

## New Tools, New Science: **BIOLOGY**

**EMSL** evolves with the needs of its scientific users. Because of recent upgrades, users are benefitting from a new family of EMSL instruments that constitute a foundation for systems-level studies of single cells and cellular communities. These next-generation tools are allowing researchers to isolate cells from complex populations or environmental samples for subsequent complementary studies, including high-throughput genomics, transcriptomics, proteomics, and metabolomics analyses as well as high spatial resolution electron and fluorescence microscopy.

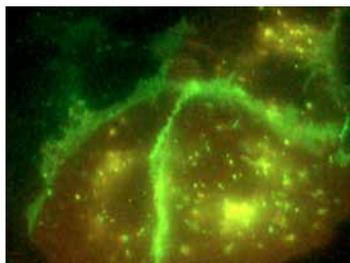
### **MICROSCOPY**

**Multi-photon fluorescence microscope:** Seamlessly integrates nonlinear two-photon excitation, laser scanning confocal microscopy and fluorescence lifetime imaging for minimally invasive and deep-penetrating 3D imaging of living tissues and cells as well as quantitative investigation of molecular interaction dynamics in living cells.

**Biomolecular imaging/mass microscope system:** Effectively identifies and characterizes a diverse range of biomolecules with 20-Hz acquisition speed and a resolution over 40,000 FWHM with sub-ppm mass measurement accuracy.

**Helium ion microscope:** One of only a handful instruments in the world for cutting-edge imaging and chemical analysis with extremely high spatial resolution (0.35 nm).

### **TRANSCRIPTOMICS**



**Next-generation sequencing technology (RNA-Seq) for transcriptional profiling:**

Offers massively parallel next-generation sequencing platforms for unbiased and quantitative profiling of gene expression patterns in

prokaryotic and eukaryotic cells, complete with facilities for sample preparation as well as data processing and analysis.



### **PROTEOMICS**

**High-field Fourier transform ion cyclotron resonance mass spectrometry:** 15 Tesla FT-ICR MS offers the highest mass resolving power and mass accuracy available on any commercial mass spectrometer, is a key technology for analyzing intact proteins (top-down mass spectrometry), and offers higher specificity for identifying metabolites and peptides from very complex mixtures (e.g., microbial communities) in a high-throughput fashion.

**Advanced mass spectrometry capability:** Orbitrap Velos ETD/H-ESI combines three different and complementary fragmentation techniques and represents the most comprehensive solution for analysis of post-translationally modified peptides and metabolites and for quantitative proteomics measurements.

**Ion mobility spectrometry-mass spectrometry proteomics system:** A next-generation proteomics platform that combines liquid chromatography, IMS, and time-of-flight MS for increased throughput and sensitivity for systems-biology research.

**Metalloomics mass spectrometry capability:** Combines ICP and ESI ionization with independent TOF-MS detection channels for the study of metals and their interactions and transformations in biological and environmental systems.

## ABOUT EMSL

EMSL, a U.S. Department of Energy national scientific user facility located at Pacific Northwest National Laboratory, 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.

EMSL's distinctive focus on integrating computational and experimental capabilities as well as collaborating among disciplines yields a strong, synergistic scientific environment. Bringing together experts and an unparalleled collection of state-of-the-art instruments under one roof, EMSL has helped thousands of researchers use a multidisciplinary, collaborative approach to solve some of the most important and complex national scientific challenges in energy and environmental sciences.

To learn more about EMSL, the science conducted at EMSL, as well as the instruments and expertise available to users, visit [www.emsl.pnl.gov](http://www.emsl.pnl.gov).

## BECOME AN EMSL USER

Researchers are invited to access the world-class capabilities and collaborate with the internationally recognized experts at EMSL via its peer-reviewed proposal process. To submit a proposal, follow the five steps outlined on the EMSL website ([www.emsl.pnl.gov](http://www.emsl.pnl.gov)) under User Access. Current and potential EMSL users are encouraged to respond to Calls for Proposals, which are announced each spring. However, unique research proposals that fall outside the Calls for Proposal focus may be submitted at any time.

Applicants are encouraged to submit proposals for use of EMSL's capabilities with an emphasis on integrating computational and experimental tools. In general, most users whose open research proposals are accepted may use EMSL resources free of charge. Open research is loosely defined as science and engineering research for which the resulting information is published and shared broadly within the scientific community.

## SCOTT BAKER

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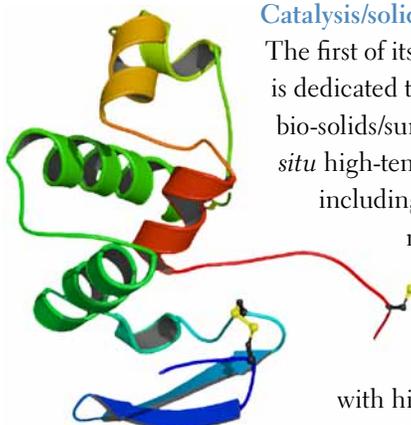
## METABOLOMICS

### Next-generation metabolomics

**characterization capability:** For global and targeted profiling of important metabolic pathways, fatty acids, and volatile molecules based on triple quadrupole MS coupled with GC or LC separations or with EMSL's existing 600-MHz LC-NMR platform.



## NMR & EPR



### Catalysis/solids 850-MHz WB NMR system:

The first of its kind in North America, the system is dedicated to solid-state NMR and applicable to bio-solids/surface interactions complete with *in situ* high-temperature and constant-flow probes, including a 60-kHz probe to allow the highest resolution of complex materials in the solid state.

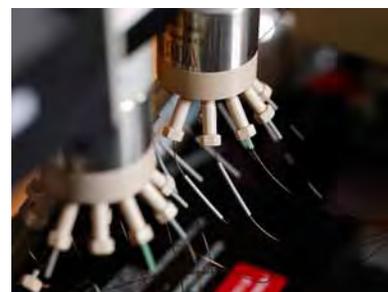
### High-field EPR (95-GHz) system:

One of only three systems of its kind with high-power capability worldwide, the system is designed not only for high field but high power (1 kW vs. 70-400 mW), sharply reducing acquisition time; the instrument allows the study of integer spin metal centers like Ni(II) that are "EPR silent" at low field and easier interpretation of the spectra of high-spin systems (molecular magnets, e.g., Mn(II)).

## OTHER

**Archive storage capability:** Large, energy efficient, easily scalable scientific data archive that houses the terabytes of data generated at EMSL per month.

**Microfabrication capabilities:** To facilitate bioenergy research, such as investigating cellulose breakdown using microbial communities; integrated sample handling; the separation and detection of biomolecules; the separation and analysis of single cells; as well as improved identification and quantification for proteomic analyses.



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