EMSL

THE ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY

Scientific innovation through integration

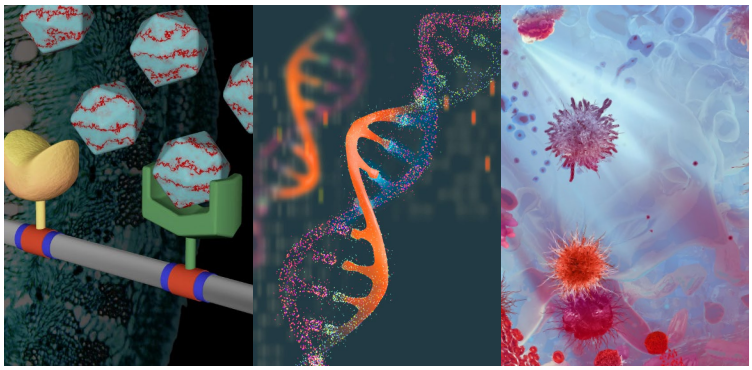
EMSL, the Environmental Molecular Sciences Laboratory, is a U.S. Department of Energy (DOE) Office of Science User Facility supported by the DOE Office of Biological and Environmental Research (BER). Research at EMSL supports BER's mission to understand the biological, biogeochemical, and physical principles needed to predict a continuum of processes occurring at the molecular and genomics-controlled smallest scales to environmental and Earth system change at the largest scales. EMSL is in Richland, WA, at Pacific Northwest National Laboratory.

World-class experts, premier instrumentation, and state-of-the-art facilities enable users from academia, government labs, research institutes, and industry across the U.S. and around the world address a variety of biological and environmental challenges.

Individual users and teams enjoy a holistic environment for scientific discovery in areas such as visualizing molecular reactions in living cells, characterizing constantly evolving atmospheric particles, discovering new pathways for producing biofuels and bioproducts, predicting contaminant transport, understanding disease processes, and developing more efficient energy storage devices.

Access to resources at EMSL is provided through a variety of proposal mechanisms that involve an open, peer-review proposal process (www.emsl.pnl.gov/emslweb/proposal-opportunities)

EMSL focuses user projects in two areas: Functional and Systems Biology and Environmental Transformations and Interactions.



The **Functional and Systems Biology Area** focuses on the biochemical pathways that connect gene functions to complex phenotypic responses through interactions within cells, among cells in communities, and between cellular membrane surfaces and their environment for microbes, fungi, and plants.

The **Environmental Transformations and Interactions Area** focuses on the mechanistic and predictive understanding of environmental, microbial, plant and ecological processes in above and belowground ecosystems, the atmosphere, and their interfaces.

FICUS Facilities Integrating Collaborations for User Science

EMSL also collaborates with other User Facilities through the Facilities Integrating Collaborations for User Science (FICUS) joint proposal call process. Using the peer reviewed proposal process, researchers have an added advantage of using resources at more than one User Facility using a single research proposal.

EMSL Facts – *FY 2019*

577
Users worldwide

$44.8M
Budget from DOE BER

416
Peer-reviewed scientific publications using EMSL resources

274
Active projects

234K
Square footage research facilities

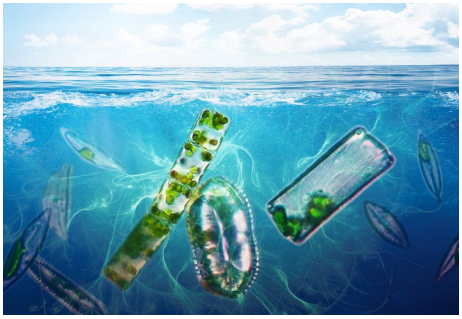
180
Scientific instruments, including high-performance computer

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

For more information about EMSL: **www.emsl.pnnl.gov**

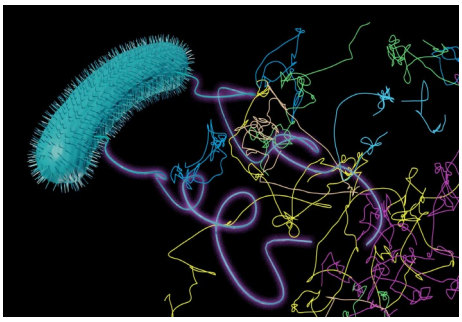
Selected EMSL Research and Capability Highlights



The Secrets of Microbial Competition for Nitrogen

Scientists are uncovering how diatoms use nitrogen to outcompete other phytoplankton. The secret could help scientists make biofuels efficiently.

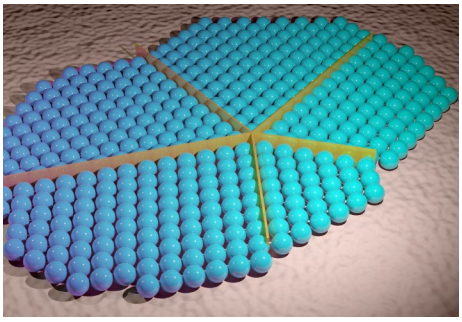
(Nature Communications, Oct. 7, 2018) Image by N. Johnson, PNNL Creative Services



Calculating Behavior of Bacteria in Groundwater

This study can help scientists develop more accurate numerical models of bacterial transport to better understand bacteria's role in hydrobiogeochemical processes.

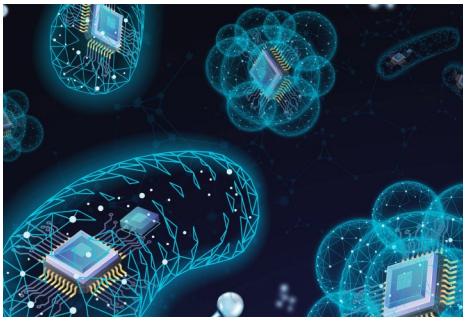
(Scientific Reports, Oct. 10, 2019) Image by N. Johnson, PNNL Creative Services



The Power of Twins

Researchers unlocked the secret to one of the most useful nanostructures: the fivefold twin. Through this research, scientists suggest guidance on controlling twin structures that could advance materials design and synthesis.

(Science, Jan. 3, 2020) Image by N. Johnson, PNNL Creative Services



Studying Bacterial Metabolites

Scientists teamed with EMSL and JGI to study biosynthetic gene clusters using CRAGE (chassis-independent recombinase-assisted genome engineering) developed at Lawrence Berkeley National Laboratory.

(Nature Microbiology, Oct. 13, 2019) Image by W. Keefe, Berkeley Lab Creative Services

Getting to the Root of Carbon Storage in Deep Soils

Scientists found age and mineral composition of the soil, as well as the time exposed to root-driven weathering, dictate whether roots store or release carbon.

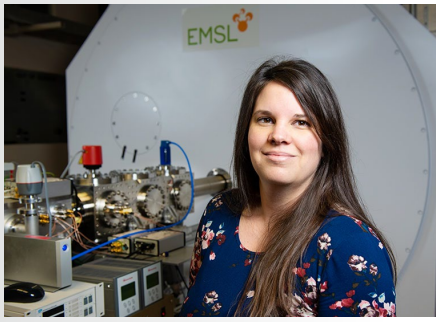
(Geochimica et Cosmochimica Acta, Oct. 15, 2019) Image by N. Johnson, PNNL Creative Services

For more EMSL science highlights:
www.emsl.pnnl.gov/emslweb/science-highlights

EMSL Capabilities

EMSL's technical capabilities include unique suites of instrumentation, such as a full range of nuclear magnetic resonance spectrometers; high-resolution mass spectrometers; a wide variety of microscopes for static and dynamic imaging; atomic-scale chemical and structural characterization instruments; single cell, microbial community, and plant growth and characterization chambers; and production high-performance computing resources for molecular to continuum-scale modeling and compute-intensive data analysis.

750 NMR, Robert Young, Chemist and EMSL Staff Scientist



21T FTICR, Emily Graham, Earth Scientist and EMSL User

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