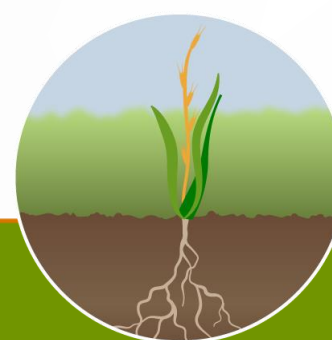
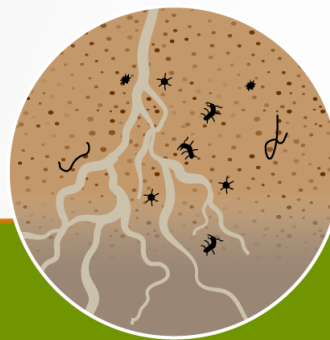


EMSL: Where we're heading

Douglas Mans, EMSL Director

October 25, 2019



SCIENTIFIC INNOVATION THROUGH INTEGRATION

Agenda



- Introduction to EMSL
- Where we are headed
- BERAC's feedback



New Director, Douglas Mans

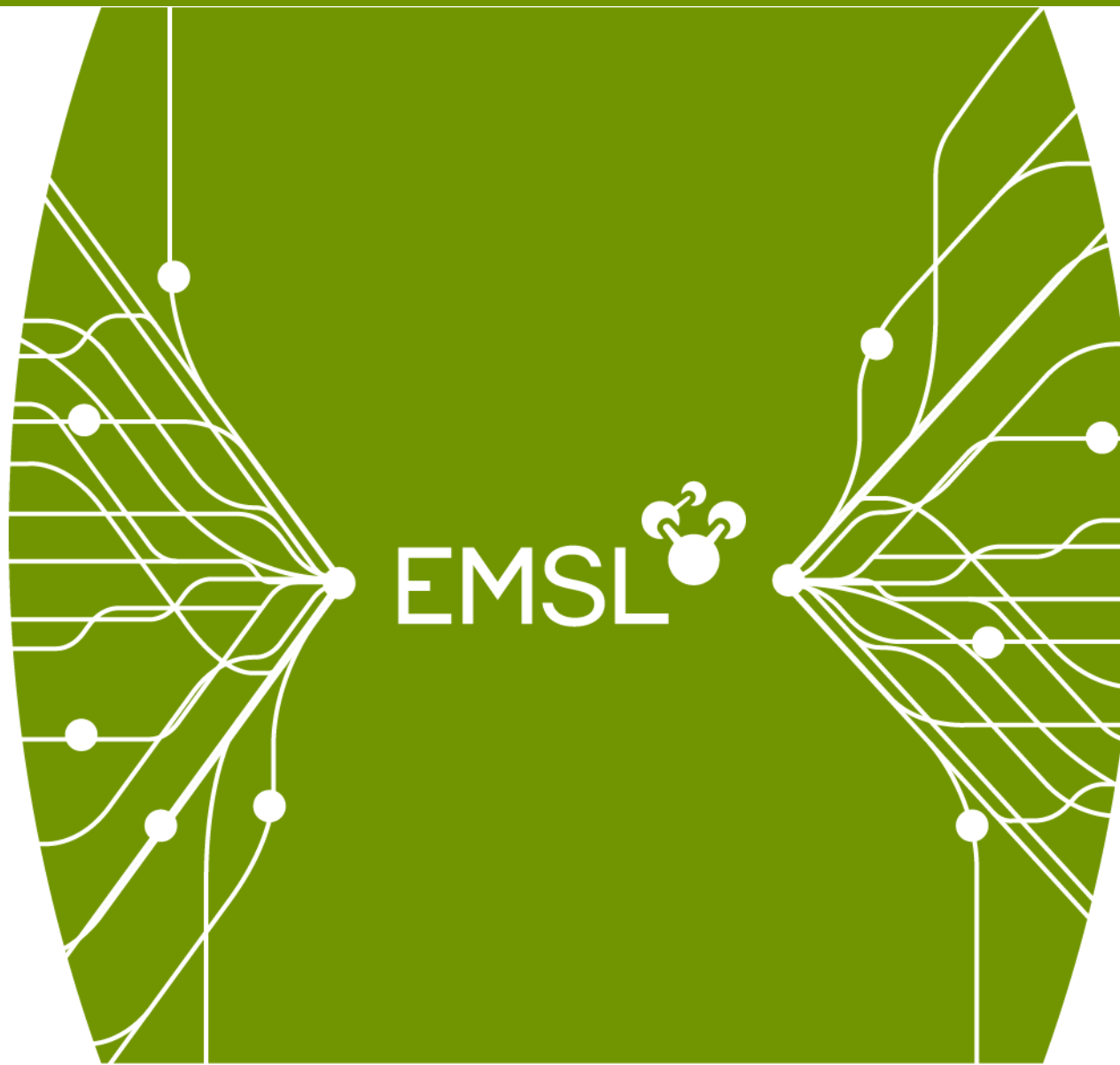


Pharmaceutical Industry



GlaxoSmithKline

13 YRS



Organic Chemistry



UNIVERSITY OF MICHIGAN

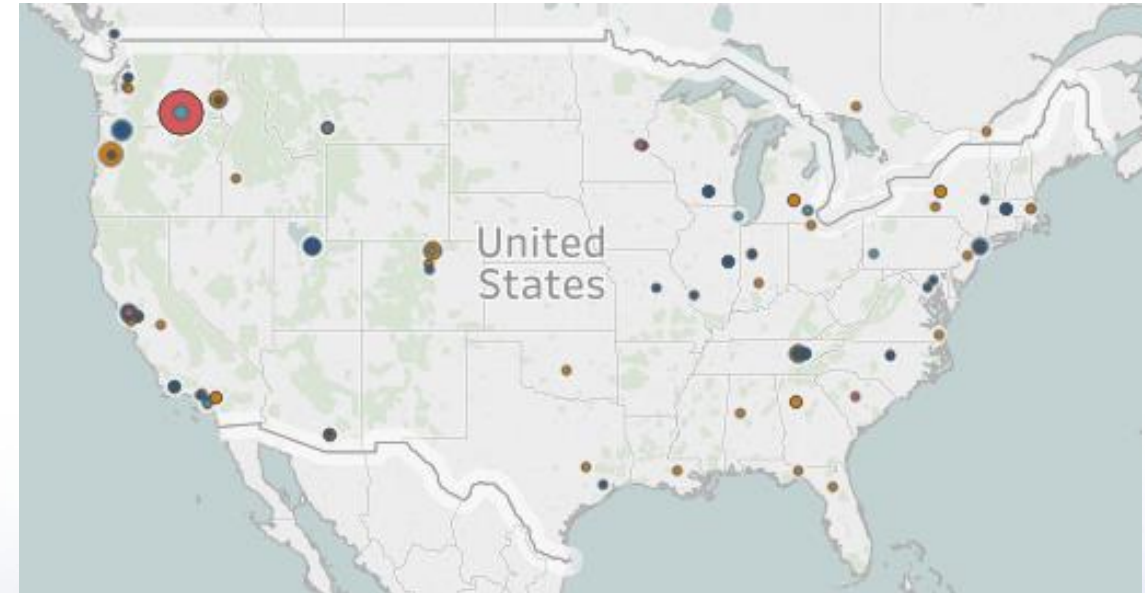


TEXAS
The University of Texas at Austin

EMSL at a glance



- EMSL is a national user facility (234,000 ft²)
- Unique collection of >150 instruments and supercomputer
- 508 users from the US and worldwide
- 262 active user projects
- \$44.8M operating budget



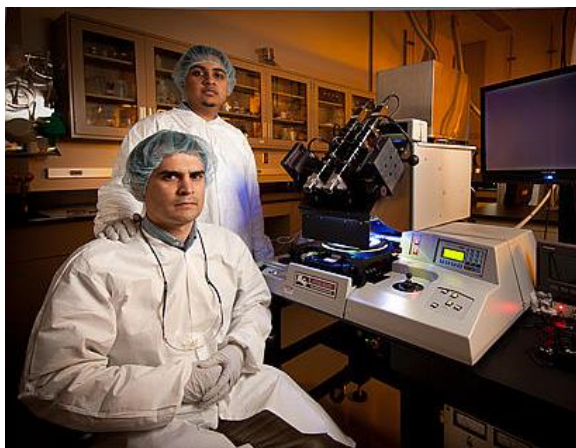
EMSL's global and US user community:
<https://www.emsl.pnl.gov/emslweb/for-users>



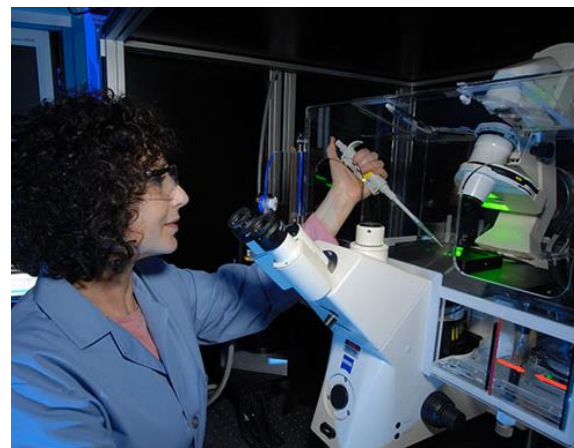
EMSL capabilities



Advanced Scientific Computing



Deposition & Microfabrication



Cell Isolation & Systems Analysis



Mass Spectrometry



Subsurface Flow & Transport



Spectroscopy & Diffraction



NMR & EPR



Microscopy

EMSL Proposal Process



Two award cycles – provide instrument time and staff support through external panel recommendation

- **Winter award cycle**— multi-year awards
 - Large-scale EMSL Research
 - FICUS Research
 - Research Campaigns (not offered every year)
- **Summer award cycle** — partial-year award
 - Helps obtain preliminary data for larger cycle
 - Allows resubmittals if PRP recommends

General proposals — provide short-term or proprietary awards based on available capacity

- Limited scope
- Proprietary
- other contracting mechanisms

USER MODEL

CALL RESPONDER

- 98% of User Project Support budget supports these projects
 - Highest priority for instrument allocation and staff support
- Target BER programs, priorities, and EMSL science areas*

CAPACITY

- Utilize instrument time available after call responders
 - Majority of PIs provide funding for staff support needs
- Augment productivity and scientific staff funding*

SCIENTIFIC PARTNER

- Receive negotiated access to resulting capability
- Share costs to build new capabilities*

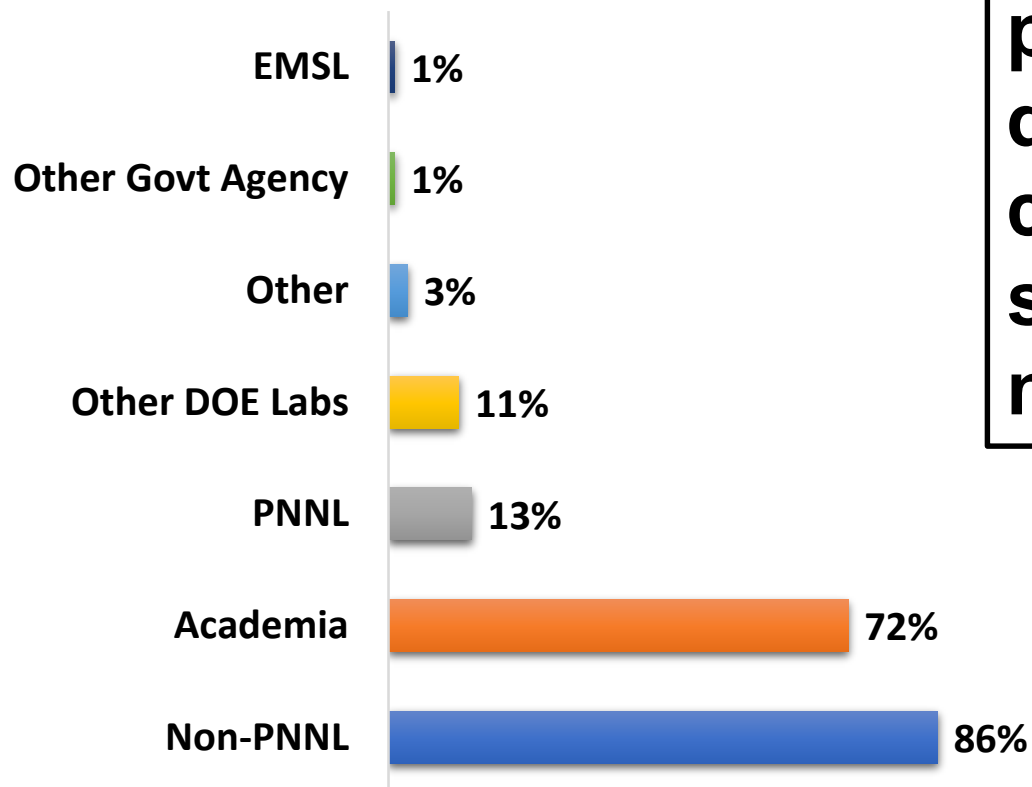
RESOURCE OWNER

- Track usage to ensure at least 20% instrument time available to EMSL users per Utilization Policy
- Leverage other programmatic resources*

EMSL attracts diverse PIs focused on BER science

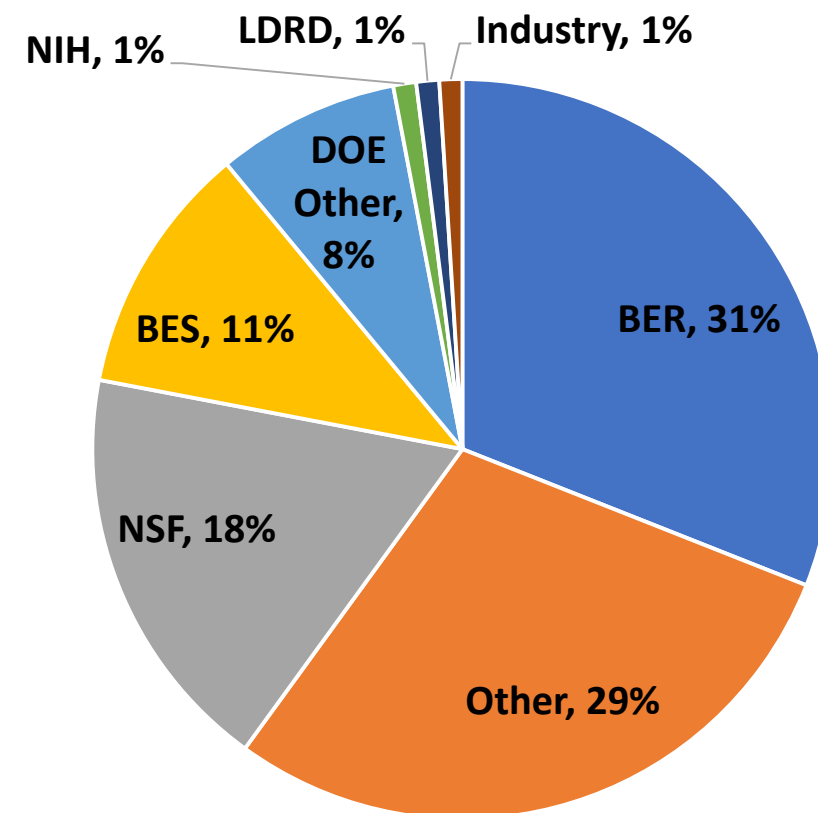


All large-scale EMSL research and FICUS research



FY 2020 proposal call delivered consistently strong numbers

BER-Aligned but Diverse Funding Pool



FICUS: EMSL-JGI joint calls attract new users, enables career growth

FICUS Quick Facts

1

7

30%

36

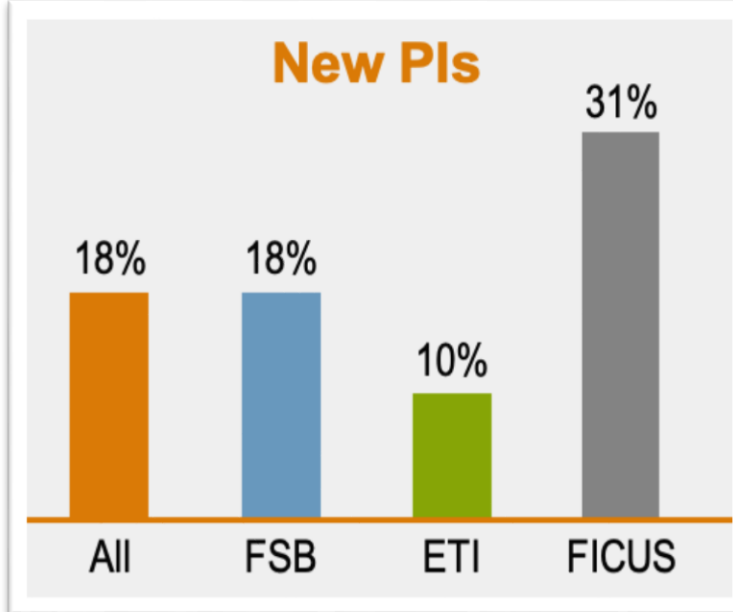
25%

8.84

FICUS
Facilities Integrating
Collaborations for User Science



New PIs



Microbial communities in the gastrointestinal tract of wild moose studied — microbial food web responsible for biomass processing

Reference: Solden, et al. 2018. "Interspecies cross-feedings orchestrate carbon degradation in the rumen ecosystem." *Nature Microbiology*. DOI:10.1038/s41564-018-0225-4.

Functional and Systems Biology Area highlights



Algal circadian rhythm coordinates cellular growth before cell division with a lower respiratory activity at night due to multiple fermentation pathways.

Reference: D. Strenkert, S. Schmollinger, S.D. Gallaher, P.A. Salomé, S.O. Purvine, C.D. Nicora, T. Mettler-Altmann, E. Soubeyrand, A.P.M. Weber, M. Lipton, G.J. Basset, and S.S. Merchant. “Multiomics resolution of molecular events during a day in the life of *Chlamydomonas*.” *Proceedings of the National Academy of Sciences* (2019). DOI: 10.1073/pnas.1815238116.

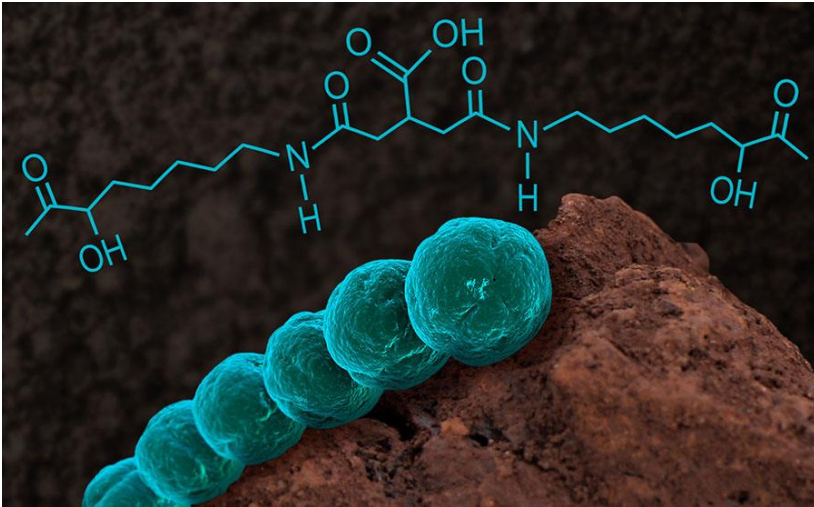


Viruses control bacterial colonization in the deep subsurface after hydraulic fracturing

Reference: R.A. Daly, S. Roux, M.A. Borton, D.M. Morgan, M.D. Johnston, A.E. Booker, D.W. Hoyt, T. Meulia, R.A. Wolfe, A.J. Hanson, P.J. Mouser, M.B. Sullivan, K.C. Wrighton, and M.J. Wilkins 2018, “Viruses control dominant bacteria colonizing the terrestrial deep biosphere after hydraulic fracturing.” *Nature Microbiology*. DOI:10.1038/s41564-018-0312-6

Environmental Transformations and Interactions

Area highlights



Developed methodology to extract siderophores from soil samples, building fundamental understanding of how microbes obtain scarce nutrients from their environment.

Reference: Boiteau, et al. 2019. "Siderophore profiling of co-habiting soil bacteria by ultra-high resolution mass spectrometry." *Metallomics*. DOI: 10.1039/C8MT00252E



Determined how the viscosity of organic matter in soot-containing particles in the atmosphere impacted estimates of their radiative forcing properties and resulted in improved numerical models.

Reference: Sharma, et.al. 2018. "Physical Properties of Aerosol Internally Mixed With Soot Particles in a Biogenically Dominated Environment in California." *Geophysical Research Letters*.

EMSL's science focuses on BER grand challenges



EMSL's science focuses on BER grand challenges



Functional and Systems Biology

SCIENCE AREAS

Environmental Transformations and Interactions

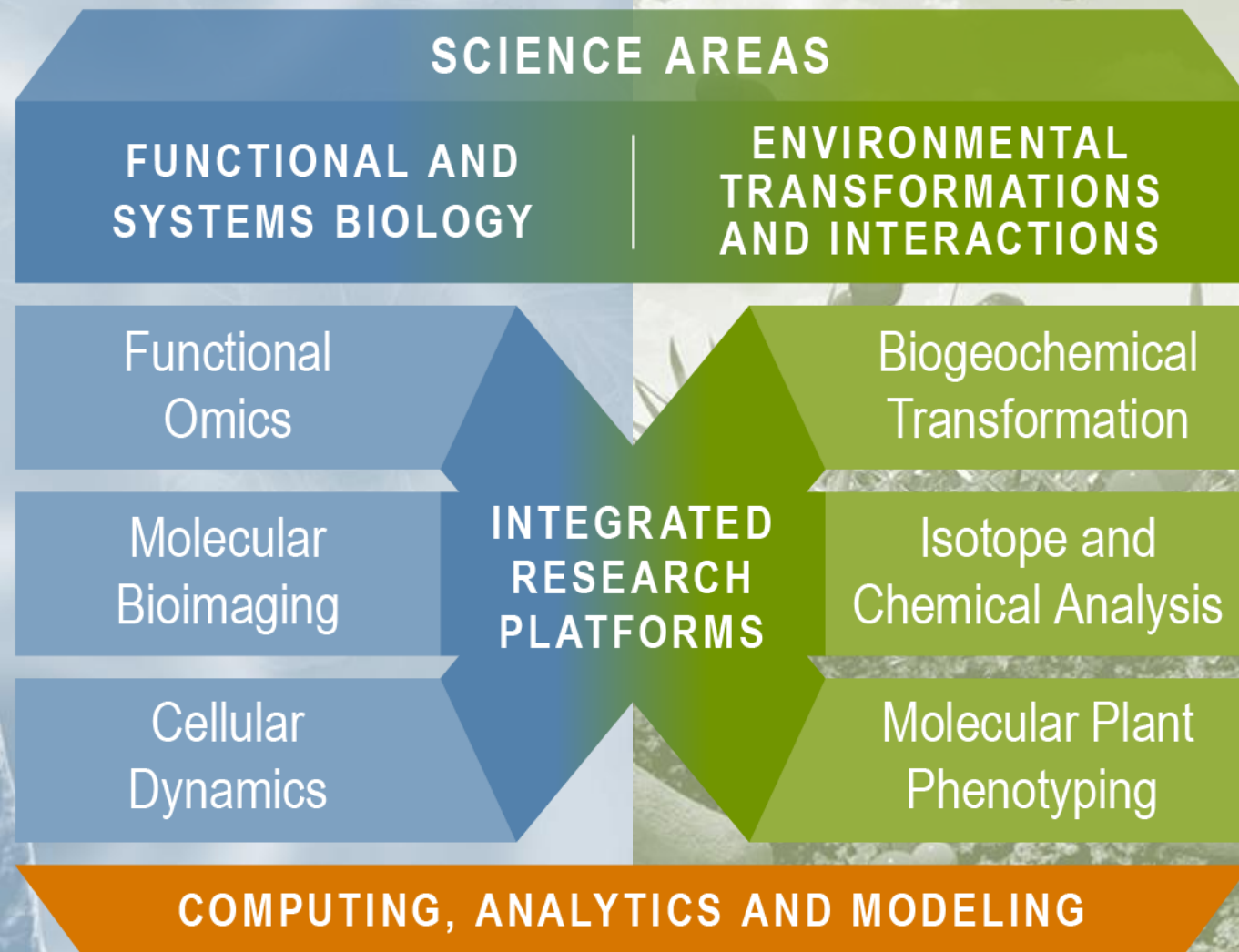
- Molecular “machines,” processes, interactions, and models
- Design plants, fungi, and microbes for bio-based fuels and products
- Complex plant and microbial metabolism impacting carbon, nutrient, and elemental cycles

- Fundamental biogeochemical, plant, microbe, hydrologic, and atmospheric processes
- Mechanistic understanding of these processes
- Interdependencies across scales
- Representation in predictive models

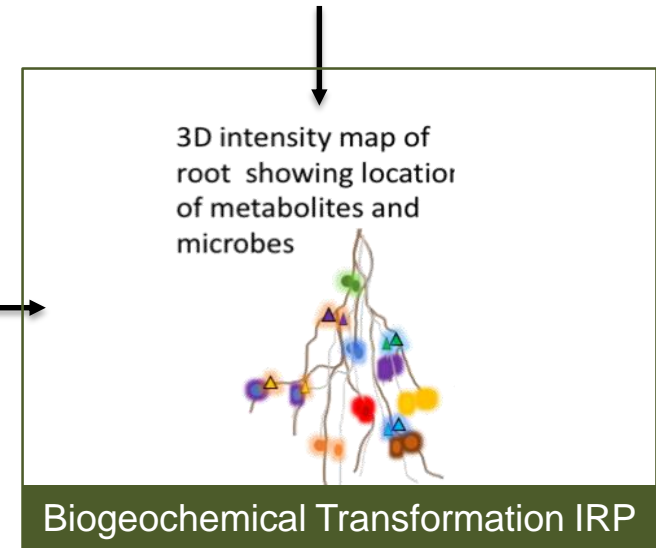
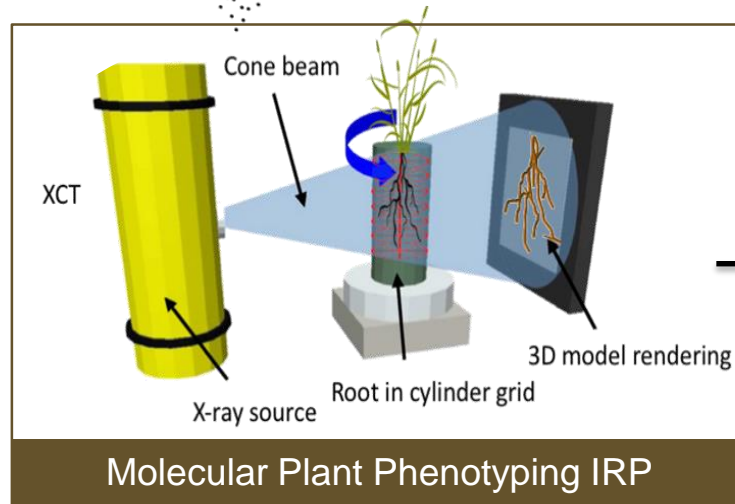
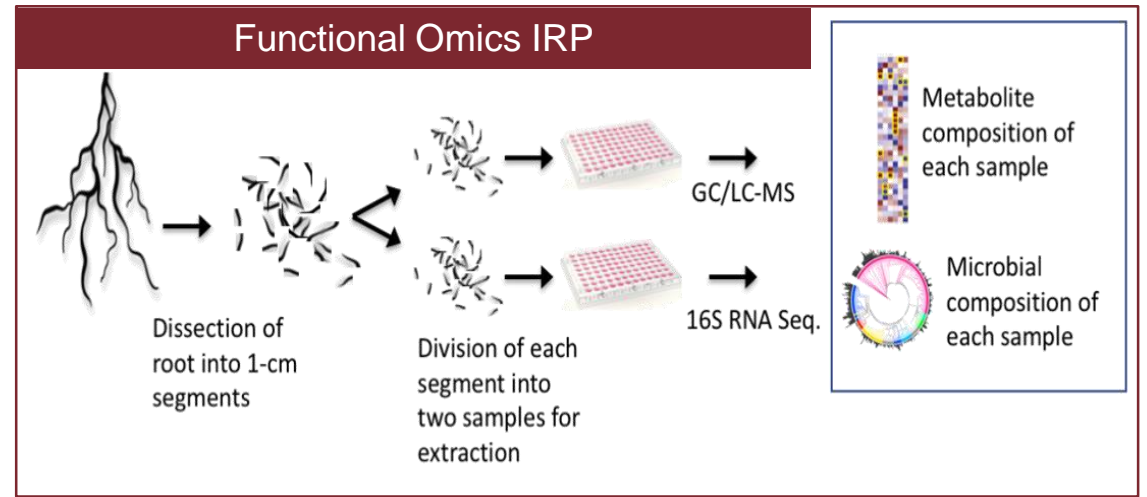
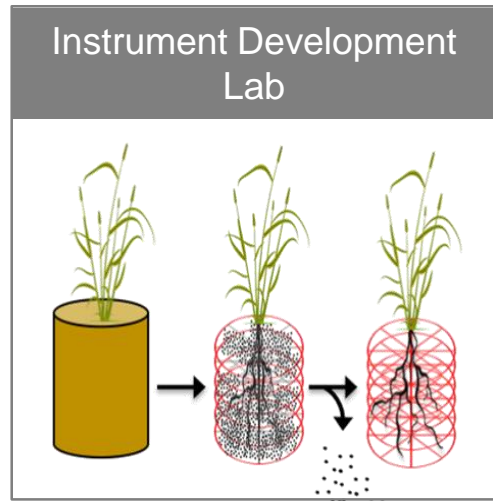
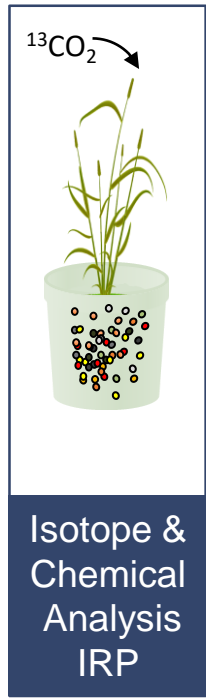
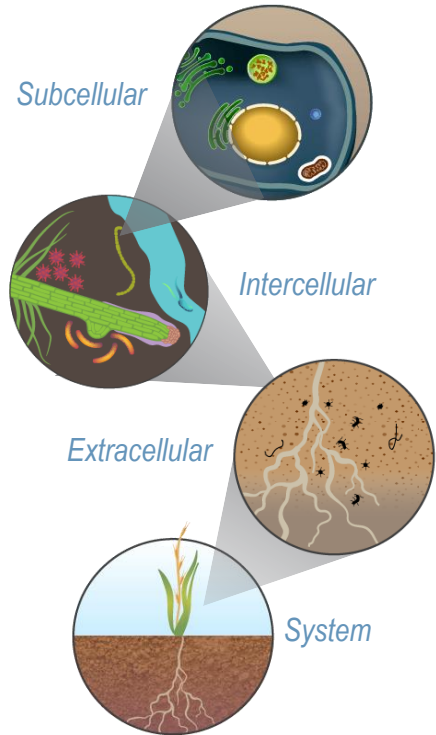
Integration of experimentation and computation

Strategic Science Area — Understanding carbon cycling in plant-microbe-soil systems at the molecular level

EMSL capabilities focused on core areas for leadership



Example Multi-IRP Application: Carbon cycling across plant - soil - microbial systems



EMSL Engages Science Community for Future S&T



- BER PM's engaged to help co-create Science Areas and Integrated Research Platforms
- EMSL User Executive Committee (UEC) input on MIEs and science areas
- Science and Technology Advisory Committee Re-established
 - ▶ Membership from:
 - BERAC
 - PNNL Earth & Biological Sciences DAC
 - UEC
 - National Laboratories- ANL, LBNL, ORNL
 - User Facilities – APS, JGI
 - Industry
 - Academia
 - ▶ Mix of Science, Technology and Computational Modeling expertise across both BSSD and CESD

Your thoughts?



- Do you have any input on EMSL's priority areas of focus that could further enhance supporting BERAC grand challenges and BER mission?
- Are we missing any opportunities in meeting BER's mission?





www.emsl.pnnl.gov



U.S. DEPARTMENT OF
ENERGY