around the state came together in Huntington and submitted their creations for judges to review and the public to explore in person. A more detailed recap of the event, along with photos, is in this issue of *The Neuron* in case you missed it.

We also have a great profile piece about Justin Chambers, a WVU graduate student who has launched a portable energy company. After succeeding with a design project during his senior year of undergraduate studies, Justin decided to expand his work beyond the classroom and, as a result, created a useable product to solve a real-world problem. Read more about him and his company, called WindPax, on page 10.

Not only does encouraging research, innovation and, ultimately, entrepreneurship support people personally as they pursue their dreams, but their success can also have a direct benefit on economic development. I hope you'll agree that it's a win-win on both sides of the coin.

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

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