

Advancing Science

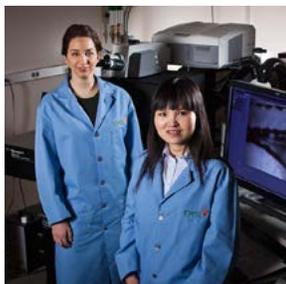
Using State-of-the-Art Capabilities



Soil fungus that lives mainly on organic biodegradable substances was imaged with a Helios 600 Nanolab dual-beam scanning electron microscope (FEI) at EMSL.



CAPABILITIES have helped thousands of researchers use a multidisciplinary, collaborative approach to solve some of the most important national challenges in energy and environmental sciences.



Cell Isolation and Systems Analysis

The function of proteins, cells and cell communities can be investigated using super resolution, quantitative fluorescence microscopy with single molecule sensitivity, cell sorting and transcriptomic analysis, together with proteomics, metabolomics and electron microscopy.

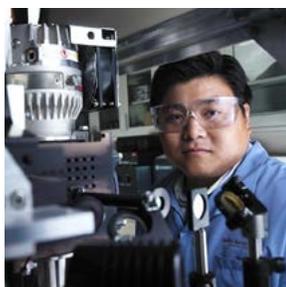
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Deposition and Microfabrication

Physical structures ranging in size from miniature objects (nanomaterials) to electrical devices (thin films) with planned properties can be made using deposition and microfabrication. Materials with specific surface, bulk and interfacial properties for energy and environmental applications can be designed and made using this integrated capability.

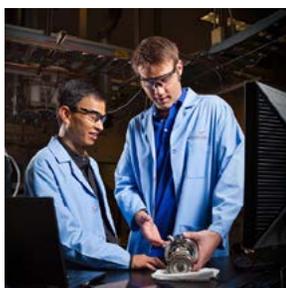
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Instrument Development Laboratory

Scientific discovery is enabled and expedited using unique, purpose-built instrumentation such as advanced signal acquisition and processing instrumentation, signal analysis algorithms, laboratory automation systems and data management solutions.

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Mass Spectrometry

Systems biology and complex mixture studies in biofuels, microbial communities, climate and environmental remediation can be analyzed with world-class separations and mass spectrometry capabilities, providing sensitive compositional and structural information at the molecular level.

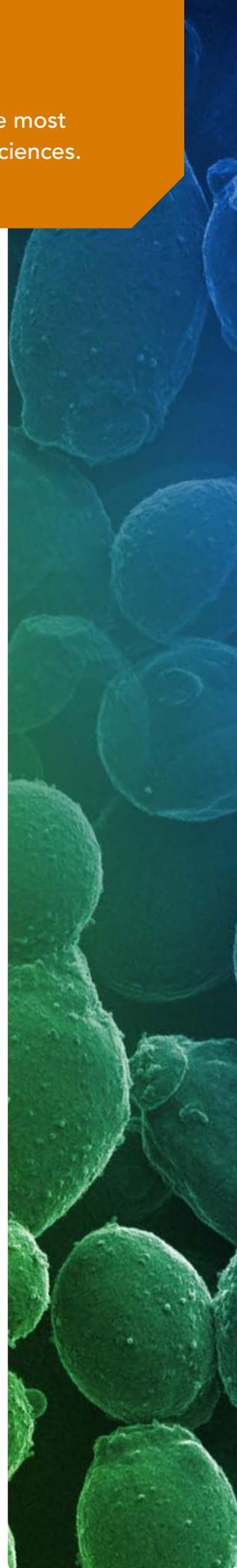
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Microscopy

Advancement in energy, environment and biology research relies heavily on micro-, nano- and atomic-scale chemical and structural imaging. Many of EMSL's microscopy instruments have high resolution imaging capabilities including complementary chemical, structural and phase information, *in-situ* imaging in native environments and imaging dynamic processes with high temporal resolution.

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Molecular Science Computing

Environmental molecular research is accelerated when combined with leading-edge hardware, efficient parallel software, predictive theories and visualization capabilities. Users are encouraged to combine computation with other state-of-the-art experimental tools, providing an integrated platform for scientific discovery.

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NMR and EPR

Molecular systems important to biology, environmental remediation and sustainability are studied using a suite of nuclear magnetic resonance (NMR) spectrometers with frequencies ranging from 300 to 850 MHz. An ELDOR-capable, 9.5-GHz electron paramagnetic resonance (EPR) spectrometer complements the capability.

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Spectroscopy and Diffraction

Molecular level solid-, liquid- and gas-interactions can be investigated through structural, chemical and compositional analysis with remarkable atomic-scale spatial and high-energy resolution spectrometers and diffractometers for novel fundamental research.

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Subsurface Flow and Transport

Remediation strategies have been developed for a variety of contaminants by integrating theory, experiment and numerical simulation prior to field-scale studies. Researchers conduct pre-experiment modeling as well as experiments at various scales, and compare experimental and numerical results.

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◀ *Yarrowia lipolytica* is an oil-producing yeast imaged with a helium ion microscope located in EMSL's Quiet Wing.

EMSL'S SCIENCE THEMES provide the framework for capability investments and focus user projects that will enhance scientific progress in areas of environmental molecular science most critical to DOE and the nation.

- ▶ Biosystem Dynamics and Design
- ▶ Atmospheric Aerosol Systems
- ▶ Terrestrial and Subsurface Ecosystems
- ▶ Molecular Transformations

SPECIALIZED LAB AREAS

The Quiet Wing houses a sample preparation area and eight laboratory cells, each designed to eliminate or minimize acoustic and electromagnetic noise on specialized electron and scanning probe microscopes.

The RadEMSL offers spectroscopic and imaging instruments designed to study contaminated environmental materials, and examine radionuclides and chemical signatures for a greater understanding of chemical fate and transport in terrestrial and subsurface ecosystems.

BECOME AN EMSL USER

At EMSL, science is enabled by capabilities. Give your research the benefit of internationally recognized experts, and unique and state-of-the-art instruments and facilities at EMSL. Remote access to EMSL's supercomputer is also available to save time and travel costs. Typically, researchers use EMSL's resources at little to no cost if results are shared in open literature.

EMSL offers several avenues for collaboration, including proposal opportunities and fellowships.

LEARN MORE AT: www.emsl.pnnl.gov/emslweb/working-us ■ www.emsl.pnnl.gov/emslweb/fellowships-and-awards



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EMSL is an Office of Science user facility. It provides integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences to support the needs of DOE and the nation.



U.S. DEPARTMENT OF
ENERGY