EMSL

THE ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY

Scientific innovation through integration

The **Environmental Molecular Sciences Laboratory (EMSL)** is a U.S. Department of Energy (DOE) Office of Science user facility supported by the Biological and Environmental Research program. We offer scientific expertise spanning biologists, chemists, physicists, engineers, hydrobiogeochemists, atmospheric scientists, computational and data scientists, along with world-class instruments and facilities. EMSL is located in Richland, WA, at Pacific Northwest National Laboratory.

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

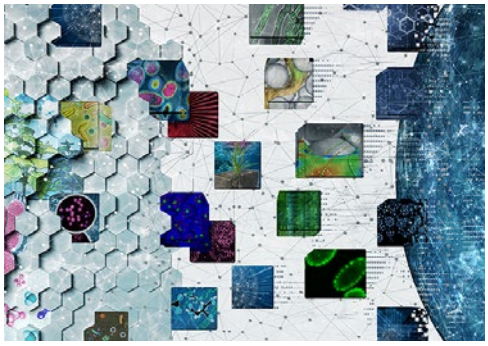
Access to resources at EMSL is possible through a variety of proposal mechanisms that involve an open peer review proposal process.

For more information about proposals:
emsl.pnnl.gov/proposals

EMSL FOCUSES ON THREE SCIENCE AREAS

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.



The **Computing, Analytics, and Modeling Area** maximizes biological and environmental understanding using advanced data analytics and visualization, computational modeling and simulation, and efficient parallel software for greater scientific discovery.

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 under a single research proposal.

EMSL Facts – FY 2023

689 Users worldwide

$65M Budget from DOE BER

~500 Peer-reviewed scientific publications using EMSL resources

254 Active projects

234K Square footage research facilities

>150 Scientific instruments

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

For more information about EMSL:
emsl.pnnl.gov

Selected EMSL Research and Capability Highlights

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The Surprising Role of Plant-Mediated Oxygen Transport in Coastal Wetlands

In a four-year study in a tidal marsh on the Chesapeake Bay, scientists manipulated conditions and observed changes more closely than ever before. Their surprising results showed that warmer temperatures and higher levels of carbon dioxide could actually result in less carbon in the soil and less methane released to the atmosphere, and that these outcomes were dependent on the complex interactions among plants, microbes, and oxygen fluxes in tidal marsh soils.

Airborne Measurements Shed Light on Accuracy of Cloud Physics Theory

A multi-institutional team of researchers used airborne measurements of aerosols from the Department of Energy (DOE) Southern Great Plains site to assess the differences in what is called a closure study. Their results showed that, under certain conditions, theoretical modeling can accurately predict the number and properties of cloud condensation nuclei with 80 percent certainty.

New Deep Neural Network Could Speed Calculations in Climate Models

A group of researchers created and then embedded a physics-informed deep neural network (DNN)—a sophisticated mathematical model that can learn as it processes data—in a detailed regional model of the Amazon rainforest to demonstrate a new way to speed output and resolve compounding errors.

Using the Metaproteome to Uncover the Microbiome of the Complex Soil Environment

Using a new approach, a broad spectrum of scientists can now generate a protein database directly from proteomics data gathered from a specific soil sample. A key element of this new approach is a digital tool called Kaiko, a deep learning computer model that has significantly improved accuracy compared to currently available digital tools for generating a protein database.

For more EMSL science highlights:
emsl.pnnl.gov/news

Molecular Observation Network (MONet)

Through the Molecular Observation Network (MONet), EMSL is leading the creation of a new regional-scale database of molecular and microscale soil parameters from across the United States to advance the span and accuracy of multiscale models of Earth systems. This database will be findable, searchable, and publicly accessible.

TerraForms

Scientists at EMSL developed a group of platforms known as TerraForms to provide users with an avenue for investigating hydrobiogeochemical processes. Through TerraForms, researchers use custom-designed synthetic environments, microfluidics technologies, and in-house instrumentation to simulate soil properties and visualize soil microbial and plant community dynamics.

EMSL instruments and resources:
emsl.pnnl.gov/instruments

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