West Virginia University
Machine learning to predict ventricular disease

School of Osteopathic Medicine
The effects of poor nutrition during gestation

WVU Tech
Funding to expand STEM education in West Virginia

NEURON

West Virginia's Journal of Science and Research

FALL 2020

MARSHALL UNIVERSITY

Philippe Georgel

Mentoring aspiring scientists through a pandemic

West Virginia Science & Research

FALL 2020

EDITOR
Angela Sundstrom

CONTRIBUTING WRITERS
Angela Sundstrom, Kristen Hammer, West Virginia University, Marshall University, West Virginia University Institute of Technology, West Virginia School of Osteopathic Medicine, Fairmont State University

CONTRIBUTING PHOTOGRAPHER
Mark Webb Photography

ADDRESS
1018 Kanawha Boulevard East
Suite 700
Charleston, W.Va. 25301

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

FUNDING
This material is based upon work supported by the National Science Foundation under Award No. OIA-1458952.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Above: The basic "tools of the trade" for micro-pipetting

INSIDE THIS ISSUE

News briefings

UC professors publish book on medicinal plant toxicology

Rebecca S. Linger, Ph.D. and Dennis K. Flaherty, Ph.D., both professors from the University of Charleston School of Pharmacy, have published A Guide to the Toxicology of Select Medicinal Plants and Herbs of Eastern North America, a treatise on the toxicology of medicinal plants that grow in our area.

The book covers the medicinal properties of select Appalachian plants that can cause serious health problems if overused. It also gives a layperson's level explanation of how the plant components interact with the body. The information has been synthesized from a wide variety of science-based sources and provides the reader with current, concise information. In addition to educating the weekend forager, it is a useful resource for Poison Control Centers, physicians, academics, students, herbalists, and regulatory agencies.

The book is available at Taylor Books, the WV Marketplace at Capitol Market, the Kanawha State Forest Gift Shop and on Amazon.com.

New undergraduate major in specialty agriculture now available at Marshall

The Marshall University College of Science is now enrolling students in a new undergraduate major in specialty agriculture, which prepares them for the field of sustainable, high-yield agriculture suitable for mountainous regions.

The major focuses on the agricultural aspects of greenhouse production, hydroponics, precision farming, urban agriculture, community gardens and specialty crop production. It also explores new and emerging technological advances for improving yield, as well as business and marketing practices supporting the small farmer.

The major in specialty agriculture provides plenty of educational opportunities for students to develop expertise in both traditional and sustainable agricultural sciences. Marshall's specialty agriculture faculty members collaborate with local and regional agriculture enterprises and educational institutions, as well as the Marshall University Sustainability Department, to offer students hands-on experiences and to build relationships with field experts with a wide range of expertise.

"This is a growing field due to an increasing environmental awareness of the need for sustainable agriculture. Add to that the nutritional benefits of local products, and smaller farms are positioned to become a growing powerhouse nationally," said Dr. Mindy Armstead, chair of the Department of Natural Resources and the Environment, in which the new major will be offered.

Good candidates for the new major include those who care about sustainability, enjoy the outdoors and working with their hands, or want to create quality agricultural products.

First2 Network reports findings from Year Two

The First2 Network is a statewide alliance seeking to improve the early persistence of rural, first-generation science, technology, engineering, and mathematics (STEM) college students in their programs across West Virginia.

The Network was established to address a troubling problem identified by research, namely that attrition from STEM majors is most likely to occur during students' first two years of college. Over Year 2, the Network saw a 97 percent increase in membership, from 144 in Year 1 to 283 in Year 2. Students represent 50 percent of the membership. There was also a 157 percent increase in the number of summer interns working in a research capacity on campuses or virtually across the state, from 30 in Year 1 to 77 In Year 2.

These findings are compiled by First2 Network external evaluator ICF.

FROM THE DIRECTOR: Juliana Serafin

The pandemic has created a climate of change

Serafin

Photo courtesy of University of Charleston

These are tough times for everyone, but especially for students. For students trying to plan their path to higher education, disruption and uncertainty have been created by COVID-19.

On the other hand, our higher education institutions have adjusted to the challenges presented and have not only remained open through the pandemic, but have also effectively adjusted to virtual teaching and learning. Amazingly, the important research done at our higher education institutions has also continued throughout the pandemic, offering important experiences to undergraduates, graduate students and postdoctoral students. The return on investment of a higher education degree in terms of personal financial stability remains the same, so it's important to remind students that opportunities for assistance in making that initial investment in a degree or certificate program are still available.

The West Virginia Invests Program is the state's tuition-free grant program for students pursuing certificate or associate degree programs at two-year colleges. The preferred application deadline is April 15.

The Promise Scholarship remains one of the best deals in four year higher education! Applications are open until March 1, and there's a special incentive program called Cool Cash for College going on now. Find out more about the Promise Scholarship in this issue on the inside front cover.

The pandemic has created a climate of change. Let's step up and meet the challenge by preparing for the future.

Julie

Juliana Serafin, Ph.D.
Senior Director of Science & Research, West Virginia Higher Education Policy Commission, and Project Director, WV EPSCoR

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

Science & Research Council Members

Sarah Armstrong Tucker, Ph.D.
Chancellor, West Virginia Higher Education Policy Commission

Juliana Serafin, Ph.D.
Senior Director, West Virginia Science & Research, and *Project Director,* WV EPSCoR

Anne Barth
Executive Director, TechConnect

Clayton Burch
Superintendent, West Virginia Department of Education

John "Jack" Dever, Ph.D.
Chief Technology Officer, MATRIC

Ed Gaunch
Cabinet Secretary, West Virginia Department of Commerce

Laura Gibson, Ph.D.
Senior Associate Vice President for Health Sciences Research and Graduate Education, West Virginia University

Fred King, Ph.D.
Vice President for Research, West Virginia University

John Maher, Ph.D.
Vice President for Research, Marshall University

Maura McLaughlin, Ph.D.
Professor of Physics and Astronomy, West Virginia University

Colleen J. Nolan, Ph.D.
Professor of Biology, Shepherd University

Michael Norton, Ph.D.
Professor of Chemistry, Marshall University

Rachel Roberts
Unit Leader, Dow Chemical Company

Uma Sundaram, M.D.
Vice Dean for Research and Graduate Education, Joan C. Edwards School of Medicine at Marshall University

Jose Ulises Toledo, Ph.D.
Vice President for Research and Public Service, West Virginia State University

Mentoring aspiring scientists through a pandemic

Philippe Georgel admires his students and wants them to succeed

Written by **Angela Sundstrom**
Photos by **Mark Webb Photography**

Unbelievable. Fantastic. Such potential. These are all ways Philippe Georgel, Ph.D. chooses to describe his students.

Georgel, a professor of biological sciences at Marshall University, believes hiring and training the next generation should be about finding those better than you.

"I want to see someone that's going to be not just my colleague, but someone's who is going to take it to the next step," Georgel said. "It develops your program and it also challenges you to at least try to match what that person can do. You benefit always from getting the best people in your lab or in your department."

Georgel collaborates with his students on multiple projects. One of his most notable is a bioinformatics analysis on water contaminants funded by the National Science Foundation (NSF) Established Program to Stimulate Competitive Research (EPSCoR). This study is attempting to find out whether endocrine disrupting chemicals such as pesticides, herbicides, or detergents can be detected in water supplies around Huntington, W.Va. In collaboration with former students James Kessler, Ramin Garmany, Dr. Diane Dawley and Daniel Crow, it was recently published in the open-access journal *Water.*


Georgel

Endocrine disrupting chemicals can cause DNA damage and possibly lead to an increased risk of developing diseases such as cancer. These chemicals also present a risk during pregnancy, especially for those experiencing addiction. Buprenorphine is a chemical of interest in the study due to the ongoing opioid crisis.

According to the National Institutes of Health (NIH), buprenorphine is a semi-synthetic opioid used for opioid detoxification, opioid maintenance and pain management in patients. Georgel and his team studied whether exposure to buprenorphine in the womb can lead to improper gene expression or brain development issues in infants.

"We need to look carefully at what is actually dumped into the main waterways," Georgel said.

Although the concentration of chemicals potentially entering water supplies can vary, Georgel emphasizes prolonged exposure often leads to chronic effects.

A theme throughout much of Georgel's research – whether it be how various cooking oils change overall health outcomes or the impact of epigenetics on gene expression – is how the emphasis often lies on the rippling effects of minor habits.

"Sometimes something simple can have very large consequences," Georgel said.

Epigenetics, the study of how a person's behaviors and environment can change their genes, is also a primary focus in Georgel's lab. He describes it as like reading a book. When the Human Genome Project was completed in 2003, it became an invaluable resource. All the books, all the chapters, all the letters were written. Epigenetics tells you which parts to read and which to not.

Georgel is quick to admit much of his time these days is spent in front of a computer screen, especially during

Photo by Mark Webb Photography

Georgel

the COVID-19 pandemic, but he visits the lab as often as possible. Watching students blossom into scientists is one of his favorite aspects of the job.

"You see that transition all the time," Georgel said. "They take ownership. If they take ownership of their project, they are there because they care. If they care about something, they will probably do the best they can. That is my job. To make sure that they can optimize the result."

Georgel has spent over 30 years studying the biological sciences. A native of France, he attained his doctorate in biophysics and biochemistry from Oregon State University in 1993. After years of travels that included stints in San Antonio, TX and at NIH in Bethesda, MD, Georgel settled into a career at Marshall beginning in 2002.

In addition to research, Georgel has also taken on administrative responsibilities including serving as Chair of the Faculty Senate. As of January 1, 2021, he will be Interim Assistant Vice President for Research at Marshall.

Many challenges await today's students and soon-to-be-graduates with mentorship more important than ever. Georgel knows this. Relocating to another country,

"Do not let yourself be slowed down by the fact that we have difficulties right now."

adapting to a new culture, and learning a new language were all part of his experience. He was fortunate to have a supporter in Dr. Ken E. van Holde, his advisor at Oregon State, someone whom he respected tremendously and considered both a colleague and friend until his recent passing. Perhaps because of this early connection, Georgel speaks and thinks so highly of his own students. Though much is uncertain in this moment, Georgel is encouraged by those following in his footsteps and offers some advice in this unprecedented year.

"Try to find a location where you are comfortable and where you are going to be able to learn what you need to learn to build up into a scientist or a medical doctor," Georgel said. "Do not let yourself be slowed down by the fact that we have difficulties right now."

Photo by Mark Webb Photography

WVU Heart and Vascular Institute cardiologist uses machine learning to predict ventricular disease

Courtesy of **WVU Medicine**

Partho Sengupta, M.D., WVU Heart and Vascular Institute Cardiology division chief and director of cardiac imaging, and an international team of researchers have successfully implemented machine learning as an effective screening tool for early diagnosis of left ventricular diastolic dysfunction (LVDD), a common form of heart failure.

Machine learning uses algorithms that automatically improve and become more accurate over time.

"This research can be used by internists and physicians for early identification of heart dysfunction and to predict the progression of heart disease in order to help patients take action to improve their cardiac health," Sengupta said. "We applied machine learning to the results of an electrocardiogram, a common, cost-effective test used by physicians. We can use that data to extract information that would otherwise come from more expensive imaging tests, using the heart's electrical signals to provide information about the speed with which the heart is squeezing and relaxing."

The researchers used electrocardiogram data gathered from a diverse patient population at risk of heart failure at four centers in North America to develop a predictive model of patient risk. Recent studies suggest that heart failure develops in 50 percent of patients due to the heart's inability to relax. Slower relaxation requires higher pressures to fill the cardiac chamber, despite normal left ventricular ejection fraction, the heart's ability to pump blood out of the left side.

"By taking data from a large sample of patients in varying locations, we are able to gather information that can be applied to people from different locations and backgrounds," Sengupta said. "We know that there are areas that are more likely to have higher incidences of heart disease due to socioeconomic factors that make it difficult to maintain a healthy lifestyle. This research will allow us to develop cost-effective screening tools that

Sengupta

Photo courtesy of WVU Medicine

can be used in community to identify patients at risk even before they develop any symptoms."

This model can be used to determine the patient's current stage of disease such that early interventions can be taken in order to halt the progress or reduce the likelihood of heart failure. It takes into account the patient's age and sex, which can inform individualized risk estimation and interventions for men and women.

Sengupta's work is supported in part by funds from the National Science Foundation. The work is currently posted on the website of the Journal of American College of Cardiology and features Naveena Yanamala, Ph.D., principal data scientist for the WVU Heart and Vascular Institute Innovation Center and Grace Casaclang-Verzosa, M.D., M.B.A., WVU Heart and Vascular Institute administrative director of non-invasive cardiology, among other distinguished international collaborators.

Above: (left to right) Donald Primerano, Ph.D., Jun Fan, Ph.D., and Robin Turner, M.S with the NextSeq 2000

Marshall University brings advanced genome sequencing to the Mountain State

Courtesy of **Marshall University**

Each genome tells a story. Genome sequencing chronicles the ribonucleic acid (RNA) or deoxyribonucleic acid (DNA) that carry an individual's genetic information.

In the Genomics and Bioinformatics Core (GABC) at the Marshall University Joan C. Edwards School of Medicine, researchers use advanced sequencing technology to accurately measure the abundance of messenger RNA (mRNA) in whole transcriptome analyses and discover genetic variants in genomic sequencing studies.

"Findings from studies like these can ultimately lead to new therapeutics or lifestyle modifications that could reverse or mitigate the disease process," said James Denvir, Ph.D., associate professor of biomedical sciences at Marshall and co-director of the GABC. "This type of research also opens the door to more personalized medicine that specifically treats the underlying genetic cause."

The GABC primarily focuses on next generation sequencing, which includes RNA sequencing, whole exome/genome and chromatin studies. Whole transcriptome studies allow investigators to determine the abundance of all mRNAs in a cell or tissue, and therefore, are very useful in discovering genes and metabolic pathways whose regulation is changed by genetic factors, diet or exposure to drugs or other environmental factors. Whole exome and whole genome sequencing can be used to identify genetic variants (e.g. single nucleotide polymorphisms, insertions and deletions) that are present in some individuals but absent in others.

This year, the GABC acquired an Illumina NextSeq 2000 high throughput sequencer with support from West Virginia IDeA Network of Biomedical Research Excellence (WV-INBRE), a National Institutes of Health (NIH) funded program.

"The NextSeq 2000 really puts us on the forefront of high throughput sequencing technology," said Donald A. Primerano, Ph.D., professor and vice chair of biomedical sciences at Marshall and co-director of the GABC. "We're now able to sequence 100 RNA samples, known as libraries, in 19 hours that previously took six days with an older system. The NextSeq 2000 system also allows us to sequence samples at a much lower cost, which is essential in furthering genomic research throughout our state."

The scope of services provided by GABC, however, goes far beyond the advanced technology. Before work begins, investigators meet with GABC staff to discuss experimental design and objectives, technical issues (e.g. biological replicates and input DNA/RNA quality and quantity), probable sequence yields, methods of data analysis and outcomes and overall cost.

The GABC is supported by funding from WV-INBRE grant P20GM103434, COBRE ACCORD grant 1P20GM121299 and the West Virginia Clinical and Translational Science Institute grant 2U54GM104942.

Photo courtesy of Marshall University

WVU Tech instructors secure $1.6 million in NSF funding to expand STEM education in West Virginia

Courtesy of **WVU Tech**

WVU Tech professors across a variety of disciplines have been awarded more than $1.6 million in funding from the National Science Foundation.

The researchers plan to boost STEM education from K-12 through college across two major projects. The first program, "Supporting Undergraduate Scholar Cohorts to Prepare Career-Ready Engineering and Science Graduates," received $650,000 from the Foundation, and plans to address the nation's need for skilled scientists, engineers and technicians.

The five-year effort begins next March and will support high-achieving, low-income students at WVU Tech in the electrical engineering, computer engineering, computer science and information systems programs.

Dr. Kenan Hatipoglu, the project's principal investigaor and an associate professor of electrical engineering at WVU Tech, will be joined by four co-principal investigators, including Dr. Stephen Goodman, interim associate dean, professor and chair of the electrical and computer engineering department; Dr. Sanish Rai, assistant professor of computer science and information systems; Dr. Joan Neff, WVU Tech campus provost and professor of criminal justice; and Dr. Yogendra Panta, associate professor of mechanical engineering.

The second project to land an NSF award is "Secure and Upgrade Computer Science in Classrooms through an Ecosystem with Scalability & Sustainability (SUCCESS)."

With NSF funding in the amount of nearly $1 million, SUCCESS will build on an existing outreach partnership with the West Virginia University Center for Excellence in STEM Education, Code.org, the West Virginia Department of Education and the Raleigh County School District to boost access to computer science learning.

Beginning next June, the three-year program will focus on three key factors in middle school computer science education: increased computer science content knowledge for teachers; structures for principals and counselors to support teachers as they expand access; and increased computer science career awareness for teachers, principals, counselors and students.

Dr. Afrin Naz, project principal investigator and an associate professor of computer science and information systems at WVU Tech, will be joined in this effort by Dr. Gay Stewart, Eberly Professor of STEM Education at WVU in Morgantown and director of the West Virginia University Center for Excellence in STEM Education; and Dr. Mingyu Lu, WVU Tech professor of electrical engineering.

Fairmont State engineering student spends summer rebuilding vehicles

Courtesy of **Fairmont State University**

Fairmont State University engineering student, Jonathan Kostyshak, like many of his peers, has experienced the furthest from a typical senior year.

Kostyshak planned to seek career placements and an internship during the summer months, but no opportunities were present due to the current conditions. Instead of waiting, Kostyshak created an opportunity for himself. He sold his motorcycle and 2012 Ford F-150 to purchase a previously wrecked 2016 Ford F-150 to test his skills.

"The next morning, I found myself driving six hours to Lake Ontario, NY to purchase an entire frame. The following two weeks I worked outside from sunrise to sundown, with help from my father we were able to completely swap everything from one frame to another with no proper lift or tooling," Kostyshak said.

In addition to his impressive mechanical engineering and rebuilding skills, Kostyshak utilized his talents to become an Engineering Graphics Teaching Assistant last spring. He served as the President of the SAE BAJA organization at Fairmont State in 2019, assisting with building the first two vehicles for the club since 2013.

Kostyshak graduated in November with a Bachelor of Science in Mechanical Engineering and Technology.

WVU engineers receive NASA funding to develop 3D printed technology for use in space

Courtesy of **West Virginia University**

A revolutionary 3D printing process for use in future space missions is in development by West Virginia University engineers to provide dexterous assistance to astronauts and for various space station servicing activities.

Thanks to funding from NASA's Established Program to Stimulate Competitive Research (EPSCoR), the researchers will use a new 3D printing process to develop soft actuators – a device that can change shape or size in response to pressure, heat, light or electricity and is an integral component of soft robotic systems – with embedded sensing capabilities.

Kostas Sierros, principal investigator and associate professor of mechanical and aerospace engineering in the Statler College, explained that the project will combine ink extrusion and micro-reactor technologies together, a process that has not been previously demonstrated.

"Space is a largely unknown environment that represents hard constrained design and manufacturing challenges," Sierros said. "We propose to remove such hard design constraints and manufacturing challenges by developing smart, sensing building blocks that are 3D printed."

The $750,000 grant will be used to purchase parts, software, materials and chemicals to carry out project development and research. Engineers at WVU will work with Oregon State University and NASA Langley and Marshall Space Flight Center. The three-year project began in October.

Photo courtesy of West Virginia University

WVSOM researcher studies the effects of poor nutrition during gestation

Courtesy of **West Virginia School of Osteopathic Medicine**

It's been known for some time that "eating for two" during pregnancy doesn't have the benefits it was once thought to have. But a researcher at the West Virginia School of Osteopathic Medicine (WVSOM) is finding that maternal overnutrition can be as harmful for offspring as maternal undernutrition — and that the negative effects can last for generations.

Using various research models, Christopher Pankey, Ph.D., a WVSOM assistant professor of physiology, has shown that mothers consuming either 50 percent ("underfed") or 150 percent ("overfed") of nutritional requirements during pregnancy both produce offspring with increased appetite, dysregulated insulin/glucose dynamics, increased plasma leptin and altered cardiovascular development compared to offspring of mothers whose caloric intake during pregnancy is appropriate. In short, "eating for half" or "eating for one and a half" equally predispose offspring to metabolic complications such as obesity, Type 2 diabetes and metabolic syndrome.

"Whether a mother eats too many or too few calories, her offspring will develop increased risk of metabolic diseases," Pankey said. "In addition to affecting maternal and fetal health, we've shown that signs of metabolic diseases are also present in grandchildren and great-grandchildren, even when all descendants eat a proper diet."

The findings were published as "Maternal Nutrition and Metabolic Outcomes of Offspring" in the International Journal of Environmental Research and Public Health. The indicators of metabolic diseases that show up in adult offspring are not always present at birth, Pankey said.

"Offspring of obese mothers were 30 percent heavier than controls halfway through gestation, and offspring of undernourished mothers were 30 percent lighter than controls halfway through gestation," he said. "Since they're born at similar weights, that means both groups experienced a period of nutrient restriction at some point during gestation. We believe this to be a mechanism that results in similar outcomes for both groups."

The maternal system simultaneously responds to the stresses of improper diet in both underfed and overfed groups, which induces a stress response in the maternal system, Pankey explained.

"Maternal stress can be quantified by looking at signals such as cortisol, which is often referred to as a stress hormone but also plays roles such as regulating blood sugar and driving the development of cells and tissues. When the mother is stressed by a poor diet, her body responds by releasing cortisol, which makes its way to the fetus and results in developmental changes that predispose it to metabolic problems."

Pankey's study is the latest obesity-related research in work he began as a student at the University of Wyoming, where he served as a research assistant at the school's Center for the Study of Fetal Programming, and during postgraduate work at the U.S. Department of Agriculture Human Nutrition Research Center in Grand Forks, N.D., where he studied signaling mechanisms that occur in the body during exercise.

At WVSOM, Pankey is following up on his research through the investigation of diet and exercise. He said that with obesity and associated conditions on the rise, studies that examine what happens within the body to bring about, or to limit, those problems are more necessary than ever.

"Undernourished mothers remain a significant public health problem, and rates of obese women entering pregnancy are increasing. Both scenarios contribute to ever-increasing global rates of obesity. If my work can promote better health outcomes for the population, that's a success."

Pankey's research was supported by a National Institutes of Health grant (HD070096-01A1) and a University of Wyoming IDeA Networks of Biomedical Research Excellence grant (P20RR16474).

Photo courtesy of West Virginia School of Osteopathic Medicine


Allen

Concord first primarily undergraduate institution in WV awarded NSF REU

Concord University will serve as the lead institution for a National Science Foundation (NSF) Research Experiences for Undergraduates (REU) program award totaling $380,000 that will fund student field research on the west coast of Greenland. Dr. Joseph Allen, professor of geology and department chair at Concord, will lead the project.


McKeen

Fairmont State graduate and local teacher recipient of Presidential Excellence Award

Dr. Angela McKeen, geoscience faculty member at Fairmont State University, received a Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. Nominations and awards are facilitated by the White House Office of Science and Technology Policy (OSTP) and the National Science Foundation.

Photos courtesy of Concord University, Fairmont State University, West Virginia University Institute of Technology, West Virginia State University


Panta

WVU Tech Fulbright recipient to focus on engineering education in Nepal

Dr. Yogendra Panta, associate professor of mechanical engineering at West Virginia University Institute of Technology (WVU Tech), received a grant from the Fulbright Grant Program in March. Panta will work in Nepal exploring methodologies for teaching, mentoring and research beginning in May 2021.


West Virginia State University campus

WVSU student group wins Outstanding Chapter of American Chemical Society

West Virginia State University's student chapter of the American Chemical Society received the Outstanding Chapter and Green Chemistry Student Chapter Awards from the national organization. In 2019-2020, students regularly visited schools to teach science while also helping STEM-related activities on campus.

COMMENTARY: Kristen Hammer

Virgin Hyperloop is coming to West Virginia

Virgin Hyperloop, the leading company in this revolutionary new technology, has selected West Virginia as the location for our Hyperloop Certification Center. Hyperloop is a new mode of transportation that consists of an autonomously controlled pod carrying passengers or cargo, which travels inside of a partially evacuated tube using electric propulsion and with the aid of magnetic levitation. At speeds reaching up to 670 mph, a hyperloop system can connect cities and regions in a way completely unique to the transportation systems of the United States and other parts of the world, but in a way which integrates smoothly into existing infrastructure. The technology is direct-to-destination, on-demand, and creates zero direct emissions – key elements of a 21st century transportation solution.

Virgin Hyperloop first tested our technology in 2017 at our full-system test facility in North Las Vegas, Nevada and we have since run hundreds of tests. Recently, on November 8, 2020, we hit a major milestone to become the first hyperloop company in the world to run passenger tests. The Hyperloop Certification Center, which is intended to be completed in the mid-2020's, will bridge the gap between the testing completed at our Nevada facility and full commercial hyperloop operations. At the same time, we are working with the U.S. Department of Transportation and other regulators around the world to build a regulatory framework for this new technology.

One of Virgin Hyperloop's goals – and one of my personal goals - is to inspire the next generation of STEM leaders, just like the moon landing did decades ago. We have worked with several STEM outreach initiatives in our home city of Los Angeles, and have also partnered with COSI in Columbus, OH on a STEM education initiative. The Hyperloop Certification Center is another excellent opportunity for us to connect with future technology leaders. As we dive into the detailed design of the West Virginia Hyperloop Certification Center, we are exploring ways to connect with the state's current (and budding) engineers, scientists, and innovators. The future of transportation is here – and it's all starting in West Virginia!

Photo courtesy of Virgin Hyperloop

VIRGIN HYPERLOOP FAST FACTS

6X MAX GRADE CAPABILITY
Climb grades up to 10% with a velocity of 100m/s due to our propulsion power. That's more than a 6x improvement over high speed rail.

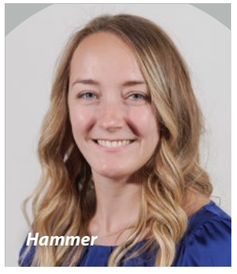
4.5x Tighter Turning Radius
Near-zero lateral acceleration, allowing high speeds with a turning radius capability of 1.36km at 100m/s.

1/2 Tunnel Cost
By virtually eliminating aerodynamic drag, the hyperloop can have a cross-sectional area ~1/2 that of high-speed rail and therefore close to half the cost.

Smaller ROW Requirements
Right-of-way requirements range from 12-24m across, a significantly smaller ROW than the 18-30m needed for high-speed rail.

Speed
Propel passenger or cargo pods at speeds of over 1000 km/h. That is 3x faster than high-speed rail.

From VirginHyperloop.com


Hammer

Kristen Hammer is a business development manager for Virgin Hyperloop. Leveraging her background in engineering, Kristen bridges the business and engineering sides of the house to advance hyperloop certification and project development. A Columbus native, she earned a degree in welding engineering from The Ohio State University.

West Virginia Science & Research
West Virginia Higher Education Policy Commission
1018 Kanawha Boulevard East, Suite 700
Charleston, W.Va. 25301
304.558.4128 | wvresearch.org

PRST Standard
U.S. Postage
PAID
Charleston, WV
Permit No. 271