U.S. DEPARTMENT OF ENERGY
Office of Science

COMMUNIQUE

1 April 2019

*Comm*unique provides a biweekly review of recent Office of Science Communications and Public Affairs work, including feature stories, science highlights, social media posts, and more. This is only a sample of our recent work promoting research done at universities, national labs, and user facilities throughout the country.
Please note that some links may expire after time.

Lighting the Way to Removing Radioactive Elements

A flick of a switch. An LED light shines on a liquid-filled beaker. Another flick. It goes dark.

This unassuming pulse of light illuminates one of the toughest challenges at two former nuclear weapons sites. The light could lead to a better way to pull a troubling element, americium, out of a soup of similar elements.

"Such separation is vital for various reasons, such as treating nuclear waste, dismantling nuclear weapons, or purifying americium for smoke detectors," said Kenneth Hanson, who leads a light-driven americium separation project at the Center for Actinide Science & Technology (CAST) Energy Frontier Research Center and is an assistant professor at Florida State University. The Department of Energy's Office of Science funds the center.

Americium is just one of the elements that scientists must deal with to clean up sites where the nation's nuclear arsenals were built. Managing these elements means uncovering scientific secrets about highly radioactive troublemakers in the 93 million gallons of waste stored in Washington State and South Carolina. "It is on a scale that is sometimes hard to fathom," said Thomas Albrecht-Schmitt, a professor at Florida State University and the CAST director. "It is staggering."

Click here to read more about the CAST EFRC and its work on these radioactive “troublemakers”

NEWS CENTER

The Office of Science posted 65 news pieces between 3/18/2019 and 3/31/2019, including 29 university articles and 36 pieces from the labs and user facilities.

Researchers at Lawrence Livermore National Laboratory have developed a new biological sensor that could help clinicians better diagnose cancer and epilepsy. Human-made biosensors typically have limitations with biocompatibility. Biological systems, however, are adept at protecting and separating vital components of biological machinery using semipermeable membranes. Learning from biology, the team created a sensor by integrating artificial transistor sensors with a lipid bilayer coating.

Researchers from Stanford University have demonstrated a new way to separate hydrogen and oxygen gas from seawater via electricity. Existing water-splitting methods rely on highly purified water, which is a precious resource and costly to produce. This method produces hydrogen fuel using solar power, electrodes, and saltwater from San Francisco Bay. Burning hydrogen fuel, rather than traditional fuels, produces only water, which could ease worsening climate change problems.

Methane is the main component of natural gas and vast reserves of this fossil fuel exist around the world. Beyond simply being burned for heating, methane can also be converted into other useful products: liquid fuels, agrochemicals, pharmaceuticals, polymers, and more. Methane is not particularly chemically reactive, however. Researchers using the Advanced Photon Source have found a way to "activate" methane by using a catalyst supported in a porous, synthetic material. This catalyst is more than 99 percent selective so generates very little byproduct while increasing the reactivity of methane.

As interest in electric vehicles grows, researchers and industry insiders are searching for improved rechargeable battery technology that can safely and reliably power cars, autonomous vehicles, robotics and other next-generation devices. Researchers from Cornell University look to advance the design of solid-state batteries, a technology inherently safer and more energy-dense than today’s lithium-ion batteries. By starting with liquid electrolytes and then transforming them into solid polymers inside an electrochemical cell, the researchers can take advantage of both liquid and solid properties to overcome key limitations in current battery designs.

Little is understood about how plant roots interact with soil at a molecular level. A narrow zone of intense microbial activity around the roots, called the rhizosphere, could hold information about how plants stimulate microbes to transform nutrients and promote plant health, resist disease, and adapt to environmental changes and stress. To better understand this zone, researchers at Ames Laboratory are developing a model instrument that will enable scientists to look at the biological interactions in the rhizosphere in real time, in the field.

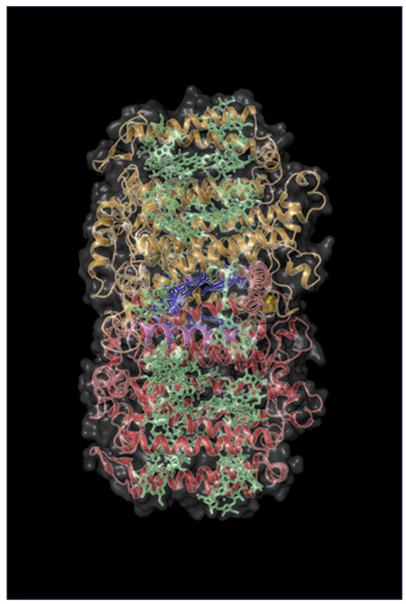
The gut of the long-horned passalid beetle has adapted to take tough plant materials, like lignin and cellulose, and transform them into hydrogen, ethanol, methane, and other energy-rich biofuels. Researchers at UC Berkeley and Berkeley Lab describe how the architecture of the beetle's gut — and the beneficial microbes that inhabit it — help the beetle carry out such a transformation. This knowledge could help scientists engineer more efficient systems for producing bioproducts in the lab.

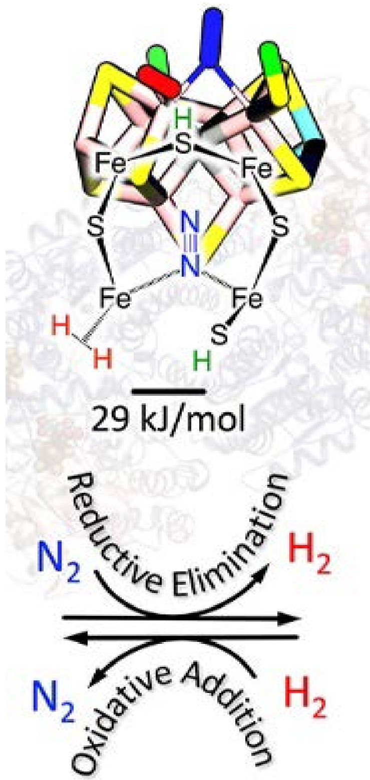
SCIENCE HIGHLIGHTS

The Office of Science posted three highlights between 3/18/2019 and 3/31/2019 spotlighting science from two programs: BER and BES.

Microbes deep in the soil influence plant health by releasing potent natural antibiotics. These bacteria thrive on the roots of dryland wheat throughout a major wheat-producing region in Washington and Oregon. A study, conducted by a team including researchers from Pacific Northwest National Laboratory, provides direct evidence that chemicals formed by bacteria here increase the formation of root-associated bacteria that help the wheat grow and may also improve the soil.

To create chemicals and fuels from solar energy, scientists often look to the process of photosynthesis for inspiration. Now, a team from Arizona State University has gotten a detailed view of the pigment-protein complex that acts as the heart of photosynthesis in a primitive organism. With these results, scientists can compare the primitive reaction center to more advanced centers in other photosynthetic organisms to better understand how reaction centers optimally gather light and convert it into chemical energy that the organism can use.





Currently, most ammonia is made by breaking apart nitrogen in an energy-demanding reaction. But nature performs this same chemistry in a more environmentally benign way through the action of an enzyme called nitrogenase. This enzyme also produces molecular hydrogen in a process that chemists have long viewed as inefficient. With a recent closer look into the enzyme, researchers at Pacific Northwest National Laboratory have concluded that the hydrogen formation actually enables the process to help break nitrogen apart, fostering new ideas for the design of synthetic catalysts to make ammonia.

TOP TWEETS

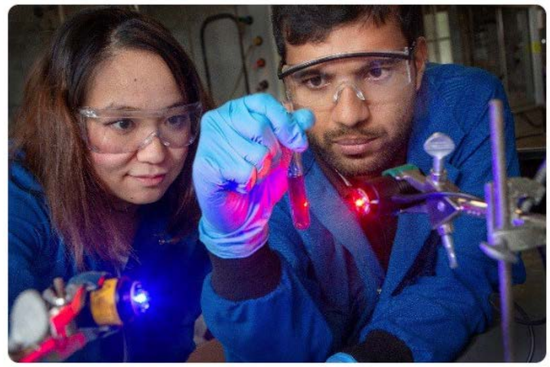
The Office of Science sent out 63 tweets between 3/18/2019 and 3/31/2019 and gained 328 new followers. Here are our two most popular from the past two weeks:

DOE Science @doescience

.@ENERGY partners with @intel and @cray_inc to develop nation's first exascale computing system bit.ly/2HEsNIF @argonne

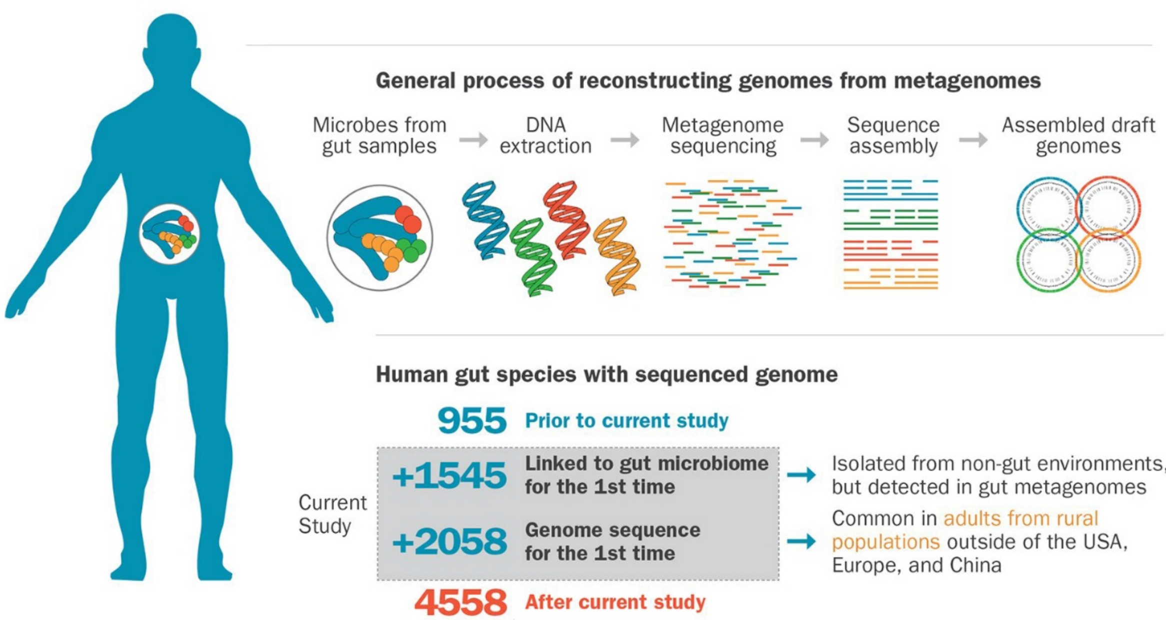
DOE Science @doescience

Discovering how heavy elements behave can light the way to fine tuning #nuclear waste treatment @FIU @floridastate @NationalMagLab @BerkeleyLab @LifeAtPurdue @LosAlamosNatLab @Penn @UBuffalo @umanitoba #teamscience science.energy.gov/news/featured- ...



BY THE NUMBERS

Joint Genome Institute



Serving 1,598 people in Fiscal Year 2017, the Joint Genome Institute (JGI) is a Department of Energy user facility that provides genome sequencing, genome data acquisition, and genome analyses in support of research in bioenergy, carbon cycling and biosequestration, and biogeochemical processes. Earlier this month, researchers used JGI facilities to computationally reconstruct 61,000 microbial genomes, bringing the number of known human gut species to 4,558 and increasing the phylogenetic diversity of sequenced gut bacteria by 50 percent. To learn more about the people who helped facilitate this discovery and much of the rest of the Department of Energy's wide range of science, check out OCPA's ongoing series of profiles of the user facility directors.

END NOTES

Interview: 'Why Anything?': Fermilab Scientists Ask the Universe's Biggest Question in Study of a Tiny Particle

Beneath a prairie about 35 miles west of Chicago, scientists are beaming subatomic particles through the Earth at nearly the speed of light. A feature story on WBUR, an NPR radio station, highlights Fermilab's work as a global center for research into a tiny particle that could help answer some of the biggest questions in physics. Neutrinos have no electrical charge and almost no mass, but they're everywhere.

Neutrinos may be ubiquitous, but they're also mysterious. Despite being the second-most abundant particle in the universe, they rarely interact with other matter. Scientists think studying neutrinos could reveal more about the origins of the universe. "Put simply, are neutrinos the reason we exist?" Fleming says. "What they're going to tell us about the cosmos, we're still learning."

To help answer that question, scientists at Fermilab are working on a project called the Deep Underground Neutrino Experiment, in collaboration with the Sanford Underground Research Facility in South Dakota.

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