EMSL

THE ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY

Scientific innovation through integration

The **Environmental Molecular Sciences Laboratory (EMSL)** is a U.S. Department of Energy Office of Science user facility providing the global scientific community with shared resources and expertise to advance biological and environmental research at the molecular level.

Access 150+ instruments, specialized workflows, and supporting data analysis pipelines to solve high-impact scientific problems.

EMSL users conduct advanced molecular-level research to investigate environmental processes, develop innovations to enhance energy access and production, identify and extract critical minerals, and advance biotechnology.

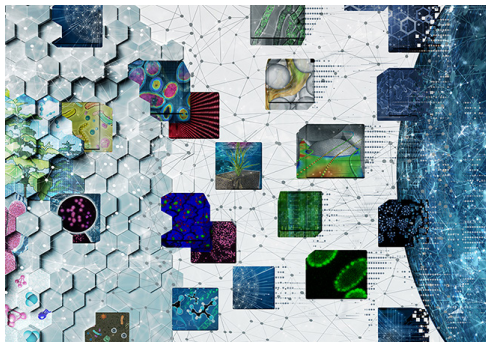
Access to resources at EMSL is possible through a variety of proposal mechanisms that involve an open peer review proposal process.

For more information about proposals:
www.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 2025

600 Users worldwide

$57M Budget from DOE BER

~300 Peer-reviewed scientific publications using EMSL resources

246 Active projects

234K Square footage research facilities

>150 Scientific instruments

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

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

Selected EMSL Research and Capability Highlights

Analyses of Fungal Genomes Reveal Hidden Carbon Metabolism Potential

Fungi may play a larger role in energy cycling of forest deadwood than previously recognized. A multi-institutional team of scientists compared DNA from bacteria and fungi to look for enzymes in fungal cells that help process lignin byproducts from deadwood. They found many fungal cells have these enzymes and have adapted to increase their ability to degrade a wider range of compounds than previously thought.

Discovery of a Novel and Sustainable Organic Liquid Hydrogen Carrier

Hydrogen is a versatile energy carrier important for achieving sustainable fuel. However, its volatility and explosive nature makes it difficult to store and transport, and it requires special pressurized tanks to do so safely. A multi-institutional team of scientists recently identified a new way to bind hydrogen to a compound within lignin-based jet fuel, forming what is called a liquid organic hydrogen carrier. The process makes the fuel much more stable and thus easier to transport.

Pore2Chip Python Package: From 3D Soil Scans to Creation of Lab-on-Chip Micromodels

A multi-institutional team of researchers developed Pore2Chip, a Python package used to design realistic geometric pore network details. These details are printed or laser-etched on a plastic or glass chip used for experimentation— known as a TerraForm. With these, researchers can perform a range of chemical imaging and analysis to study key molecular interactions and movement of nutrients within a simulated soil environment.

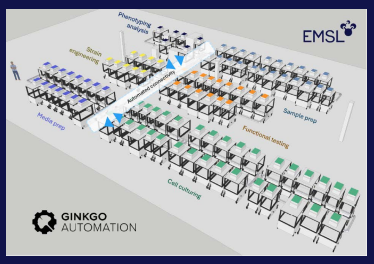
Coupling Mid-Infrared Spectroscopy to Data from MONet Enables Prediction of the Effect of Microbial Communities on Soil Nutrient Cycling at the Continental Scale

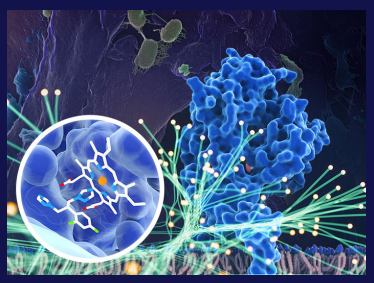
Limited data on microbial community properties in soil remains a key gap in understanding biogeochemical cycling. A multi-institutional study used mid-infrared spectroscopy to estimate microbial and chemical properties from U.S. soils using samples collected and data generated by EMSL's Molecular Observation Network (MONet).

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

Anaerobic Microbial Phenotyping Platform (AMP2)

EMSL's new AMP2 capability enables researchers to investigate different microbes in variable conditions using 18 instruments with minimal need for operator intervention. Instrumentation includes devices necessary to perform complete design–build–test–learn cycles for many microbial phenotyping experiments.





Microbial Molecular Phenotyping Capability (M2PC)

EMSL's forthcoming 32,000-square-foot Microbial Molecular Phenotyping Capability (M2PC) will offer an integrated suite of automated phenotyping instrumentation and analytical tools that unlock functional knowledge about microbial and microbiome communities of critical importance.

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

For more information, contact:

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