the NEURON

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Zach Etienne
West Virginia University

"They say Einstein's is the face that launched a thousand physics careers. Well, I'm one of them."

Zach Etienne

West Virginia University

Zachariah Etienne, assistant professor of mathematics in the Eberly College of Arts & Sciences at West Virginia University (WVU), has always been attracted to physics that borders on science fiction.

"As a high schooler, I would devour all of the popular science books at the library written by famous physicists like Stephen Hawking and Steven Weinberg. Learning about the weird implications of modern physics captivated my imagination."

A native of Tell City, Indiana, Etienne earned bachelor's degrees in Physics and Mathematics with a minor in Astronomy from Indiana University. He completed his PhD in Theoretical Astrophysics at the University of Illinois.

Upon finishing his doctorate, Etienne was awarded a National Science Foundation Astronomy & Astrophysics Postdoctoral Fellowship at the University of Illinois, and then was the Joint Space Science Institute Prize Postdoctoral Fellow at the University of Maryland and the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center. In 2014, he started the position he holds today at WVU.

Etienne's work primarily involves studying colliding black holes and neutron stars on super-computers. His supercomputer simulations provide the scientific community with detailed theoretical models of the strong gravitational waves and intense light emitted before, during, and after these collisions.

"When your research hinges on supercomputer simulations," Etienne said, "you must learn to write fast software." Etienne's work within the Laser Interferometer Gravitational Wave Observatory (LIGO) Scientific Collaboration, funded by the National Science Foundation, focuses on optimizing the performance of software that is needed for LIGO data analysis. "Our group at WVU reduced the time necessary to do certain mission-critical gravitational wave data analyses from a century to months."

Gravitational waves are ripples in the fabric of space-time caused by some of the most violent and energetic processes in the universe, including colliding neutron stars and black holes. Albert Einstein predicted the existence of gravitational waves in 1916 in his general theory of relativity. Etienne himself is one of 1,200 scientists from around the world participating in the LIGO Scientific Collaboration.

In 2015, LIGO first detected gravitational waves, a discovery that would lead to the 2017 Nobel Prize in Physics for three of the LIGO Scientific Collaboration's founders. On October 16, 2017, LIGO announced their first detection of colliding neutron stars.

Photos by Alex Wilson

about West Virginia 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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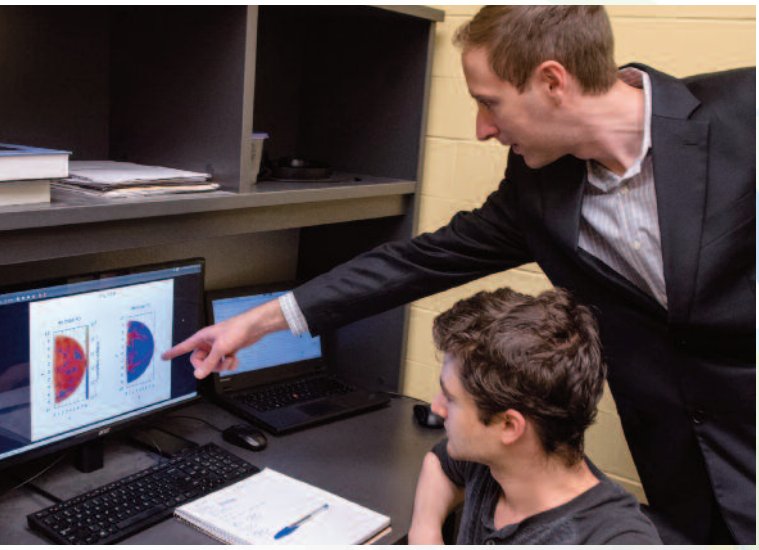


Etienne works with his postdoctoral research assistant, Ian Ruchlin.

"Imagine something that is so dense that a teaspoon full is as massive as Mount Everest. That's a neutron star. They're ridiculous. They're extreme. They're freaks of nature. Something spectacular must happen when they collide, and our simulations indicate that when they do, they can create an object that is very highly spinning, very hot, and super dense. The object collapses to a black hole surrounded by an orbiting disc of matter. Magnetic fields around the spinning black hole are twisted by the spin and the rotation of the disc. As they twist, they get stronger until ultimately they completely dominate the dynamics. They violently uncoil and create what is called a relativistic jet, which generates one of the most spectacular outbursts of energy in the universe, called gamma-ray bursts. This is what was observed."

In addition to the gravitational waves and gamma-ray burst, scientists witnessed clumps of radioactive matter ejected from the collision. These clumps decayed into heavy elements like gold and platinum. The radioactivity produced an afterglow that was observed by approximately 70 telescopes. Scientists hypothesize that most of the gold in the universe is produced from colliding neutron stars.

"Neutron stars tell an amazing story—a story of our universe that we're just now learning. Some of my simulations and other folks' simulations hinted at what might happen when neutron stars collide, but to actually observe it? Wow!"

Etienne says that the LIGO gravitational wave observatory is currently offline for scheduled upgrades. When it comes back online in Fall 2018, scientists estimate its enhanced sensitivity may increase the rate of gravitational wave observations by a factor of two or three.

"While we have some guesses about what the next version of LIGO might discover, the universe is full of surprises. That's the exciting part of being a scientist. Gravitational wave observatories are opening a new window on the universe. Every time we've opened such a window, whether it be from building new telescopes or gravitational wave detectors, something surprising and exciting has been discovered. It is a great privilege to take part in the advent of gravitational wave astronomy."

MARSHALL UNIVERSITY WATER FESTIVAL

About 250 elementary school children from Cabell and Lincoln County converged at Marshall University on Thursday, September 21st from 9:00 a.m. - 1:00 p.m. to participate in the annual Water Festival.

Mandee Wilson, Outreach Coordinator at Marshall University's College of Science, reported that students who attended the daylong event in Huntington experienced firsthand the importance of water.

"Young people and educators participated in a variety of activities designed to promote awareness, knowledge and stewardship of water resources."

Children learned about "Nonpoint Source Pollution" from Marshall University Creek Geeks, "Trouting About" from Marshall Environmental Science Association, "Water you doing now? Focus on clean water" from Marshall University Parks and Recreation Organization for Students, "Stream Ecology" from West Virginia Department of Environmental Protection Division of Water and Waste Management, "Project Learning Tree" from West Virginia Division of Forestry, "Watershed Studies" from Huntington High School, "Incredible Journey" from Marshall University College of Education and Professional Development and West Virginia Department of Environmental Protection Youth Environmental Program, greenhouse tours from Marshall University Sustainability Department, "Bonds, Boats, and Biofuels" from the Marshall University Chemistry Department, "Mussels of the Ohio River" from the Marshall University Chapter of American Fisheries, "Scuba, coral reef restoration and lionfish removal" from the Marshall University Scuba Club, "Water Monitoring Trends" from the United States Army Corps of Engineers, "Augmented Reality Sandbox" from the Fourpole Creek Watershed Association, "United States Coast Guard Jobs and Boat Safety" from the United States Coast Guard Marine Safety Unit and "Acid Rain" from West Virginia Department of Environmental Protection Division of Air Quality.

The event is sponsored by West Virginia Project WET's program through West Virginia Department of Environmental Protection, Marshall University, and National Science Foundation (NSF) Award OIA-1458952.

Photos Courtesy of Marshall University

W.VA. STATE UNIVERSITY STUDENTS PARTICIPATE IN NASA ROCKET LAUNCH

West Virginia State University (WVSU) students participated in a successful launch of a NASA suborbital sounding rocket at the NASA Wallops Flight Facility in Virginia in August.

More than 100 students from over 15 universities and community colleges around the U.S. collaborated to design, build and launch experiments into space as part of the RockSat-X program, which allows students to build their own experimental payloads and launch them on a NASA sounding rocket.

"The purpose of the experiment was to measure radiation levels during the flight, detect the direction of high energy particles, and measure flight dynamics such as acceleration and rotation rate, the strength of Earth's magnetic field, and its direction and ozone concentrations during the descent," said WVSU Physics Professor Dr. Marek Krasnansky.

The payload flew to an altitude of 94 miles during its suborbital flight. It descended by parachute and landed in the Atlantic Ocean, where it was recovered for the data to be analyzed.

Sponsored by the Colorado Space Grant Consortium, NASA's Rock Sat-X program introduces students to building experiments for space flight and requires them to expand their skills to develop and build more complex projects as they progress through the program.

Participating WVSU students included James Davis, Caleb Eskins, Justin Graham, Jacob Moore, Jonathan Musselwhite, Saira Rizwan, Umer Rizwan, Danford Smith, Justin Spradling and Jaime Veronda.

Photos Courtesy of West Virginia State University

COLLEGE OF SOCIAL AND BEHAVIORAL SCIENCES OPENS NEW PSYCHOLOGY LAB

A new laboratory at Shepherd University will allow students and professors in the Department of Psychology to conduct more research.

The department, part of Shepherd's newly formed College of Social and Behavioral Sciences, received a $30,000 grant from the West Virginia Higher Education Policy Commission Health Sciences Division for the lab located on the second floor of White Hall.

"Having a place dedicated to psychology research allows both the faculty and students to do more and better professional research," said Dr. Larry Daily, chair of the psychology department.

Until now, faculty and students had to seek out classroom space to conduct research, hoping they wouldn't be interrupted. Daily said psychology research often requires working with participants in a distraction-free environment, and the information collected must be kept confidential. The new lab provides a quiet, private area to conduct research. There's a reception area primarily used to receive research participants that can also be used for small group meetings.

A hallway from the reception area leads to a general workroom with a couple of computers where students can enter data and write research reports. Daily said the computers in the lab have a special software package that will make conducting research much easier and will give students and faculty more research options. A multipurpose conference room that has a table and computer stations will provide enough space to conduct research that requires subjects to move around. A small room with a one-way mirror will allow researchers to observe what's going on in the conference room. The lab also has a storage cabinet to house special equipment.

"We were trying to design this space to be as flexible as we could to meet the needs of as many faculty and students who are doing research as possible," Daily said.

Daily sees a lot of uses for the lab. Faculty members have conducted research on everything from how meditation affects stress reduction to whether participating in leisure activities impacts well-being. Potential future research projects that can be implemented in the lab include color vision and healthy eating; stress, meditation, and neurofeedback; multisensory perception and aging; changing attitudes toward health behaviors; increasing compliance with medical advice and behavioral follow-through on health decisions; and leisure activities related to personality and wellness.

Daily envisions collaborating with other departments on projects as well.

"The social work department, for example, is interested in utilizing that space for some activities they do in their classes where they need to observe students in mock counseling sessions," Daily said. "I can also see doing some collaborative research in the criminal justice program where we could simulate lineups in that space, or with the nursing department."

Dr. Ann Marie Legreid, dean of the College of Social and Behavioral Sciences believes the new psychology lab will open doors in faculty-student research, innovations in teaching, and collaborative work among faculty across disciplines. "This lab supports our college mission to be 'engaged, innovative, and excellent' in the areas of scientific inquiry, well-being, and community outreach. We take pride in the many achievements of our students and faculty, and the multitude of ways their work positively impacts the greater community, from workshops to internships and community service projects."

Dr. Larry Daily, chair of Shepherd's Department of Psychology, works with two students in the new psychology laboratory.

Photo Courtesy of Shepherd University

WVU professors Lian LI and Cheng Cen are researching "unthinkable speeds" for future computers using condensed matter.

Photo Courtesy of West Virginia University

WVU PHYSICISTS CHASE NEW 'WAVE' OF CONDENSED MATTER RESEARCH

Just one year after arriving at West Virginia University, physicist Lian Li is taking physics research to new frontiers.

In collaboration with fellow WVU condensed matter experiment expert Cheng Cen, he is breaking the rules of classical physics in search of a solution to making computers faster than ever.

"The majority of information today is carried by electronic signal. While those voltages or currents are fine for now, we want to think about what we want technology to be doing not just next year but 10 to 20 years from now," said Cen, an assistant professor in the Department of Physics and Astronomy. "In the future, we won't be happy with the current performances of computers and cell phones. We want to push for unthinkable speeds – what will come next."

Funded by a $2 million National Science Foundation Emerging Frontiers in Research and Innovation grant, their research team is just one of nine to receive the prestigious award.

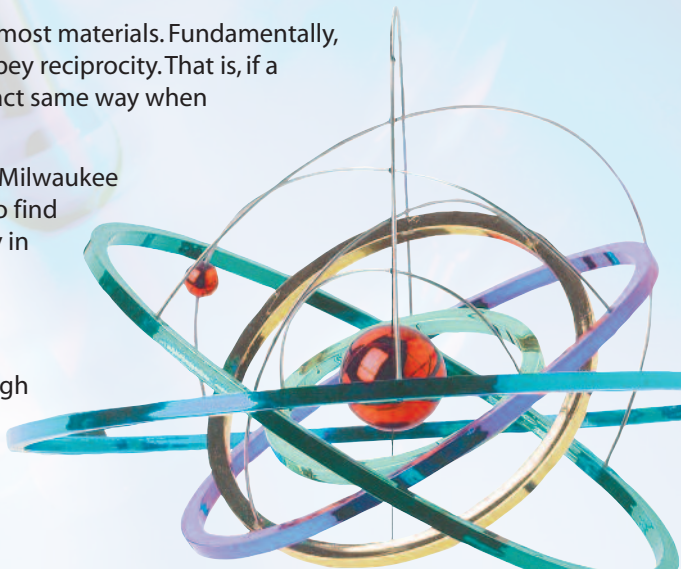
"This research is an organic integration of Cen's expertise in optical characterization of devices and my expertise in physical properties of materials," said Li, WVU's Robert L. Carroll Professor of Physics. "We want to take something wonderful and make it useful."

Photons, or light particles, can transmit data at a much faster rate than traditional electron-based data transfer methods in computers. Li and Cen's research will disrupt the conventional design of computers by recruiting photons as the data carriers and making them as "tamed" as the electrons.

The biggest obstacle to this goal is the time-reversal symmetry present in most materials. Fundamentally, having a time-reversal symmetry means that the travel of photons must obey reciprocity. That is, if a photon behaves a certain way moving forward, it should behave in the exact same way when traveling backward.

Over the next four years, Li and Cen, working with University of Wisconsin-Milwaukee theorists Michael Weinert and George Hanson, will conduct experiments to find the best approach to breaking this reciprocity and time-reversal symmetry in transition metal dichalcogenide monolayers, which are atomically thin semiconductors, to better control and manipulate light in information processing devices.

The team also plans to conduct community education and outreach through programs like Research Experience for Teachers, Science on Tap public lectures and Expanding Your Horizons, a STEM education program for middle school girls.



MARSHALL PARTNERS WITH WVU ON MULTIMILLION-DOLLAR RESEARCH GRANT

Marshall University announced its partnership with the West Virginia Clinical and Translational Science Institute (WVCTSI) on a $20 million grant from the National Institutes of Health (NIH) that further supports research aimed at improving the health of West Virginians and those in the Appalachian region.

As part of the federal grant to West Virginia University, the WVCTSI institution of record, Marshall will receive $4.3 million over a five-year period, which will support continuing research in several areas.

"We are excited about being part of the WVCTSI and contributing to this statewide initiative to support clinical and translational research," said Gary O. Rankin, Ph.D., vice dean for basic sciences at the Marshall University Joan C. Edwards School of Medicine and the grant's associate director.

"This program will provide research and collaborative opportunities for our faculty that could ultimately lead to improvements in health for all West Virginians. With our expertise in genomics, strong interest in addiction research and capacity for conducting clinical trials, Marshall will provide added strength to an already strong program."

According to the grant application, mortality rates in Appalachia have progressively increased during recent years, in contrast to decreasing mortality rates in the rest of country. The grant will focus on research that supports workable solutions.

Marshall School of Medicine Dean Joseph I. Shapiro, M.D., said the school is continuing to make strides in biomedical research.

"I am very pleased to participate in this partnership with WVU, which will enable our medical school to increase our research footprint and address the health care problems that trouble our West Virginia communities."

Shapiro went on to say that in addition to helping patients, the grant allows new research and educational opportunities for Marshall medical students and residents.

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>
> Gary O. Rankin, Ph.D

Sally Hodder, M.D., the grant's primary investigator and associate vice president for clinical and translational science at West Virginia University, said partnerships like the one with Marshall are invaluable.

"I am delighted with the partnership between WVCTSI and Marshall University and look forward to working with Drs. Rankin, Shapiro and others at Marshall to drive improvements to health outcomes in West Virginia," Hodder said.

In addition to Marshall University, other partners on the grant include the Charleston Area Medical Center, West Virginia School of Osteopathic Medicine, as well as the University of Kentucky, the Veterans Administration and the National Institute for Occupational Safety and Health.

The National Institutes of Health, the nation's medical research agency, includes 27 institutes and centers and is a component of the U.S. Department of Health and Human Services. NIH is the primary federal agency conducting and supporting basic, clinical and translational medical research, and is investigating the causes, treatments and cures for both common and rare diseases.

The IDeA-CTR (Institutional Development Award for Clinical and Translational Research) program builds research capacities in states that historically have had low levels of NIH funding by supporting basic, clinical and translational research; faculty development; and infrastructure improvements.

W.VA. STATE UNIVERSITY TO RECEIVE NEARLY $2.5 MILLION IN HBCU MASTERS FUNDING

West Virginia State University (WVSU) will receive nearly $2.5 million in federal funding over the next six years to support graduate education in Science, Technology, Engineering and Mathematics (STEM) through the Historically Black Colleges and Universities (HBCU) Masters Program.

Funds will be distributed annually in the amount of $416,666 beginning in fiscal year 2018 through 2023 and will be used to support WVSU's master's degree in Biotechnology.

"The restoration of HBCU Masters funding will significantly impact West Virginia's economy and society," said WVSU Vice President for Research and Public Service Dr. Orlando F. McMeans. "This will translate into West Virginia State's continued tradition of graduating highly competent, successful students who will go on to careers as scientists, physicians, dentists and other STEM occupations."

Initially funded in 2008 through the U.S. Department of Education's Higher Education Opportunity Act, the HBCU Masters program was created to improve graduate education opportunities at the master's level in mathematics, engineering, physical or natural sciences, computer science, information technology, nursing, allied health and other scientific disciplines where African-American students are underrepresented. The program was cut in 2015, only to be reinstated for the coming fiscal year.

WVSU's Master of Science in Biotechnology program provides cross-disciplinary education and training in 21st century concepts, preparing students for careers in a variety of industries. Biotechnology is, in essence, technology based on biology and harnesses molecular and cellular processes for product development and the advancement of technology. The program was among the University's first master's degree offerings when it gained university status in 2004.

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>
> Dr. Orlando F. McMeans

FORENSICS PROGRAM TEAMS UP WITH BECKLEY POLICE ON ENHANCED LEARNING EXPERIENCES

Red and blue lights bathe the park entryway as two young investigators arrive at the scene. They're greeted by an officer from the Beckley Police Department. He tells them about the scene, that there's a suspect in custody and that officers are interviewing potential witnesses. One investigator takes out a notebook and begins to jot down notes while the other turns on her camera. They've got work to do – because it's up to them to begin piecing the puzzle together.

This is no real crime scene; at least in that no crime has actually been committed. Instead, it's a newkind of classroom: a partnership between WVU Tech's Forensic Investigation program and the Beckley Police Department.

The two groups recently signed a memorandum of understanding that outlines a partnership based on mutual learning experiences. The Beckley Police Department, with its wealth of experience, will help WVU Tech students learn new skills in an immersive environment.

Roger Jefferys, professor in WVU Tech's Forensic Investigation program, said that the partnership holds immense potential for the student experience.

"It's all about enhancement," Jefferys said. "We want to enhance our students' education. That's the primary focus: giving the students unique opportunities that they wouldn't otherwise have."

One of the goals of the partnership is to extend the mock crime scene experience into the city of Beckley, where students can train in real-life environments. The program plans to work with police and other first responders to maximize the authenticity of the experience.

"Not only will we be able to train students at our new crime scene house and on other areas of campus, but also out in the city, which I believe has never been done before in this type of environment," Jefferys said. "This takes learning to a whole new level and will be extremely beneficial to our students."

Jefferys added once students have completed their work at the scene, they will testify in mock trials held in real courtrooms featuring actual attorneys and judges.

Detective Sergeant Morgan Bragg, an officer with the Beckley Police Department's detective bureau, said the partnership will create well-rounded students.

"I think it's an opportunity for students to get a more hands-on approach," he said. "We have a unique ability to allow them to experience it in a real-life situation as opposed to book study. The opportunity to actually be involved in real-world situations is one of the better ways to learn."

For Jefferys, the partnership is the beginning of what he hopes will be a long and productive relationship.

"We are very excited about partnering with the Beckley Police Department and look forward to working with them long-term," he said. "This is a big step forward for our program, and students who are actively involved in what we're doing here are going to be very well prepared for their future careers."

Photos Courtesy of WVU Tech

BANDURA PLAYS KEY ROLE IN TELESCOPE PROGRAM THAT WILL MAP THE HISTORY OF THE UNIVERSE

Since the early 1900s scientists have known that the Universe is expanding but recent studies have shown that the rate of expansion is accelerating. The reason for this is currently unknown. However, Kevin Bandura, an assistant professor in the Lane Department of Computer and Electrical Engineering at West Virginia University, has been working on the Canadian Hydrogen Intensity Mapping Experiment, or CHIME, for the past several years to find out why.

Researchers think that an unknown form of energy, called dark energy, is causing the accelerated expansion but this cannot be confirmed without first understanding the history of the Universe. CHIME is a telescope project that was designed to map that history by studying dark energy and observing hydrogen gas in distant galaxies that were strongly affected by it.

The CHIME telescope, located in the Dominion Radio Astrophysical Observatory in Kaleden, British Columbia, is comprised of four cylindrical reflectors, 256 dual-polarized antennas for data collection and an F-Engine and X-Engine for data processing. Bandura played a key role in developing the device's F-Engine, which digitally processes signals from space into frequencies that can then be processed into digital maps of the Universe.

Photos Courtesy of West Virginia University

According to Bandura, the instrument generates the maps by measuring the radius of spherical shells of matter called Baryon Acoustic Oscillations (BAO) that developed nearly 400,000 years after the Big Bang.

"The characteristic size of BAO matter developed solely due to the expansion of the Universe over the past 13 billion years," Bandura explained. "Therefore it can provide a standard ruler that can be used to measure the Universe's expansion rate."

The BAO scale has been measured before using individual galaxy surveys to map the distribution of matter. CHIME, however, will map that distribution through radio emissions of neutral hydrogen at a resolution much lower than that of individual galaxies but high enough to still measure the BAO scale. This technique, known as hydrogen intensity mapping, will create a digital map of the Universe larger than anything previously observed and will produce results at a much faster rate.

"We are aiming to establish a core understanding of the makeup of our Universe, a concept that has remained completely foreign to us," said Bandura. "The results collected by the CHIME telescope will help us understand the fundamentals of our Universe once and for all."

The telescope, which was set to begin collecting data on September 7, will be receiving radio waves around the clock to create a continuous 3-D map of the Universe. But that's not all: it will also pick up short explosions of energy, called fast radio burst, that last only a few milliseconds and have an unknown origin.

Since fast radio burst were first reported in 2007 by Duncan Lorimer, an astronomy professor at WVU, less than 25 have been recorded. The CHIME telescope is estimated to capture many instances per day.

"Although the CHIME project began before fast radio bursts were even understood it turned out to be a good tool for capturing and measuring them," said Bandura. "We have the opportunity to be the first to understand what they are."

CHIME will also record pulsars, which are small remnants of giant stars that have gone supernova. Once this occurs they leave behind rapidly spinning cores that emit radio energy that can be recorded and used to detect gravitational waves rippling through the galaxy. Dr. Maura McLaughlin, partially supported by National Science Foundation Award No. OIA-1458952, heads the gravitational wave project with pulsars.

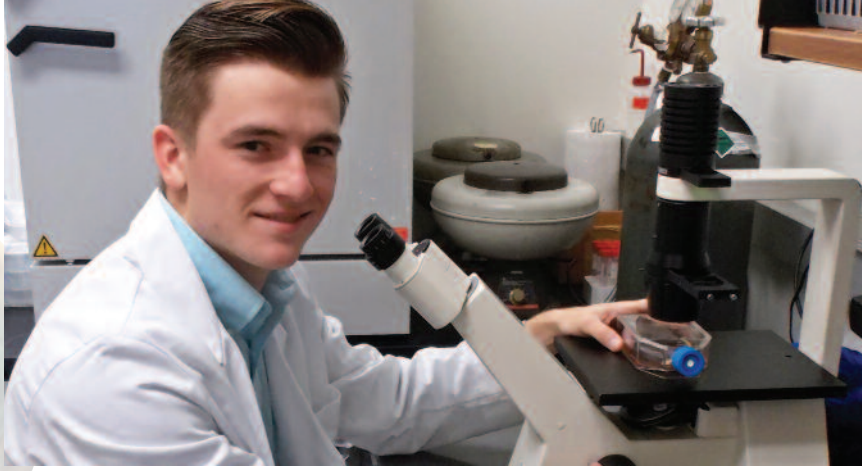
It will take several years before data can be analyzed related to dark energy, however fast radio burst and pulsar data could be available within as little as one year.

"There is so much we still do not understand about the Universe," said Bandura. "CHIME will be critical in helping us understand how it's expanding and will help us discover things we didn't even know we were looking for yet."

Bandura will continue to serve as a critical member of the project and participate in analysis of the collected data as it becomes available.

COMPANY TO PURSUE DEVELOPMENT OF CANCER THERAPY DEVELOPED BY HENDRIX LAB

A new cancer therapy that Shepherd University President Mary J.C. Hendrix helped develop to target Nodal, a protein involved in cell differentiation, for treatment and diagnosis of cancers is one step closer to benefitting those who suffer from the disease.



Shepherd University student Adam Hull, a senior biology major from Inwood, is the first recipient of the Robert Louis Katz Medical Research Foundation internship in Shepherd President Mary J.C. Hendrix's cancer research laboratory at West Virginia University.

TaiRx, Inc., a Taiwanese biotechnology company, has entered into an agreement with Northwestern University and the Ann & Robert H. Lurie Children's Hospital of Chicago to acquire the rights to a portfolio of seven patents plus three pending patent applications using Nodal as a new target for treatment and diagnosis of aggressive cancers.

Hendrix, who served as president and chief scientific officer of the Stanley Manne Children's Research Institute, led the original group of Nodal inventors at Northwestern University, Feinberg School of Medicine. After accepting her current position as president of Shepherd, Hendrix moved her lab to the West Virginia University Cancer Institute, making it possible for a Shepherd student to intern there with her laboratory research team.

Adam Hull, a biology major from Inwood, is the first recipient of the Robert Louis Katz Medical Research Foundation internship in Hendrix's laboratory in Morgantown, where Hull spent part of his summer working and presenting his findings.

The research team discovered that Nodal is highly expressed in various malignant cancers, especially associated with the cancer stem cell phenotype and drug resistance to current therapies. Hendrix's group has shown that an antibody directed against Nodal effectively decreases tumor cell growth and induces cell death in certain tumor types. TaiRx will further develop this technology as a new treatment strategy for targeting cancer stem cells and also as a biomarker to be used with its clinical compound, CVM-1118, which is currently in clinical Phase I development as a potential next-generation treatment for various aggressive cancers.

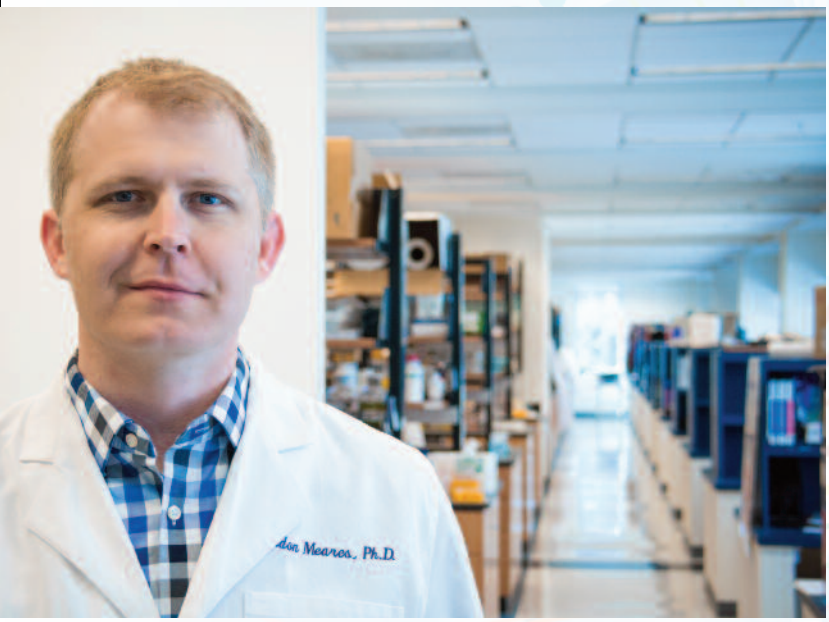
Photos Courtesy of Shepherd University

Shepherd University President Mary J.C. Hendrix and Dr. Du-Shieng Chien, the president and founder of TaiRX, Inc.

WVU RESEARCHER RECEIVES$1.6 MILLION TO FIGHT INFLAMMATION IN NEURODEGENERATIVE DISEASES

Inflammation is overwhelmingly beneficial, helping to fight illnesses caused by bacteria and viruses. However, most neurological diseases involve inflammation in the brain, which is thought to contribute to or exacerbate diseases.

A West Virginia University researcher has been recently awarded $1.6 million to conduct research on how harmful inflammation can be targeted without disrupting normal immune function.



Gordon Meares

Photos Courtesy of West Virginia University

Gordon Meares, Ph.D., was selected by the National Institutes of Health (NIH) to receive the funding over the next five years.

"Our approach is to examine how cell stress and cell damage drive inflammation as these are prominent features of neurological diseases," Dr. Meares said. "We have found that by targeting the mechanisms by which cell stress drives inflammation, we can limit what we hypothesize is potentially harmful inflammation without disrupting normal immune responses."

Researchers are poised to identify new therapeutic targets for diseases. Currently there are few and mostly ineffective treatments for neurodegenerative diseases such as dementias and progressive Multiple Sclerosis. Through his research, Dr. Meares hopes to contribute to the development of new treatments.

"We hope to detect new therapeutic targets for neurodegenerative diseases," he said. "We have identified a previously unknown signaling pathway that could be a new drug target to selectively control inflammation."

Dr. Meares is a strong proponent of collaboration as a key to success. His research utilizes tools and techniques across the university and is currently expanding into the area of stroke, joining efforts facilitated by WVU Stroke Center of Biomedical Research Excellence (WVU Stroke CoBRE). The state has one of the highest incidences of stroke in the nation propelling a growing need to address innovative stroke research.

Meares is an assistant professor in the Department of Microbiology, Immunology and Cell Biology. He attributes his passion for research to curiosity and freedom that are seldom experienced in other professions. He is hands-on mentor to his students, and his lab is currently preparing a cohort of young scholars paving the way for a new generation of scientists conducting innovative, cutting-edge research.

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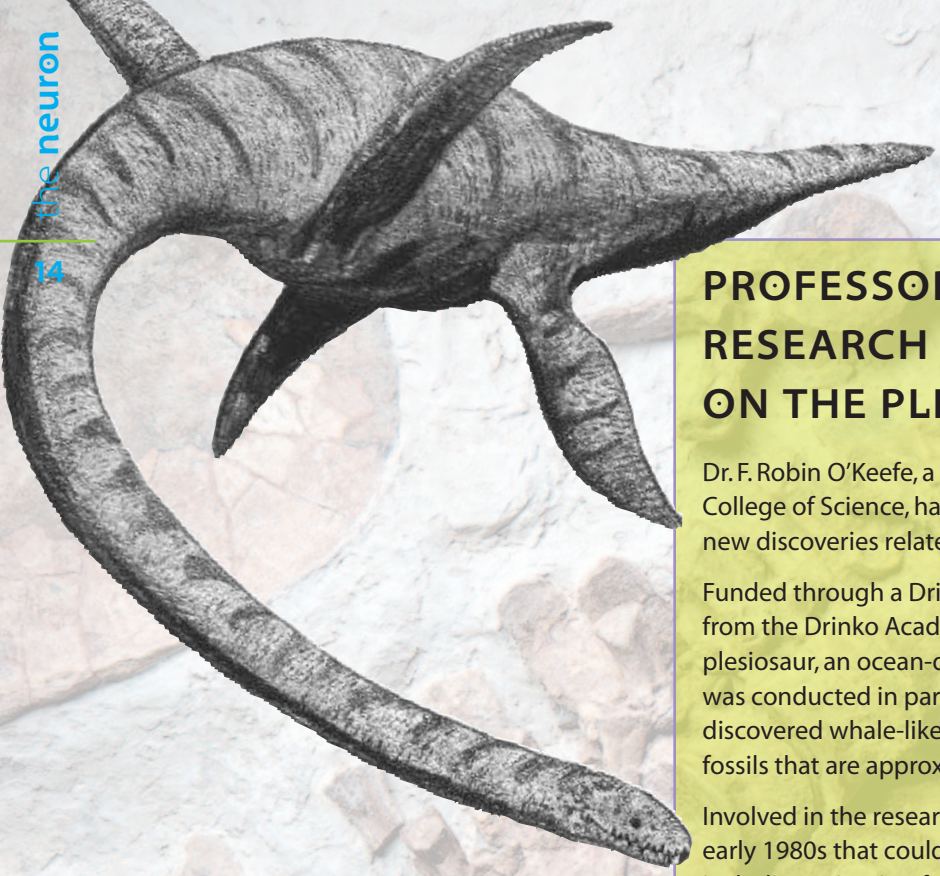

PROFESSOR, SOUTH AMERICAN RESEARCH TEAM PUBLISH DISCOVERY ON THE PLESIOSAUR

Dr. F. Robin O'Keefe, a professor of biology in Marshall University's College of Science, has led an international team of researchers in new discoveries related to marine life evolution.

Funded through a Drinko Distinguished Research Fellowship grant from the Drinko Academy at Marshall, his research has focused on the plesiosaur, an ocean-dwelling lizard from the age of dinosaurs, and was conducted in partnership with South American scientists. They discovered whale-like feeding habits of the marine reptile through fossils that are approximately 65 million years old.

Involved in the research were fossils from Antarctica found in the early 1980s that could never be interpreted. O'Keefe and his co-authors, including scientists from Chile and Argentina, used different fossils from Chile and Argentina to determine how the pieces from Antarctica went together and may have functioned. Their research has been published in the Journal of Vertebrate Paleontology. The title of their paper was, "Cranial Anatomy of *Morturneria seymourensis* from Antarctica, and the Evolution of Filter Feeding in Plesiosaurs of the Austral Late Cretaceous."

Previously, all plesiosaurs were thought to be predators that ate fish, squid, and even other marine reptiles, O'Keefe said. They discovered fossils of a plesiosaurus with teeth that did not meet tip to tip, as in all other plesiosaurs, but lie together in a battery that acted in straining food particles from the water. This feeding style is unknown in other marine reptiles, but is found in today's baleen whales.

"Our identification of whale-like filter feeding is a startling case of convergent evolution," O'Keefe said. "Plesiosaurs and whales shared many of the intervening steps in the evolution of this feeding style, and their extreme morphologies are similar despite arising from different ancestors. The evolution of filter feeding may be linked to changes in ocean circulation brought on by the southward movement of Antarctica during the Late Cretaceous."

O'Keefe is a globally recognized scientist specializing in the study of Mesozoic marine reptiles, and in the interplay between evolution and the physical environment.

A NEW PATH FORWARD IS PAVED IN TECHNOLOGY AND CREATIVITY

Fred L. King
Vice President for Research, West Virginia University

Our state is in transition – both economically and culturally. The future of West Virginia has become as foggy as our recent autumn mornings. One thing that is clear, however, is that the future of our state depends now more than ever on our ability to diversify our workforce and attract new business.

Inevitably, a new economic future will largely depend on a strong foundation of science, technology, engineering and mathematics. But I would like to add one more thing to the list – creativity.

Our future success will require innovation in its purest form.

That means West Virginia's community colleges, colleges and universities must develop citizens who have technical expertise coupled with a drive to create the next great idea, product or company.

In shale gas, West Virginia also has a natural resource ripe for development with opportunities for innovation at every step along the resource-to-product pipeline. The new West Virginia Forward collaboration involving West Virginia University, Marshall University and the West Virginia Department of Commerce seeks to seize these opportunities.

With shale gas production expected to double in the coming years, West Virginia has the opportunity to create robust and safe storage, processing, and transportation infrastructure around natural gas that facilitate renewed growth of the chemical and polymer industries.

There is significant opportunity here for innovation in new techniques for the conversion of low value alkanes into higher value hydrocarbons through cracking and catalysis. This prompted WVU to join the Rapid Advancement in Process Intensification Deployment institute, or RAPID, a national research collaboration with the U.S. Department of Energy and private industry to develop breakthrough technologies related to natural gas conversion and utilization.

The availability of higher value hydrocarbons facilitates growth in the area of carbon fiber reinforced plastics, or CFRP, using existing technologies as well as new processes being developed in the laboratory. West Virginia is well positioned to capitalize on the anticipated growth in the market for CFRP and CFRP products of more than 10 percent per year for the next decade.

We already have a foundation of companies capable of manufacturing CFRP products, research centers for testing and prototyping new materials, and zoning and tax set ups to encourage industrial development. At the end of the product pipeline are value-added finished products that can be exported beyond our states borders while providing good jobs for West Virginians.

In the next decade, there will be a great need not only for scientists and engineers, but people with talents ranging from design to delivery. The greatest need will be for people who can create new opportunities, products and jobs from those discoveries and ideas.

The good news is that the path to our new economic future isn't as foggy as it once seemed. We just have to work together as one West Virginia to seize the opportunities presented.

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FROM THE DIRECTOR: THE WONDERS OF SPACE

Another Star Wars movie will be upon us this December. Star Trek just launched its seventh television series installment while a reinvigorated Doctor Who has been going strong for over a decade.

Science fiction captures the attention of many, but none quite so much as aspiring physicists and astronomers. It's natural to admire characters that appeal to your chosen career path, no matter how fantastic. But why does it draw them in? Could it be this entertainment is the only available outlet for a young scientist?

Many high schools nationwide are lacking resources, such as certified instructors or equipment, to adequately offer such courses. According to the Physics Teacher Education Coalition or "PhysTEC," the United States has a severe, long-term shortage of qualified physics teachers. In 2013, the National Task Force on Teacher Education reported that "the need for qualified physics teachers is greater now than at any previous time in U.S. history."

Higher education has an opportunity to fully invest in the next generation of astrophysicists and aeronautic engineers. Take the dreams of the young and turn them into reality. Without such support, we might not see the next Zach Etienne, our cover story subject, or his colleague Sean McWilliams working to detect gravitational waves. Future Kevin Banduras may not receive funding to discover all the Canadian Hydrogen Intensity Mapping Experiment has to offer. Students like those at West Virginia State University participating in the RockSat-X program at NASA will never design, build and launch experiments into space. Let's ensure they do.

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