Machine that oxygenates blood may help critically ill COVID-19 patients, according to WVU study

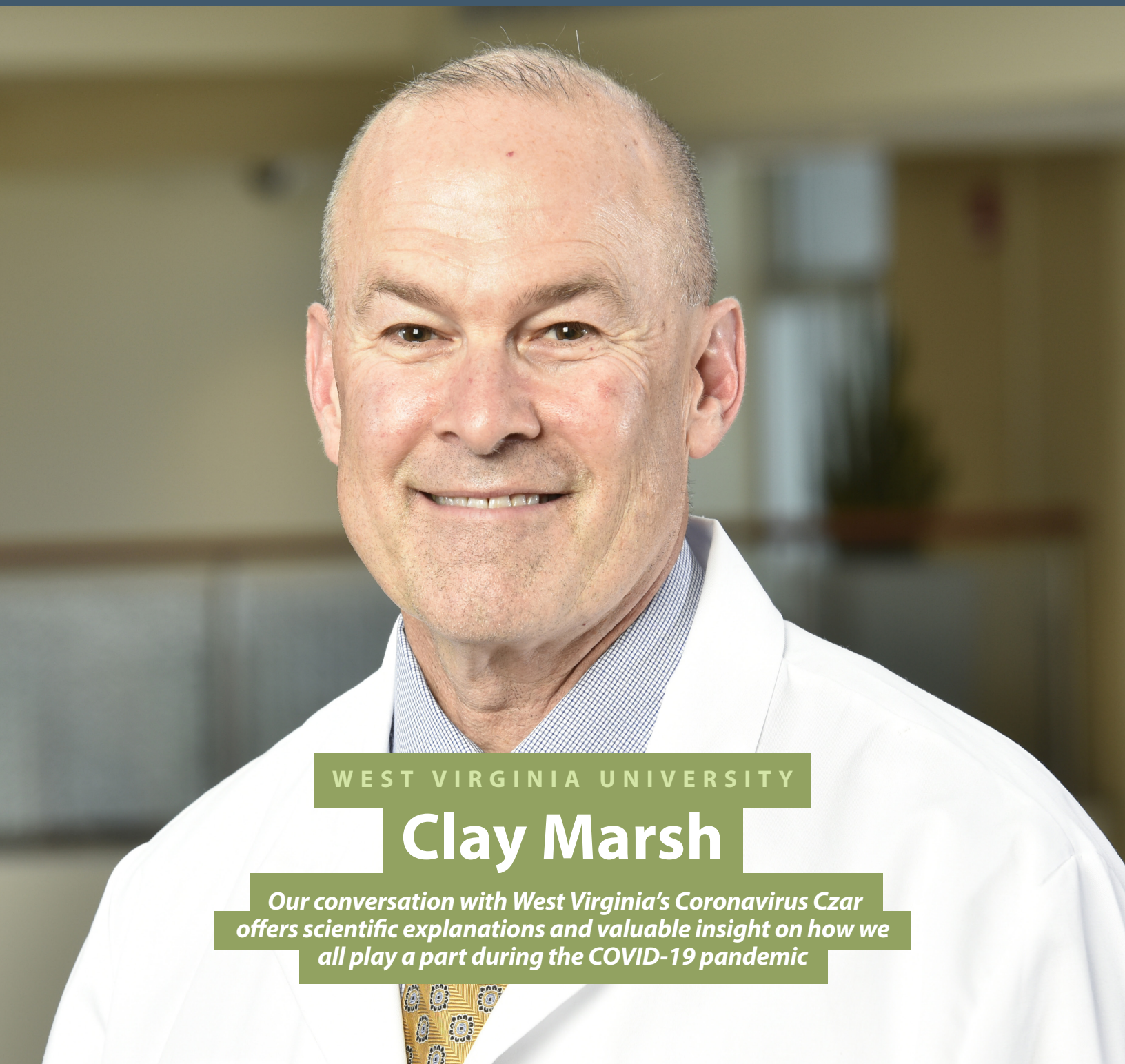
West Liberty researcher plays part in rapid COVID-19 test

Environmental conditions found to affect stability of COVID-19 virus, says Marshall researcher

NEURON

West Virginia's Journal of Science and Research

SPECIAL ISSUE 2020



WEST VIRGINIA UNIVERSITY

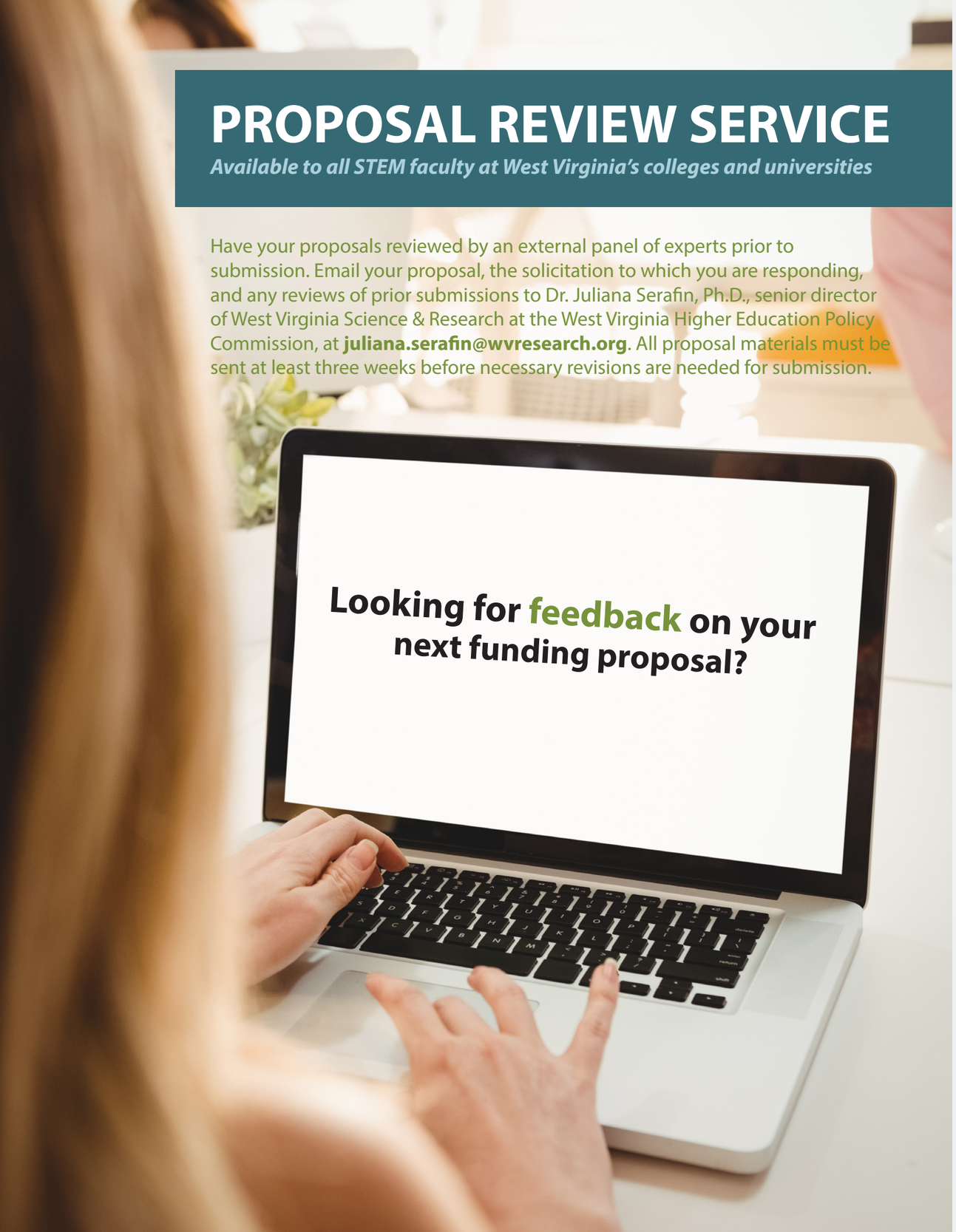
Clay Marsh

Our conversation with West Virginia's Coronavirus Czar offers scientific explanations and valuable insight on how we all play a part during the COVID-19 pandemic

PROPOSAL REVIEW SERVICE

Available to all STEM faculty at West Virginia's colleges and universities

Have your proposals reviewed by an external panel of experts prior to submission. Email your proposal, the solicitation to which you are responding, and any reviews of prior submissions to Dr. Juliana Serafin, Ph.D., senior director of West Virginia Science & Research at the West Virginia Higher Education Policy Commission, at **juliana.serafin@wvresearch.org**. All proposal materials must be sent at least three weeks before necessary revisions are needed for submission.



West Virginia Science & Research

SPECIAL ISSUE 2020

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

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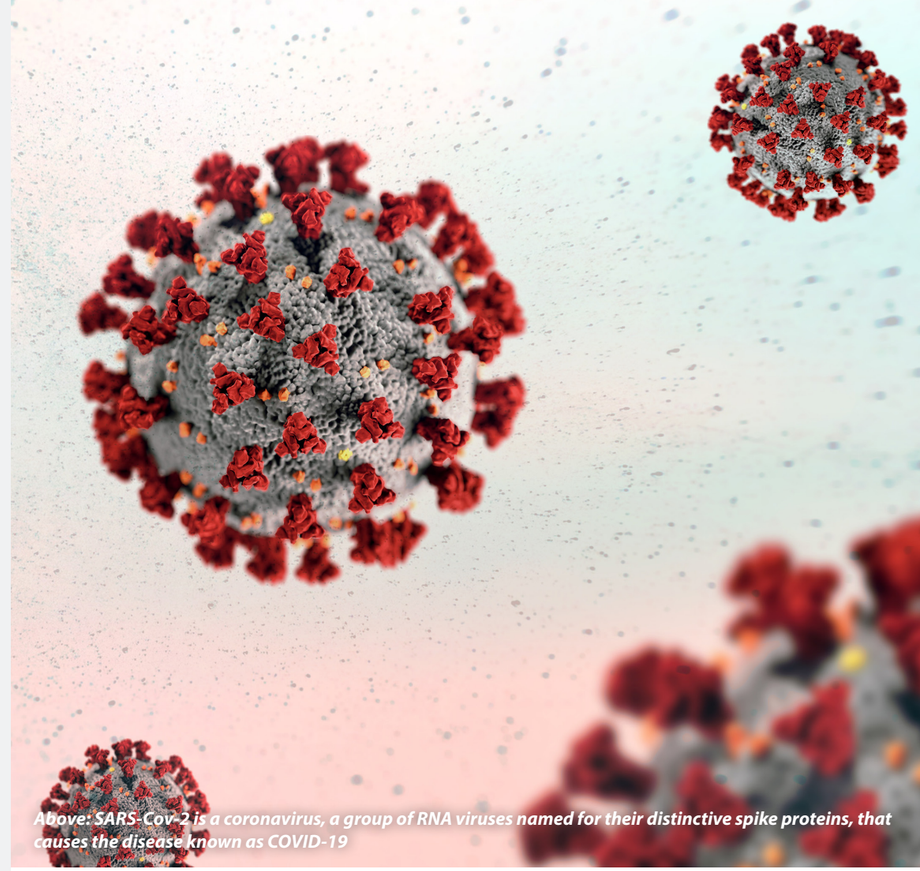

Above: SARS-Cov-2 is a coronavirus, a group of RNA viruses named for their distinctive spike proteins, that causes the disease known as COVID-19

News briefings

Morgantown biotech accepted into prestigious UC Berkeley SkyDeck Accelerator Program

Morgantown-based biotechnology firm IstoVisio, Inc., developer of scientific data visualization and annotation system "syGlass," announced it has been accepted into the prestigious University of California at Berkeley SkyDeck Accelerator program.

The company is one of 26 firms to be accepted into the program out of 1,600 applicants.

IstoVisio will receive a $100,000 investment from the Berkeley SkyDeck Fund, will be paired with key advisors, go through the six-month Berkeley Acceleration Method Program and receive guided access to the SkyDeck community including Silicon Valley investors and venture funds.

Since 2012, companies affiliated with SkyDeck have raised $1.2 billion.

"This is a major step forward for our company and a validation of our syGlass system, which is a technology that allows massive images to be viewed in high-res virtual reality," said Michael Morehead, chief executive officer of IstoVisio.

"syGlass allows users to view 3D image stacks, like CT, MR, and PET scans inside of an immersive virtual reality (VR) environment. Inside of syGlass, these scans are stacked up to represent the original 3D object and appear as a hologram to the user. Exploring this data in VR allows new insights previously unseen on 2D monitors."

Morehead announced the firm has also been awarded a Direct-to-Phase II, two-year, $1.6 million Small Business Innovation Research (SBIR) grant through the National Institute of Mental Health of the National Institutes of Health BRAIN Initiative.

Under the grant, IstoVisio will conduct research and develop products that dramatically increase useful yield of 3D microscopy. The goals will bring state-of-the-art technologies to every step of the image acquisition and processing pipeline.

Under the SBIR program, intellectual property garnered through the research is the property of IstoVisio and can be commercialized for the company's use.

The company's syGlass technology is now used in more than 100 international research institutions, including Harvard, Johns Hopkins, Institute de la Vision in Paris, and multiple Max Planck institutions. The company also received the 2019 Governor's Commendation for International Market Entry Award for sales to the following new countries: Australia, Germany and the United Kingdom.

IstoVisio has partnered with Ector County ISD of Odessa, Texas to bring syGlass to the K-12 market. Ector is purchasing four copies to connect their students with ongoing scientific research studies. The students will annotate data for the scientists, and get to experience cutting-edge research work, all in virtual reality.

Community members band together to provide masks for frontline workers

Dr. Suzanne Strait, Ph.D., a biology professor at Marshall University and director of West Virginia Science Adventures, founded the West Virginia Mask Army in March 2020 as a response to the shortage of personal protective equipment (PPE) for frontline workers.

Strait teamed up with former students Patricia Rogers and Dr. Rose Ayoob, as well as Dr. Hilary Brewster from Marshall's Department of English, to organize a team to work separately and sew masks for local hospitals in need.

The group initially created masks out of furnace filters as a N95 alternative, but have since switched to multilayered, rewashable, cotton-based masks with filter pockets.

For more information, visit their website at westvirginiamaskarmy.com or on Facebook at "West Virginia Mask Army."

FROM THE DIRECTOR: Juliana Serafin

We hope this issue finds you safe and well


Serafin

Photo courtesy of University of Charleston

Welcome to this special double-issue of the Neuron featuring an interview with Dr. Clay Marsh, West Virginia's Coronavirus Czar. We're grateful to Dr. Marsh for taking time out of his busy schedule to be interviewed by Communications Manager Angela Sundstrom. We've also featured important work going on at the state's universities that help treat patients with COVID-19 and allow us to better understand the virus through basic research. We hope this issue will give you more information about the virus and how West Virginia is being impacted by it.

Like everyone in the state, our lives have been changed by the pandemic. At West Virginia Science & Research, we've been lucky to be able to keep our momentum going in spite of not being able to work in our offices since mid-March. While we've all had our routines turned upside down, on the positive side, we've all learned to be more flexible and understanding of the needs of those dealing with health and family issues. We also realize that there are huge changes and specific challenges for both our K-12 and higher education students.

Now, more than ever, science is important to quality of life. Science and research have the potential to help us get through the pandemic faster and with less loss of life. The development of COVID-19 testing methods and vaccines will play a key role in what happens in the next six months.

Finally, we hope this issue finds you and your family healthy and safe. We are grateful to those who serve our country and our state as essential workers, and especially those who use their science and health care skills to help society deal with crises like COVID-19. Stay safe.

Julie

Dr. 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.

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“It’s interesting that in China, where the virus first started at a market in Wuhan, it was really a disease that looked like it created more problems in the lungs. In the United States, it looks like this is presenting as more of a blood vessel disease...”

- Dr. Clay Marsh, M.D.

Photo: Adobe Stock

Above: In order to limit the spread of COVID-19, face masks have become a normal part of life in 2020

A Conversation with the Coronavirus Czar

Clay Marsh offers scientific explanations and valuable insight on how we all play a part during the COVID-19 pandemic

Edited by **Angela Sundstrom**

The following article features Dr. Clay Marsh, M.D., vice president & executive dean for health sciences at West Virginia University and coronavirus czar for the State of West Virginia. This conversation is based off of multiple phone and email correspondences that occurred throughout the summer of 2020. It has been edited for length and clarity.

***Question (Q):* What do we currently know about COVID-19 and how it affects the body?**

Answer (A): COVID-19 is a novel, or new, coronavirus. Under a microscope it looks like a crown or a sun with little spiky projections, which are the spike proteins. Those spiky proteins are the way the virus enters our bodies. This coronavirus does not have the capability to reproduce in our bodies so it binds to cells in our nose or the back of our throat and enters these cells to replicate. The virus will then bind and be taken up into human cells using specific receptors, called the angiotensin converting enzyme-2 (ACE-2) receptors, mediated by these spiky proteins on the virus. After 24 hours, the virus multiplies in our cells from one copy to ten thousand copies. If it’s not sequestered and limited to that upper airway or the back of the nose or the back of the throat, then by four days, or so, you can have over 100 million copies in a teaspoon full of blood.

Photo courtesy of West Virginia University

What we’ve found is that in many people the coronavirus causes a flu-like syndrome and people get better, but about 5-10 percent end up in the hospital while 2.5-5 percent might end up in the intensive care unit or die.

This novel coronavirus appears to have a predilection for being more severe in people that are older, have preexisting disease in our bodies, in our lungs, hearts, blood vessels or have obesity, diabetes or high blood pressure. It’s interesting that in China, where the virus first started at a market in Wuhan, it was really a disease that looked like it created more problems in the lungs. In the United States, it looks like this is presenting as more of a blood vessel disease causing problems in a lot of organs because the blood vessels are what delivers the oxygenated blood to the different organs.

***Q:* Are there any symptoms specific to infected patients in West Virginia?**

A: The loss of smell and taste – called anosmia - is a symptom that is pretty specific for COVID-19. It appears the virus can directly infect the olfactory nerve which is where we get our sense of smell. The sense of taste is largely driven by our ability to smell.

***Q:* What makes this coronavirus different than others?**

A: We do have several types of coronaviruses that cause just colds, as well as coronaviruses that caused life-

threatening problems in people. The two coronaviruses that caused life-threatening problems in people recently are severe acute respiratory syndrome (SARS) and middle east respiratory syndrome (MERS), which were largely seen in Asia. COVID-19 is not as deadly to humans as SARS or MERS, but has a unique ability to spread from people who are asymptomatic or presymptomatic, which makes controlling the spread of this novel coronavirus very difficult. Right now, we are trying to exist with COVID-19, but to be a successful virus, and many viruses have lived with humans for millions of years, COVID-19 will need to exist with us. Thus, COVID-19 should get less toxic over time to live in harmony with humans. The two other coronaviruses mentioned, SARS and MERS, are really quite deadly to humans. You couldn't communicate them until you got sick so it was pretty easy to identify the people and isolate them which caused those two infections to kind of go away. COVID-19 is different and more challenging to control its spread right now.

***Q:* How has COVID-19 affected various demographics in our state, including minority populations?**

A: When we look at the initial part of the pandemic in China and then in a disproportionally affected country like Italy we generally saw older men, often times who had histories of smoking, succumb to this disease at a much greater level both in getting sick enough to go to the hospital and also dying in the hospital. When it came over to the U.S., we started to see things a bit different. This was no longer just a disease of older people. It is also a disease of younger people. We've seen things like this multisystem inflammatory syndrome in children (MIS-C) that resembles Kawasaki's Disease. This disease is likely a manifestation of the immune response against the virus. We have one documented case in West Virginia.

In West Virginia, we have seen more women affected. Although our state has seen relatively fewer cases than many other places in the U.S., we have seen about 53 percent of our deaths come from nursing homes or long-term care facilities.

In the U.S., there is a disproportionate mortality rate among African Americans and Latinos as well. We are mostly a Caucasian population in West Virginia, on a percentile basis, but when we look at African Americans, we see a disproportionately high share of African Americans in West Virginia that test positive for COVID-19 versus the percent of the West Virginia population. We want to make sure that we are screening and identifying people that might be at risk in all populations, but particularly these vulnerable populations so that we can intervene early and try to prevent infection of anybody susceptible to worse outcomes and to be able to help them navigate through that journey if they are found to be positive. To accomplish this and to get valuable input, the West Virginia Department of Health and Human Resources has organized a task force with African American leaders.

***Q:* What additional risks are there for chronically ill people? What is classified as chronically ill? What precautions should they take?**

A: There appear to be different risk factors today than we appreciated when the pandemic started. We saw this from people in New York City that looked at the characteristics of the folks in their intensive care units (ICUs). In the U.S., we still see the impact of age. Certainly, being over 70 years old and infected is a substantial predictor of bad outcomes, but the folks in New York reported more people with blood vessel-like high blood pressure. Obesity and diabetes are also predictors. We know today that COVID-19 can directly infect the heart and can cause heart inflammation, called myocarditis. COVID-19 can also cause brain issues. We have seen acute strokes and in some, a longer-term issue of clear thinking after infection. Blood clotting is also seen in the heart, giving heart attacks, in the blood vessels of the lung, giving pulmonary emboli and in the blood vessels of the kidneys, giving renal failure. It appears to be more related to preexisting risk factors for having blood vessel problems.

We also know that COVID-19 leads to more severe illness in people that smoke, vape or use e-cigarettes, especially in children. Smoking leads to a 33 percent increased risk of severe disease in children. West Virginia has significant exposure to cigarette smoking as well as existing blood vessel problems related to heart disease, high blood pressure, diabetes and obesity. All are substantial risk factors for hospitalization, ICU admissions and even death.

***Q:* Can you explain the modeling that you have been following?**

A: One of the challenges with modeling is it that these mathematical approaches use certain assumptions and try to project outcomes based on these assumptions. For instance, the University of Washington has a modeling site that a lot of people follow. Modeling systems use projections of how different mitigation measures will work, like masking, stay-at-home orders, travel restrictions, etc., and then use a mathematical set of equations to predict outcomes. The problem is that in real life, these assumptions are not always valid and mitigation measures may not have the same impact on all populations. As the model evolves and gets feedback from what really happens versus what the model predicted would happen, it continues to look at the assumptions and equations and changes them. That really became a challenge. A model, to me, is good for following trends, but not as good at predicting precise outcomes.

The R0, or R-naught, is a measure to detail the rate of spread person-to-person in a community, county or state. It is used at the beginning of an outbreak and presumes there is no one who is immune to the virus at the beginning. Once the virus circulates, we use instead the Rt value - the reproductive rate at the time measured - to measure spread. Any value of the Rt above one means the virus is spreading, and less than one means the virus spread is actively contracting. The website, rt.live, details this at a state level daily that many people follow.

We are using our own internal testing of Rt that extends to each county. We have separated community compared to congregate spread in our overall analysis, which includes our Rt values. The goal of our approach is to identify counties with increasing spread, or Rt values going up, and calculate the rate of new cases we see daily in these counties over a seven-day rolling average. This incidence rate is also found in the Harvard Global Health Institute COVID-19 data. Using these measures in aggregate, we can identify counties with higher spread that we can respond in a more precise way to reduce spread and protect citizens.

Reopening our state and schools with COVID-19 is an unprecedented challenge. There is no playbook or experience set that tells us what to do. Working together, following these metrics, intervening in counties with more COVID-19 activity by reducing person-to-person spread using masks, physical distancing and targeting the drivers of COVID-19 spread in these affected communities are the biggest health challenges West Virginia, our nation and world has ever faced.

"COVID-19 is not as deadly to humans as SARS or MERS, but has a unique ability to spread from people who are asymptomatic or presymptomatic, which makes controlling the spread of this novel coronavirus very difficult."

***Q:* Can you offer a general overview of the vaccine development and production process?**

A: There are several ways to generate a vaccine. One way to do it is to take the virus, kill it and then inject it. Another way is to use a part of the virus that does not cause infection. New approaches are to inject genetic material that allows production of the part of the virus we want people to respond to be produced in the human body. This an advantage of approaches to COVID-19 – we know which part of the virus we need people to respond to immunologically. It is the spike proteins. All COVID-19 vaccines are targeting this part of the virus to create an immune response. You want the body to respond to these spike proteins so when the real infection comes, we will block the interaction of the spike protein of the virus with the ACE-2 receptors of our body. This will allow us to reject and control the virus.

Another issue is you need something immunogenic that induces a response from a lot of people, but is not toxic. Some vaccines can induce such an inflammatory response that getting enough of the dosage into people to produce an immune response becomes problematic due to side effects. This may contribute to the side effect that led to stopping the AstraZeneca trial, temporarily.

In some experiences, like with the human immunodeficiency virus (HIV), the vaccines that were injected affected the immune system in a negative way and made it easier for the virus to survive. Sometimes you can get a backwards or opposite impact. Rather than making the body's defenses stronger, you make the defenses weaker and allow the virus to move forward.

The challenge with all of these approaches and

the reason that it takes a long time is because sometimes the virus changes. To this end, we have reported the first two documented cases of people being reinfected with COVID-19. This suggests that immunity will need to be reactivated yearly, like we see with the flu. With the influenza virus, the vaccine changes year to year.

Even if we do define a vaccine – and there is a big race to do that – we have to be able to ramp up and scale that for millions of people. It takes a while just for the production and manufacturing. We also need to make sure that enough time is given between the end of the trial for these new vaccines and time to make sure they work and that there are no side effects that occur after injection.

A lot of details must be worked out. The fastest vaccine so far in history has been four years, which was for polio. Now, we are talking months. The hope is that next year or so, maybe more or less, you will get a vaccine that works. Then, manufacturing and delivering to the most vulnerable who might have the highest risk of a bad outcome and to critical front-line workers who need to remain at work during this unfolding pandemic.

***Q:* What would you say to those who are hesitant or opposed to vaccinations?**

A: I am a huge immunization fan. I think vaccines in the westernized world have been the single most important public health measure of all. Vaccines have allowed our developing world to not be burdened by polio, diphtheria, smallpox and other illnesses that used to be death sentences.

We want to recognize the rights of people. Some people do have allergies that prevent them from taking vaccines. However, it is not just about taking care of yourself, but about protecting other people around you. If you are vaccinated, you become much less likely to spread COVID-19 or measles or mumps or whatever you are vaccinated against. You are not only protecting yourself, you are protecting others, and I think that is what's really important to recognize.

Below: A healthcare professional administers a COVID-19 test via nasal swab

Photo: Adobe Stock

***Q:* What about antibody testing?**

A: One of the challenges came from the federal government not wanting to stand in the way of progress. The challenge is because of some delays in testing, the U.S. Food and Drug Administration (FDA) and federal government said we will try to accelerate the new antibody test to see if someone had COVID-19 as a way to help people feel safer and to understand how we can get our economy going again. The problem with that was many companies came forward without having the right level of accuracy. If the amount of COVID-19 in your community is really low, then a positive test becomes just as likely a false positive test. The pretest probability is influenced by the amount of disease you have in your community. As we go forward, we want to make sure we are creating antibody tests where a positive is really, truly a positive. We have to understand that if the antibody test isn't really, really, really good at detecting only COVID-19, then you are going to end up with an inaccurate assessment of how many people have actually had this virus and recovered.

***Q:* What is your advice to West Virginians anxious about the future?**

A: Although we have seen a recent upturn in the spread of COVID-19 in West Virginia, we are still a very safe place relative to many others as far as number of deaths and cumulative rate of positives. We have aggressively tested our citizens and have been able to stay together as a community and state during this unprecedented time. However, we are seeing our Rt values become the highest in the nation, which shows that COVID-19 is spreading in West Virginia, as in many other rural communities of our nation. We need to be smart – wear your masks, stay six feet away from others, avoid crowds, indoor locations and close contact with those you do not live with in your home. Stay home if you can and if you are ill. Protect yourself and each other. We have persevered in other challenging times and the caring and love we have for each other is our secret weapon. We continue to have the power to slow and stop COVID-19 spread by reducing the person-to-person spread as outlined above. But we also know that people are tired of this approach and yearn to be together, back in school, back to sports and to the things we deeply value. We call on our citizens to be leaders and remain a beacon for others. It is our time to shine, West Virginia and the brightest light comes from all of us, together.

STAY INFORMED AND IN TOUCH
- Get up-to-date information from public health officials
- Create a list of local organizations you and your household can contact for resources and support
- Create an emergency contact list

PREPARE FOR POSSIBLE ILLNESS
- Consider household members with increased risk for severe illness
- Choose a room in your house to separate anyone who becomes sick

TAKE PREVENTATIVE ACTIONS
- Wash your hands
- Avoid touching your eyes, nose and mouth with unwashed hands
- Stay at least six feet from other people
- Stay home when sick
- Cover your cough or sneeze with a tissue, then throw the tissue away
- Clean and disinfect
- frequently touched objects and surfaces
- Wear a mask out in public

GENERATIONS IN THE HOUSEHOLD
- Those who are at an increased risk for severe illness must take additional precautions
- Make sure you have access to several weeks of medications and supplies
- Stay at home if possible
- Notify your child's school or daycare of sickness
- Take care of the emotional health of your household, including yourself

PETS IN THE HOUSEHOLD
- Do not let pets interact with outside people

WHAT TO DO IF YOU ARE SICK
- Stay home except to get medical care
- Separate yourself
- Monitor symptoms
- Call ahead for doctor visits
- Avoid sharing items
- Clean surfaces

From the Centers for Disease Control and Prevention via the West Virginia Department of Health & Human Resources website

Above: Sometimes the lung function of COVID-19 patients deteriorates so much that even ventilators can't save them. In that case, extracorporeal membrane oxygenation machines may keep them oxygenated enough to survive. New research out of WVU provides insight into which COVID-19 patients tend to fare better on ECMO than others. Here, members of the research team—Jeremiah Hayanga (second from left) and Vinay Badhwar (third from left)—work with their colleagues at the WVU Heart and Vascular Institute to treat a patient using ECMO.

Machine that oxygenates blood may help critically ill COVID-19 patients, according to WVU study

Written by **Stacey Elza**

When COVID-19 patients are critically ill, the biggest threat to their lives is lung dysfunction. If their lungs don't work, their blood can't circulate enough oxygen to the brain, the liver and other organs.

A cohort study out of West Virginia University suggests one piece of life-support equipment—an extracorporeal membrane oxygenation machine—can be especially useful for treating some of these COVID-19 patients. But ECMO may be less helpful for COVID-19 patients who are older, who have preexisting conditions and whose heart function has deteriorated. The findings appeared in ASAIO Journal.

An ECMO machine works by pumping someone's blood outside of their body, oxygenating it and returning it to the body. In this way, the ECMO machine gives the lungs—and sometimes the heart—time to rest and heal. It can keep some patients alive when ventilators alone aren't enough.

The research team analyzed 32 COVID-19 patients with severely compromised lung function who were supported with ECMO.

At the time of the researchers' analysis, 22 of the patients—or 68 percent—had survived. Of those 22 patients, 17 were still on ECMO. Only five had been removed from ECMO and lived.

Those five patients had something interesting in common: they all received a kind of ECMO that supports the lungs but not the heart. None of the patients who had lung and heart ECMO support had been removed from ECMO successfully yet.

This disparity probably exists because patients who got ECMO support for both their heart and lungs were sicker to begin with, and their heart function was more compromised.

Insights like these help clinicians to "counsel patients and family members about the individualized risks and benefits of ECMO," said Jeremiah Hayanga, WVU's director of ECMO and a research team member.

The team also included Vinay Badhwar, the executive chair of the WVU Heart and Vascular Institute, and Jeffrey Jacobs, a consultant to HVI and a non-faculty collaborator with the School of Medicine's Department of Cardiovascular and Thoracic Surgery.

"Patients whose disease is restricted to the lung have been shown to have better survival, and this is indeed true for all indications of ECMO," Hayanga said. "When both heart and lung function are impaired, however, there is a reduction in survival, and selection in these patients warrants even greater scrutiny."

Steroids might also improve COVID-19 patients' outcomes. Of the five patients successfully removed from ECMO, four had been receiving steroids through an IV. This discovery contradicts earlier findings out of China, which suggested steroids might do more harm than good.

Photo courtesy of West Virginia University

West Liberty researcher plays part in rapid COVID-19 test

Written by **Maureen Zambito**

In the fight against COVID-19, teamwork is crucial. No one knows this better than West Liberty University (WLU) alumnus Fred Kinder, who owns a medical device company known as eHealthcare.

A resident of California, Kinder worked with his alma mater and others to bring a rapid test to West Virginia.

Kinder does business throughout Asia and was familiar with a rapid test developed in China by Ustar. This test detects pathogenic microbes, such as COVID-19, from patient samples in a matter of minutes.

"This is a state-of-the art test capable of rapidly detecting COVID-19 without the need of extracting the viral genetic material or any additional tedious steps," said Dr. Joseph Horzempa, Ph.D., a biology professor at WLU.

Horzempa, a microbiologist who was named West Virginia Professor of the Year in 2018, has gained national attention for his research.

The teamwork began when Horzempa was approached by Karen Kettler, dean of the WLU College of Sciences, and asked him to help Kinder complete the U.S. Food and Drug Administration (FDA) permit documents to acquire a rapid COVID-19 test system used in China and bring it into the U.S.

"This began back in February, when Fred thought that with the impending infection likely to be spread to the U.S., it would be a good idea to increase the supply chain of detection systems in the USA," Horzempa said.

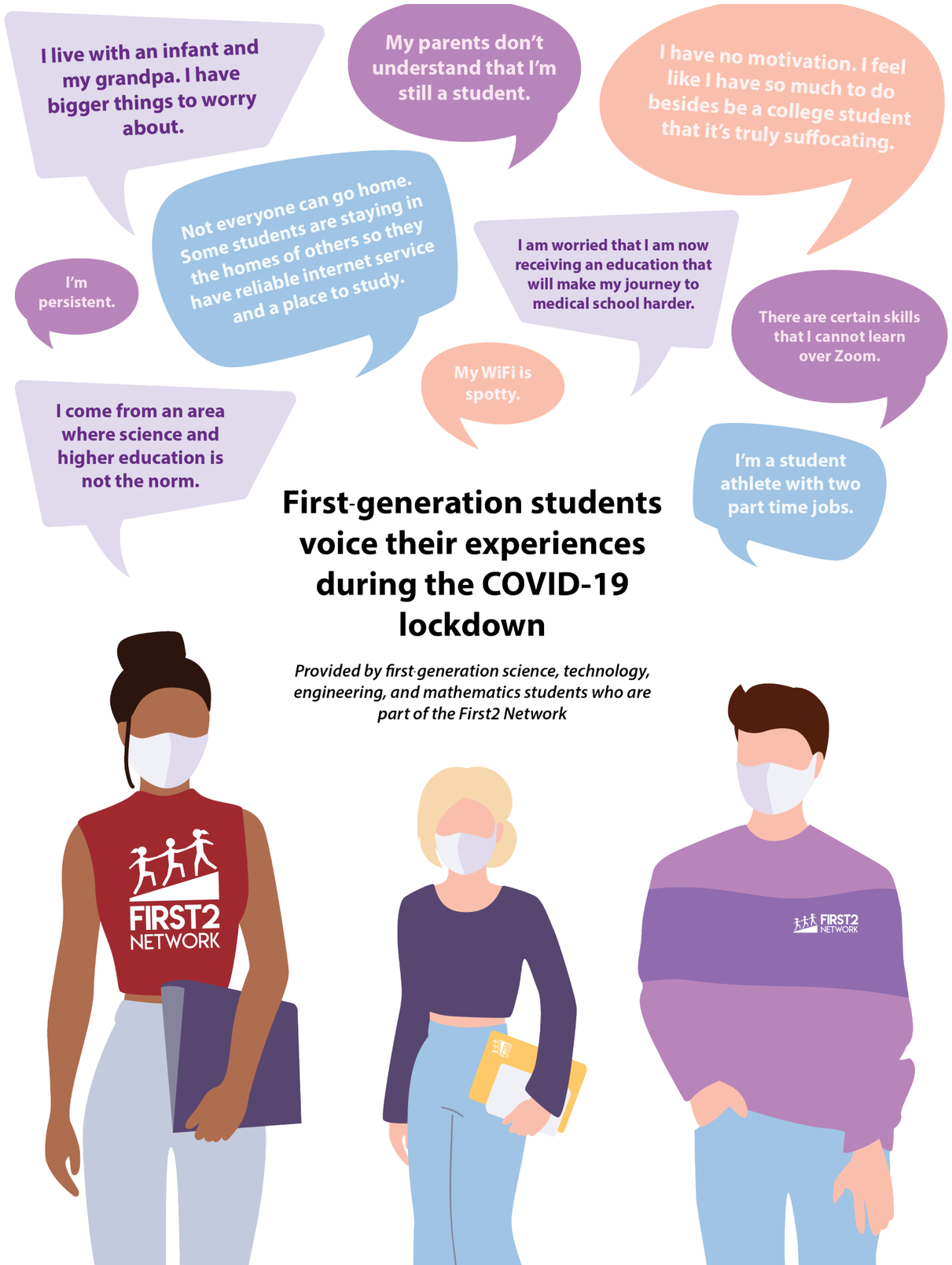
International student Yijing Shen, who graduated from WLU in December 2019, helped translate the Chinese documents given to the WLU team by Ustar into English. Once Kinder and Horzempa had the translated text from Shen, and the documentation from Ustar, the technical molecular biology portions were added by Horzempa.

"This couldn't have been accomplished without the excellent teamwork of West Liberty University's professors, administration and Chinese student Yijing Shen," Kinder said. "It is quite a process."

But the task wasn't complete yet. Kinder still needed a clinical lab to validate the test.

"Once we received word that the FDA approved shipment of the device and test kits to the U.S., we had to find a certified clinical lab to validate the test. I contacted my colleague at Marshall University, Donald Primerano, Ph.D, who I worked with through the NIH-funded WV-INBRE program. Don put Fred into contact with Microbiology Section Chief Traci Schauer, MLS (ASCP) at Cabell Huntington Hospital – which is affiliated with Marshall University Joan C. Edwards School of Medicine. Traci showed interest in receiving the system and test kits to validate the Ustar system," Horzempa said.

"After months of interpreting guidelines, the process is almost complete," Kinder said. "After we obtain the emergency use authorization (EUA) number, we can then get point of care approval for clinics like the one in WLU."



Environmental conditions found to affect stability of COVID-19 virus, says Marshall researcher

By **Sheanna Spence**

A study led by Marshall University researcher M. Jeremiah Matson found that environmental conditions affect the stability of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in human nasal mucus and sputum.

Matson, the lead author on a study published in June 2020 as an early release in Emerging Infectious Diseases, the journal of the Centers for Disease Control and Prevention (CDC), is a student in the combined Doctor of Medicine and Doctor of Philosophy in Biomedical Research program at the Marshall University Joan C. Edwards School of Medicine.

SARS-CoV-2, the virus that causes the disease known as COVID-19, was found to be less stable at higher humidity and warmer temperatures. In the study, SARS-CoV-2 was mixed with human nasal mucus and sputum specimens, which were then exposed to three different sets of temperature and humidity for up to seven days. Samples were collected throughout the study and analyzed for the presence of infectious virus as well as viral RNA alone, which is not infectious. Viral RNA was consistently detectable throughout the seven-day study, while infectious virus was detectable for up to approximately 12-48 hours, depending on the environmental conditions.

"The COVID-19 pandemic has been a sobering reminder that infectious diseases continue to be a major public health threat and require sustained research commitment," Matson said. "While this is a small study that only addresses the potential for fomite [an object that may be contaminated with infectious agents] transmission, which is thought to be less important than droplet transmission for SARS-CoV-2, it nevertheless is informative for public health risk assessment."

In a second study, also released in June in Emerging Infectious Diseases, Matson was part of a team of researchers that evaluated the effectiveness of N95 respirator decontamination and reuse against SARS-CoV-2. Vaporized hydrogen peroxide and ultraviolet light were found to be most effective if proper fit and seal were maintained.


Matson

Photo courtesy of Marshall University

Matson was granted a National Institutes of Health (NIH) Fellows Award for Research Excellence (FARE) 2021 for "scientific merit, originality, experimental design and overall quality and presentation" based on an abstract of the stability work. He is currently performing his dissertation research on Ebola virus at the National Institute of Allergy and Infectious Diseases (NIAID) Virus Ecology Section at Rocky Mountain Laboratories in Montana under the mentorship of Section Chief Vincent Munster, Ph.D.

This research was supported by the Intramural Research Program of the National Institutes of Health, the National Institute of Allergy and Infectious Diseases, and the Defense Advanced Research Projects Agency's Preventing Emerging Pathogenic Threats Program (grant no D18AC00031).

Boudreaux

West Virginia School of Osteopathic Medicine researcher receives grant to study coronavirus

Written by **Tiffany Wright**

While some scientists are hard at work trying to create a vaccine for COVID-19, other scientists, like Crystal Boudreaux, Ph.D., are researching the virus to better understand how it replicates in living cells.

Boudreaux, an assistant professor in the Department of Biomedical Sciences at the West Virginia School of Osteopathic Medicine (WVSOM), was awarded a West Virginia Clinical and Translational Science Institute (WVCTSI) grant in the amount of $30,000 at the beginning of July. The one-year grant will be used to study the mechanisms of ribonucleic acid (RNA) virus infections, such as coronavirus and rotavirus.

The research is a result of the pandemic, as the WVCTSI placed a call for proposals for its COVID-19 pop-up grant with the hope that the analysis could be translated to treatment or medicine.

"We're not necessarily looking at human subject studies or a population of people we know are infected with SARS-CoV-2. This is the basic science aspect of the research," Boudreaux said. "Our findings will contribute to the biological understanding of how these viruses interact with host proteins to provide better targeted treatments."

The objective of the proposal is to determine if regulation of serine threonine kinase 11 interacting protein (STK11IP) predicts mechanistic target of rapamycin (mTOR) expression as a determinant of viral titer. Information gleaned from the pandemic so far proves that it is important to understand how RNA viruses like coronavirus interact with host proteins to effectively produce infectious progeny.

Photo courtesy of West Virginia School of Osteopathic Medicine

The model used in this study includes infecting cultured laboratory cells with live strands of a version of coronavirus, which causes the common cold, and evaluating its replication cycle. The strands, which are safely studied in a controlled environment, might also be evaluated through the use of fluorescent microscopy and with gene expression at the nucleic acid level and at different protein levels.

Though the research is primarily focused on coronavirus, Boudreaux will also be conducting parallel experiments for rotavirus. The two viruses' basic biology is similar, but their pathogeneses are different.

"Rotavirus and coronavirus are both RNA viruses. If you study the host factors involved in virus replication more broadly, then the higher probability of identifying a possible antiviral treatment would be because that treatment could span multiple virus families," she said.

Boudreaux said that as a virologist she is eager for the opportunity to study a virus that has a current broad impact on the world.

The WVCTSI is funded by a National Institutes of Health (NIGMS) grant, #5U54GM10492-04.

Robert C. Byrd Institute responds in time of crisis with innovation, ingenuity

Written by **Mike Friel**

The Robert C. Byrd Institute (RCBI) at Marshall University has leveraged its advanced technology and expertise since the beginning of the COVID-19 pandemic to produce personal protective equipment (PPE) for healthcare workers and first responders across West Virginia.

Using laser and waterjet cutters and a variety of 3D printers in RCBI's Advanced Manufacturing Technology Centers, staff members produced components for face shields and N95 masks used in healthcare settings until commercially produced supplies were readily available.

In addition, Deacon Stone, who manages RCBI's Center for Innovation, pioneered a 3D printing method that uses a stacking system to produce multiple face shield components in one print instead of the traditional method that generates one at a time.

"Our unique innovation transforms a typical one-off 3D printer into a production powerhouse," Stone said. "This approach allows us to produce 100 face shield frames in under 24 hours, using only four machines."

The mask and face shield components were shipped to the West Virginia Army National Guard in Charleston for final assembly before distribution to critical needs areas of the state.

RCBI also manufactured and distributed face shields directly to St. Mary's and Cabell Huntington – two of the state's largest hospitals – as well as Hospice of Huntington, Necco Foster Care system and Marshall University.

To speed production of critical PPEs, RCBI's Technical Services team designed and is manufacturing a reusable mold from high-density polyurethane that is being used to produce N95 face masks more quickly and in greater quantity by pouring them from liquid rubber.

"Throughout this pandemic, RCBI has marshaled its extensive resources and worked with our strategic partners to come together to assist the needs of our state and region," said Charlotte Weber, RCBI director & CEO.

Marshall scientists produce solution for COVID-19 testing

By **Michele McKnight**

A team of scientists, pathologists and lab technicians from Marshall University and Mountain Health Network helped West Virginia address a limited supply of the solution used to transport testing swabs for the novel coronavirus (COVID-19) by making the mixture in one of the university's labs.

The clear viral transport medium (VTM), composed of specialized reagents, keeps a virus viable on the nasopharyngeal swab for transport until testing is performed.

The VTM for COVID-19 is similar to the testing medium the lab makes for ChemoID®, a patented chemotherapy-sensitivity test developed by former Marshall researcher Pier Paolo Claudio, M.D., Ph.D., and Jagan Valluri, Ph.D., professor of cellular biology and integrative medicine in the Marshall University College of Science.

"With a growing demand for viral transport media across the United States, the Centers for Disease Control and Prevention made the VTM specifications available for laboratories so that testing for COVID-19 would not be halted," said Krista L. Denning, M.D., interim chair of pathology at the Marshall University Joan C. Edwards School of Medicine and medical director of the laboratory at Cabell Huntington Hospital.

The lab, which could produce thousands of vials per week, ceased production in August as a private company can now meet the need.

Godfrey

Shepherd's Agricultural Innovation Center shares crops with those in need

From **Shepherd University Communications**

Shepherd University donated food this spring to Shepherdstown Shares, an organization started by the Shepherdstown Visitors Center and Shepherdstown Lions Club in response to the shutdown.

Shepherdstown Shares distributed grocery gift cards to a list of local people businesses had to lay off. The organization augmented the gift cards with the fresh produce being harvested at Shepherd's Agricultural Innovation Center at Tabler Farms. Then, the bags were distributed by volunteer Kerri Godfrey.

"This partnership between Shepherdstown Shares and Shepherd University to help the people of Shepherdstown who were so suddenly and unexpectedly out of work, out of money, puts these beautiful healthy foods to good use," Godfrey said.

Dr. Peter Vila, associate professor of environmental and physical sciences and director, Veterans to Agriculture program, said on March 26, the Agricultural Innovation Center at Tabler Farm donated 18 bags of kale, three bags of spinach, and three bags of mustard greens. On April 2, Haroun Hallack, farm manager, harvested 14 bags of kale and six bags of spinach.

"We will then be in our spring planting season and crops will be available depending upon their growth cycle," Vila said. "Haroun and I are delighted to be able to offer this highly nutritious produce to the community and appreciate the work that Shepherdstown Shares is doing in order to make this available."

Photo courtesy of Shepherd University

WVU Medicine receives FDA Investigational Drug Approval for COVID-19 immunotherapy

From **WVU Medicine**

A WVU Medicine pediatric and adult allergist and immunologist Brian Peppers, D.O., Ph.D., has received Investigational New Drug approval from the U.S. Food and Drug Administration for the experimental treatment of COVID-19 using convalescent donor plasma. This is the first FDA approved Investigational New Drug trial for COVID-19 immunotherapy to include pediatric patients.

The protocol, titled "Convalescent plasma collection from individuals that recovered from COVID-19 and treatment of critically ill individuals with donor convalescent plasma," will use convalescent donor plasma to deliver COVID-19 antibodies to patients currently fighting the disease.

Convalescent donor plasma is collected from someone who has been infected by COVID-19 and has recovered from the infection. The plasma contains antibodies which identify the virus and stimulate the immune system to remove it.

This technique is the basis for immunotherapy, using the body's own immune system to fight an illness. Convalescent plasma has been used to promote health and healing in those suffering from Ebola, MERS, H1N1 and bird influenza. This therapy has been used successfully for nearly 100 years and offers an approach to treatment while vaccines and other forms of treatments are developed.

"The aim of this study as well as the others that involve only adults is to determine if it will help promote health for those with this specific infection," Peppers said. "Similar pilot studies for the treatment of COVID-19 have shown positive results."

The long-term goal of the study is to develop an enriched and purified antibody medication. Antibody therapies, such as immunoglobulin G (IgG), already exist for other infections such as hepatitis B and varicella.

"It takes a village to conduct research of this kind," Peppers said. "The creation of this study and the speed of it getting to the FDA would not have been possible without the aid of the co-investigators on the study, Lisa Giblin Sutton, Pharm.D., Aaron Shmookler, M.D., Pete Perrotta, M.D., Sunil Sharma, M.D. and David Skoner, M.D., and the efficiency of WVU's Institutional Review Board during these times."


Peppers

Photo courtesy of WVU Medicine

The WVU Medicine protocol has the ability to use larger doses of donor plasma than the national campaign in the hopes of stimulating the immune system and eradicate the virus in severe and critically ill patients. Both adult and pediatric patients are eligible for this protocol.

"While this technique has been used in the treatment of COVID-19, we are still working to identify the optimal therapeutic dose and at what stage of the illness the treatment is most effective," Peppers said.

McWilliams

Marshall University's Huntington campus

The team from the WVU Rockefeller Neurosciences Institute poses with Judi, the first patient in the world to undergo focused ultrasound as part of the phase II clinical trial to treat Alzheimer's disease

West Virginia State University's Institute campus

Milestones Met: Researchers cautiously pressed on despite the disruptions of a worldwide pandemic

Uncovering the Invisible Universe

A West Virginia University physicist has created an exact mathematical formula to explain the gravitational wave signals that have been observed from colliding black holes, which serve as a key validation of Albert Einstein's Theory of General Relativity.

While scientists usually interpret the signals from gravitational waves by comparing them to computer simulations, in 2019, Dr. Sean McWilliams, Ph.D., offered a more accurate and efficient method for the calculations and interpretations.

"This new model can tell us what the signal from coalescing black holes looks like just before and while they are merging, whereas preexisting models could only really tell us what is happening well before or well after the merger occurred," said McWilliams, an assistant professor in the Eberly College of Arts and Sciences. "Unfortunately, there is still a gap between where the old models stop being valid and where my model starts being valid."

Since the observation of gravitational waves by the Laser Interferometer Gravitational Wave Observatory (LIGO) collaboration in 2015, McWilliams, also a LIGO member, has been searching for new ways to calculate the waveform produced by two merging black holes. Now, as a 2020 National Science Foundation CAREER Award recipient, he is working to bridge that gap. McWilliams hopes this project will contribute to the developing field of gravitational wave astronomy.

Landmark study reveals first genetic evidence of sodium pump's essential function

New findings offer the first genetic evidence that the sodium pump is essential for animal organ development, according to a study led by Marshall University scientists that involves the scaffolding, or signaling, function of the sodium pump.

The research, published May 27 in Science Advances, indicates that a gene sequence in the sodium pump, also known as Na/K-ATPase, is critical to embryonic development in animals. The short sequence of DNA identified in the study is nearly identical in worms, fish, chickens, birds or mammals, including humans. The sequence, called the caveolin binding motif, is required for the sodium pump to be a receptor.

"The sodium pump cannot signal without the sequence, meaning the brain cannot fully develop," said first and corresponding author, Xiaoliang Wang, M.D., Ph.D., a postdoctoral research fellow at the Marshall University Joan C. Edwards School of Medicine. "Without this function, a human stem cell can't become a stem cell."

The sodium pump, also known as Na/K-ATPase, is expressed in nearly every cell in the body and maintains the sodium-potassium gradient across the cell membrane. This study builds upon the seminal work of the late Zijian Xie, Ph.D., who, along with collaborators, discovered the signaling & scaffolding function of the Na/K-ATPase in the late 1990s.

Photos: (left to right) Alex Wilson Photo and courtesy of Marshall University

Photos: (left to right) Courtesy of West Virginia University and West Virginia State University

WVU Rockefeller Neuroscience Institute first in the world to open hippocampal blood brain barrier in Alzheimer's patients

The West Virginia University Rockefeller Neuroscience Institute announced a new study published in partnership with Weill Cornell Medical Center that demonstrates the successful opening of the blood brain barrier in the hippocampus and entorhinal cortex using focused ultrasound to treat six patients with early onset Alzheimer's disease.

This first-in-the-world study has been published in the Proceedings of the National Academy of Sciences journal. The effort is part of a Phase-II clinical trial, sponsored by INSIGHTEC, which developed the technology and manufactures the focused ultrasound device, Exablate Neuro.

"The blood brain barrier has long presented a challenge in treating the most pressing neurological disorders," said Dr. Ali Rezai, executive chair of the WVU Rockefeller Neuroscience Institute. "The ability to non-invasively and reversibly open the blood brain barrier in deep brain areas such as the hippocampus, offers a new potential in developing treatments for Alzheimer's disease."

This study reported on four subjects with early onset Alzheimer's. The six participants safely underwent a total of 17 focused ultrasound treatments with immediate opening of the blood brain barrier and closure within 24 hours with no adverse events.

West Virginia State University receives funding from the USDA

West Virginia State University (WVSU) will receive more than $750,000 in scholarship funding from the U.S. Department of Agriculture (USDA) to support new programs that will prepare students for careers in the food and agriculture industries. The 1890 Scholarship Program will provide funding for undergraduate students majoring in plant and soil science, agribusiness and agricultural economics. The new degree options launched in Fall 2020.

"These new degree programs provide yet another opportunity for West Virginia State to fulfill its mission as an 1890 land-grant university," said Vice President for Research and Public Service Dr. José Ulises Toledo, Ph.D. "This funding will enable us to invest in our students and in the future of agriculture for West Virginia and beyond."

The 1890 Scholarships Program provides scholarships to support recruiting, engaging, retaining, mentoring and training of undergraduate students at the 1890 land-grant institutions. WVSU is one of 19 such institutions in the nation, each of which will receive $752,632 in fiscal year 2020 for scholarship support.

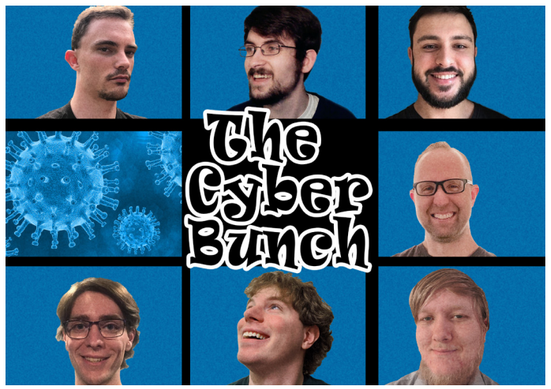
Additional funding in the amount of $500,000 will be provided to WVSU each year through 2023, contingent upon available funds.

The scholarships are intended to encourage outstanding students at 1890 institutions to pursue and complete baccalaureate degrees in the food and agricultural sciences and related fields.


Toledo

Toledo named Vice President for Research and Public Service at WVSU

Dr. José Ulises Toledo, Ph.D. has been named West Virginia State University's Vice President for Research and Public Service, and Dean and Director of the Gus R. Douglass Land-Grant Institute. Toledo will provide administrative oversight to the Agricultural and Environmental Research Station, WVSU Extension Service, and more.



Marshall Collegiate Cyber Defense Team wins national championship

Marshall University's Collegiate Cyber Defense Team won the spring national championship of the National Cyber League, placing first out of 925 teams. Student members included Peyton Stevens, Philip Taylor, Neale Tindall and Andrew (A.J.) Clark IV and were led by Associate Professor Josh Brunty.


Zatar

Marshall's Zatar appointed founding chair of prestigious transportation committee

Dr. Wael Zatar, Ph.D., a professor in the Department of Civil Engineering at Marshall University, was appointed the founding chair of the National Standing Committee on Innovative Highway Structures and Appurtenances of the Transportation Research Board of the National Academies.


Chirchir

Marshall Biology faculty member appointed to national committee

Dr. Habiba Chirchir, Ph.D., an assistant professor of biology in Marshall's College of Science, has been selected by the Federation of American Societies for Experimental Biology to serve on the Science Policy Committee for a two-year term, beginning July 1, 2020.

Photos courtesy of West Virginia State University and Marshall University

COMMENTARY: Sarah Armstrong Tucker

In the midst of a pandemic, innovation still drives higher education

West Virginia's higher education institutions are powerful engines of innovation. Faculty and students are constantly exploring, discovering and solving some of the most pressing problems facing society today. They challenge each other to advance in their studies and careers. They push for change and new ideas. But since March, our ability to continue that work became even more challenging as the COVID-19 pandemic changed how we live and learn.

Early on in this crisis, our state's public higher education institutions began working with one another as a truly synchronous team. From the highest levels of leadership, they came together – and still do today – to share their own best practices with one another, ask each other questions and learn some tough lessons together.

Our faculty and staff worked hard to pivot to non-face-to-face classes by early April, and our students adapted quickly to that change as well. We have heard from students about this transition, with some facing connectivity challenges and technical issues, and others really praising their teachers for making this transition as smooth as possible. At the statewide level, we understand the challenges associated with this swift change – and have worked together with our schools to help address them.

We have held professional development webinars with faculty regarding online teaching, with nearly 700 registrants, and worked with institutions on refining course scheduling. For our students, we held numerous webinars regarding changes to financial aid programs, college admissions, and ACT and SAT test preparation. We have provided mental health resources. And for everyone's protection, we have coordinated with the West Virginia Department of Health and Human Resources and National Guard to help campuses sanitize, access protective equipment and prepare for the safest possible return.

Our goal has been to support students and campuses in the strongest possible way, but let me be clear: West Virginia's colleges and universities have risen to this challenge on their own in remarkable and inspiring ways.

In fact, when our frontline healthcare providers faced a shortage of personal protective equipment early in this crisis, our two- and four-year institutions – even though their doors were essentially closed – began using their expertise and 3D printing equipment to manufacture face masks and shields for our medical community in coordination with the National Guard. And, as part of Governor Jim Justice's Kids Connect initiative to provide broadband access to K-12 students statewide, 39 hotspot sites at public higher education institutions are helping bridge the homework gap this fall.

As our institutions have looked out for their communities, they also have always been squarely focused on the health and safety of their students and staff. In preparation for the fall semester, the safeguards they have put in place are inventive and comprehensive.

Thanks to Governor Justice's commitment to provide $2.5 million for COVID-19 testing of all college students and staff, our institutions have also worked quickly and creatively to ensure those returning are healthy. We know these tests reflect a single point in time, and we know personal responsibility among our students will be absolutely critical, but this thorough testing gives those within and around our campus communities greater peace of mind.

Just like the rest of our state, higher education's response to COVID-19 changes nearly every day, sometimes multiple times a day. But with the collaboration and innovation we have seen over the past several months, I am optimistic in our ability to continue helping students achieve their college and career dreams, and it is perhaps more important than ever before that we do so. We need them to keep studying, keep learning and keep training. We need our students to succeed. Our future, in so many ways, depends on them.


Tucker

Dr. Sarah Armstrong Tucker, Ph.D. is Chancellor of the Higher Education Policy Commission and the Community and Technical College System. She is the first person to simultaneously serve in these two roles, leading both state agencies that guide policies and initiatives for West Virginia's two- and four-year public higher education systems.

Photo courtesy of the West Virginia Higher Education Policy Commission

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