Pacific Northwest
NATIONAL LABORATORY

PNNL'S FY 2020 ECONOMIC IMPACT REPORT PHOTOGRAPHS

U.S. DEPARTMENT OF ENERGY

PNNL'S FY 2020 ECONOMIC IMPACT REPORT PHOTOGRAPHS

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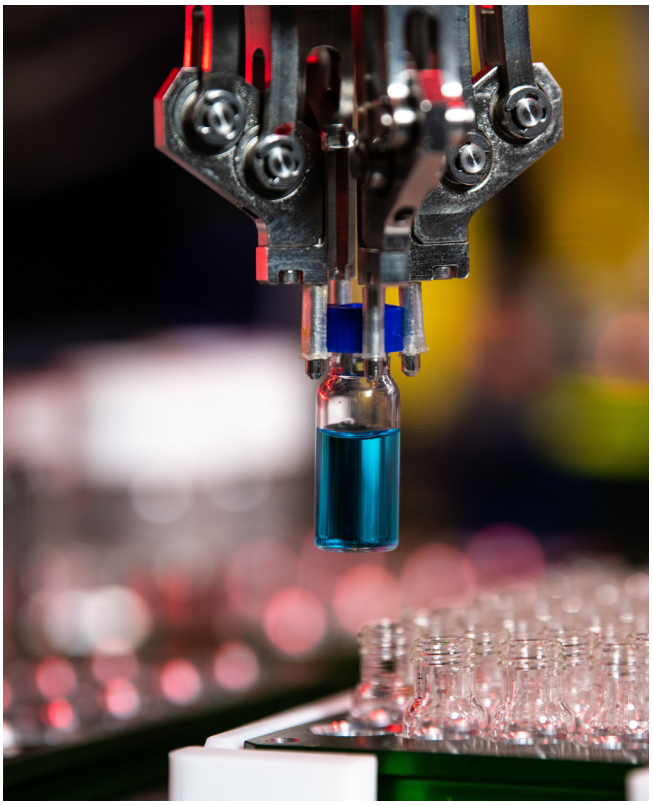

High-Throughput Experimentation System robotic systems are used for high-throughput experimentation for material synthesis preparation. The systems realize high-throughput studies of large material groups by using design experiment concepts combined with machine learning and small-scale testing.

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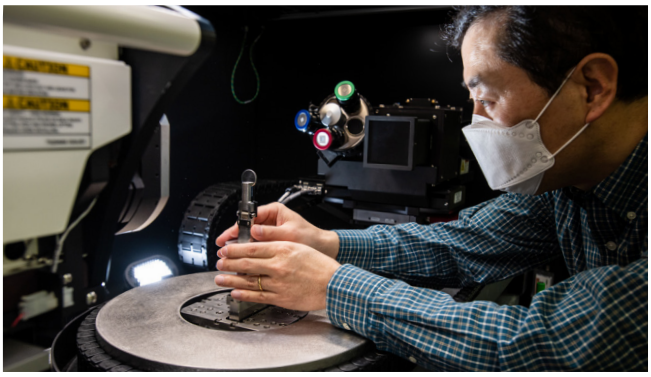

Materials scientist Dr. Guosheng Li uses the Zeiss X-ray microscope system (Versa 610) to obtain high-resolution, three-dimensional images of materials and devices of various size and format through a non-destructive, non-contact mode.

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Tubes of fine soil particles are seen separating within the sodium polytungstate mixture; light particles are floating on top, while heavy particles are sinking to the bottom of the tub. Sodium polytungstate is a compound that remains in a liquid form even after it's very dense. The solution is 2.5 times the density of water and is commonly used to separate heavier particles from lighter ones.

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Linus Pauling Fellow Darian Smercina holds a vial of blue and green gradients where nitrogen fixing microorganisms are growing in the presence of nitrogen. This gradient, generated by changes in pH, shows us that the microorganisms like to hang out near the top of the vial where oxygen is readily available. In another vial, which is a solid blue hue, nitrogen is not present, and the microorganisms are growing much slower but are more widespread in the vial because oxygen is bad for nitrogren fixation.

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Dr. Steven Ashby, director of Pacific Northwest National Laboratory since 2015.

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Dr. Emilie Purvine is a mathematician and data scientist. Her work focuses on using advanced mathematical techniques such as computation topology and graph theory to understand the shape and structure of data. This can be used in many applications from discovering important genes in a biological system to uncovering patterns of activity in a cyber network.

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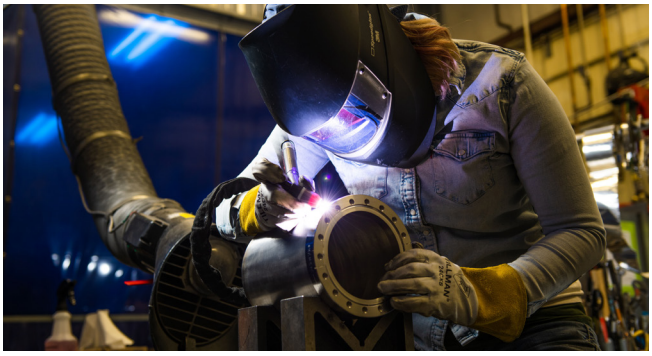

Alia Green, a welder journeyman, is among the 224 skilled craft workers at PNNL who are critical to enabling our world-class science and technology, as well as to supporting the day-to-day operation and maintenance of the national laboratory campus. Alia also happens to be PNNL's only full-time welder as well as the first female.

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Linus Pauling Fellow Sam Silva works on a computational code related to atmospheric changes. One of his approaches is to use artificial intelligence in order to make predictions about future states of the atmosphere.

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Chemist Ferdinan Colon instruments a string of 12 tensile specimens for in situ detection of stress corrosion crack initiation for a test that will take place in simulated cooling water of a pressurized water reactor. PNNL has multiple test systems dedicated to evaluating stress corrosion crack initiation of legacy and next-generation materials that are exposed to light water reactor core cooling water in support of the needs of the U.S. Nuclear Regulatory Commission, Department of Energy, and industry.

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Contractors put the last metal beam on the Energy Sciences Center at PNNL. It's tradition to include an evergreen tree and the American flag; both will eventually be removed later in construction.

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PNNL technician Lupita Renteria takes samples from the Columbia River in support of WHONDRS—a research consortium that aims to understand coupled hydrologic, biogeochemical, and microbial function within river corridors.

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Earth scientist Cailene Gunn works at the Marine and Coastal Research Laboratory, the U.S. Department of Energy's only marine research facility, located in Sequim, Washington. This laboratory is uniquely positioned for marine-based research focused on helping the nation achieve sustainable energy, a sustaining environment, and coastal security.

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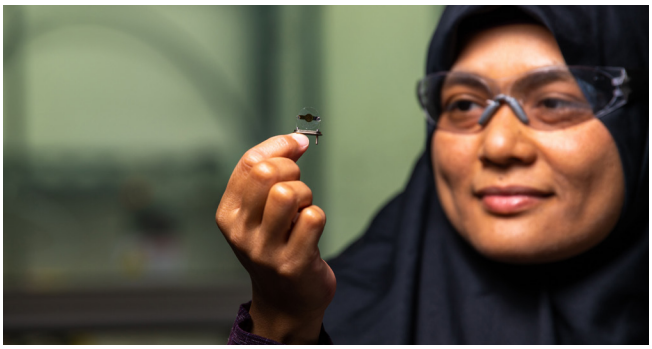

Washington State University student Fitria Fnu is learning from PNNL materials scientists who are collaborating with a commercial company to develop and test a technology that detects fluorocarbon refrigerant leaks from heating, ventilation, and air-conditioning systems—a problem that leads to costly reductions in efficiency, poses health risks, and can harm the environment.

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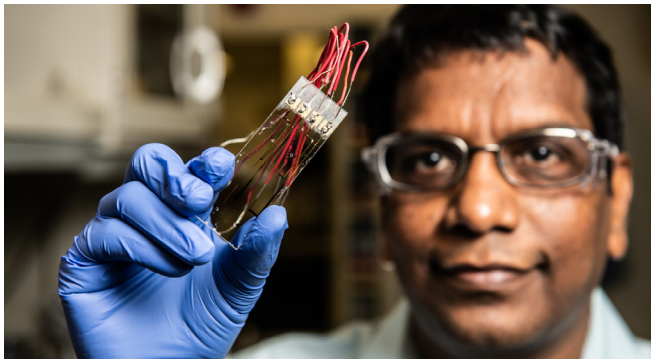

Dr. Radha Motkuri, material scientist and chemical engineer, was part of the team that developed a small device to quickly and accurately measure perfluorooctanesulfonic acid, which is a type of polyfluoroalkyl substance. Per- and polyfluoroalkyl substances are hazardous, man-made chemicals used in products like non-stick cookware, waterproof clothing, food packaging, and firefighting foam because they repel water and oils. PNNL has patented an accurate and portable way (called lab-on-a-chip) to detect miniscule amounts of an extremely persistent, toxic chemical that accumulates in our bodies and our environment.

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Carl Imhoff, electricity infrastructure manager, and Dr. Henry Huang, PNNL lab fellow in electrical engineering, gave U.S. Secretary of Energy Jennifer M. Granholm a virtual tour of PNNL's Electricity Infrastructure Operations Center, with the assistance of videographer Eric Francavilla. They shared the foundational capabilities within the center, including real data and live interconnection scale models, that support PNNL's mission to help the Department of Energy deliver clean and resilient power systems and integrate renewable energy sources into the energy grid, as well as to prepare the grid for inevitable fluctuations in renewables' contributions.

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An ultra-high vacuum chamber housed in the Environmental Molecular Sciences Laboratory.

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Chemical engineer Alan Zacher holds a jar of human waste after going through thermal liquefaction. The waste-to-biofuel project is in partnership with Greater Lakes Water Authority and sponsored by the U.S. Department of Energy's Bioenergy Technology Office.

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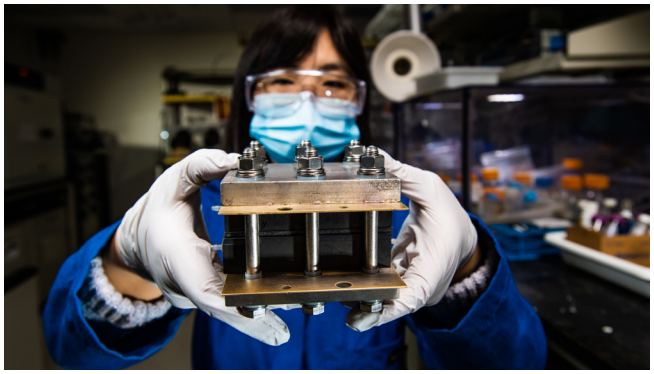

Materials scientist Qian Huang, at work in one of PNNL's redox flow laboratories, assembling and testing small flow batteries. To explore ways to increase the use of wind, solar, and other renewable energy sources across the electric grid, PNNL has a series of laboratories dedicated to researching, testing redox, and scaling up flow batteries—a new battery type that can be easily scaled up to megawatt levels for grid applications.

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In the face of the COVID-19 pandemic, PNNL quickly and successfully pivoted from in-person, on-site opportunities and engagement with students and teachers to a variety of distance learning and outreach tools and capabilities, quickly moving science, technology, engineering, and mathematics resources online via Facebook, Twitter, and Instagram channels. Here are Lucy and Isaac, children of PNNL engineers Nick and Carolyn Cramer, engaged in one of PNNL's online learning opportunities.

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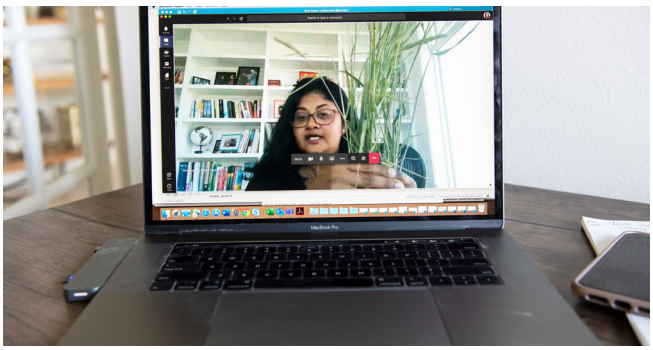

In the face of the COVID-19 pandemic, PNNL quickly and successfully pivoted from in-person, on-site opportunities and engagement with students and teachers to a variety of distance learning and outreach tools and capabilities, quickly moving science, technology, engineering, and mathematics (STEM) resources online via Facebook, Twitter, and Instagram channels. This session featured Dr. Pubudu Handakumbura, biologist and STEM ambassador.

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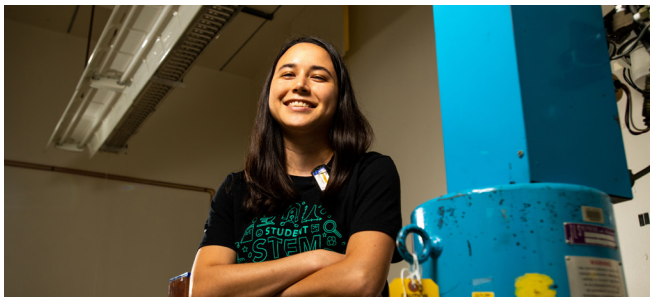

Tech student Jennifer Meza is a recent graduate of Columbia Basin College with an A.A.S. in nuclear technology instrumentation and control and is training with a Radiation Measurements and Irradiations team to become a technician. The team tests and calibrates radiation detection instruments and other materials.

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An international expert on downstream fish passage, fisheries engineer Brett Pflugrath, was part of a PNNL and Benton County Conservation team to tag and release 500 juvenile salmon for this year's annual Salmon Summit event in Columbia Park, Richland, Washington. Due to COVID precautions, this year's summit was virtual, reaching many local and regional classrooms.

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Linus Pauling Fellow Neerja Zambare works with bacteria that can precipitate calcium carbonate via ureolysis. Her goal is to use the produced calcium carbonate precipitates as biological cement in a variety of environmental remediation applications. At the Environmental Molecular Sciences Laboratory, specifically, she's interested in chemically mapping the interfaces between bacteria and the minerals as they form and in developing controls on the precipitation process with respect to crystal

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This photo was taken in Bioproducts Sciences and Engineering Laboratory 158, a fuel and chemical conversion and hydrogeneration lab. For co-optima, the researchers in this lab conduct experiments to convert the renewable ethanol into long-chain alcohol for mixing controlled combustion ignition engines.

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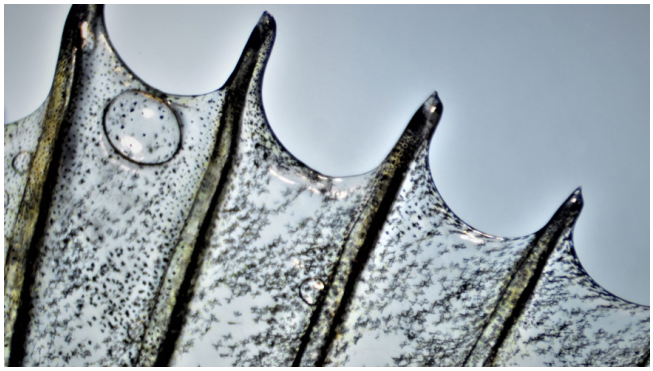
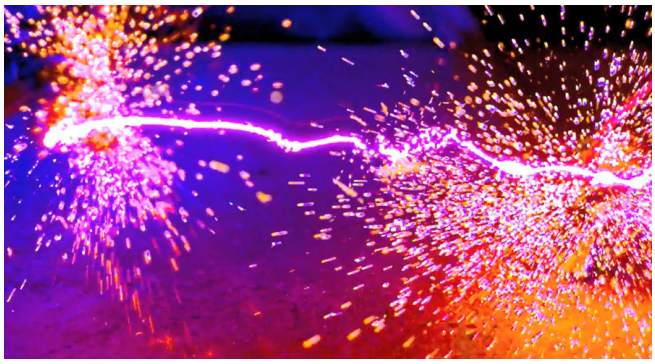
VIGNETTE 1



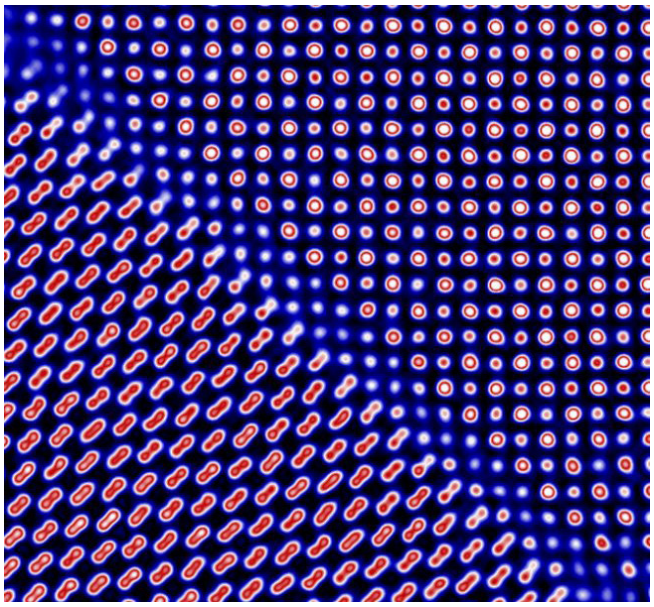
Science as Art. Pflugrath Dorsal Emphysema: emphysema (gas bubbles) in the dorsal fin of a largemouth bass after exposure to rapid decompression, simulating the pressures that fish experience when passing through hydropower turbines.

VIGNETTE 2



Science as Art. This is a high-speed image capture of a detonated stainless-steel tube. The explosions are used to test high-temperature-tolerant materials.

VIGNETTE 3



Science as Art. This colorized atomic-scale electron microscope image shows how different materials can be combined for advanced computing technologies.