

2026 EMSL Summer School | Advanced Methods for Understanding Critical Minerals and Materials Biogeochemistry

[Zoom Registration](#)

Pacific Northwest National Laboratory, Richland, WA
Environmental Molecular Sciences Laboratory (EMSL)
July 27 - 31, 2026

WORKSHOP AGENDA

Monday, July 27, 2026 Advanced methods for deep understanding of CMM biogeochemistry			
Time	Topic	Location	Presenter
7:30 a.m. – 8:30 a.m.	Badging	Access Control Office (ACO) 650 Horn Rapids Road, Richland WA	All Visiting Attendees <i>TC Black will transport students</i>
8:30 a.m. – 8:45 a.m.	Opening Remarks	EMSL Auditorium & Online Via Zoom	Tamas Varga <i>Materials Scientist, EMSL</i> Kevin Zemaitis <i>Chemist, EMSL</i>
8:45 a.m. – 9:30 a.m.	Keynote: Critical Minerals and Materials Biogeochemistry Key Gaps, Challenges, and Future Opportunities		Clara Chan <i>Professor, University of Delaware</i> <i>Virtual</i>
9:30 a.m. – 10:00 a.m.	Spatial and Phase Distribution of Critical Elements in Tailings Waste		Xiaoxu Li <i>Chemist, PNNL</i> <i>Virtual</i>

Monday, July 27, 2026

Advanced methods for deep understanding of CMM biogeochemistry

Time	Topic	Location	Presenter
10:00 a.m. – 10:30 a.m.	Applying X-ray Photoelectron Spectroscopy to Critical Mineral Speciation: Links to Organic Matter, Reactive Redox Phases, and Redox-Oscillation–Driven Mobilization	EMSL Auditorium & Online Via Zoom	Shuttha Shutthanandan <i>Materials Scientist, EMSL</i>
10:30 a.m. – 10:45 a.m.	Networking Break <i>(Refreshments provided)</i>		
10:45 a.m. – 11:05 a.m.	Advancing Critical Mineral Research Using Time-of-Flight SIMS	EMSL Auditorium & Online Via Zoom	Zihua Zhu <i>Chemist, EMSL</i>
11:05 a.m. – 11:25 a.m.	High resolution mass spectroscopy imaging by NanoSIMS		Jeremy Bougoure <i>Chemist, EMSL</i>
11:25 a.m. – 11:55 a.m.	Using MALDI MSI for CMM Research		Dušan Veličković <i>Chemist, EMSL</i>
11:55 a.m. – 1:00 p.m.	Working Lunch <i>Recruiting Discussion</i>	EMSL 1077	Elizabeth Stephens <i>STEM Workforce Development, PNNL</i>
1:00 p.m. – 2:25 p.m.	Analytical Workshop		Tamas Varga <i>Materials Scientist, EMSL</i> Kevin Zemaitis <i>Chemist, EMSL</i> Nurun Nahar Lata <i>Chemist, EMSL</i>
2:25 p.m. – 2:40 p.m.	Networking Break <i>(Refreshments provided)</i>		
2:40 p.m. – 4:00 p.m.	Experimental Design Workshop	EMSL 1077	Tamas Varga <i>Materials Scientist, EMSL</i> Kevin Zemaitis <i>Chemist, EMSL</i> Nurun Nahar Lata <i>Chemist, EMSL</i>
Adjourn for the day <i>TC Black will pick up the students outside EMSL at 4:30 p.m.</i>			

Tuesday, July 28, 2026

Resolving Molecular Processes at Pore Scale – Micromodels and Reactive Transport Modeling

Time	Topic	Location	Presenter
8:30 a.m. – 8:45 a.m.	Welcome and Introduction	EMSL Auditorium & Online Via Zoom	Pubudu Handakumbura <i>Biologist, EMSL</i> Jayde Aufrecht <i>Biologist, EMSL</i>
8:45 a.m. – 9:30 a.m.	Keynote: Transport Processes at the Pore Scale		Christof Meile <i>Professor, University of Georgia</i> <i>Virtual</i>
9:30 a.m. – 10:10 a.m.	Micromodels-based-designs: Terraforms for Visualizing Biogeochemical Processes		Jayde Aufrecht <i>Biologist, EMSL</i>
10:10 a.m. – 10:30 a.m.	Pore2Chip: Creating Reduced Complexity Micromodels from 3D Scan Data		Aramy Truong <i>Computational Scientist, EMSL</i>
10:30 a.m. – 10:45 a.m.	Networking Break <i>(Refreshments provided)</i>		
10:45 a.m. – 11:25 a.m.	SubTap Platforms: Visualizing Microbial and Plant–Microbe Interactions in the Rhizosphere	EMSL Auditorium & Online Via Zoom	Arunima Bhattacharjee <i>Earth Scientist, EMSL</i>
11:25 a.m. – 11:55 a.m.	Chip2Flow: Integrating Pore2Chip Data with PFLOTRAN and AI/ML Models for Complex Microfluidic Geometries		Maruti Mudunuru <i>Earth Scientist, PNNL</i>
11:55 a.m. – 1:00 p.m.	Working Lunch Campaign Posters	EMSL 1077	Pubudu Handakumbura <i>Biologist, EMSL</i> Jayde Aufrecht <i>Biologist, EMSL</i> Aramy Truong <i>Computational Scientist, EMSL</i> Maruti Mudunuru <i>Earth Scientist, PNNL</i>
1:00 p.m. – 2:25 p.m.	Analytical Workshop		
2:25 p.m. – 2:40 p.m.	Networking Break <i>(Refreshments provided)</i>		
2:40 p.m. – 4:00 p.m.	Experimental Design Workshop	EMSL 1077	Pubudu Handakumbura <i>Biologist, EMSL</i> Jayde Aufrecht <i>Biologist, EMSL</i>
Adjourn for the day <i>TC Black will pick up the students outside EMSL at 4:30 p.m.</i>			

In Case of Emergency Dial (509)375-2400

Wednesday, July 29, 2026

Biomolecular and Natural Organic Matter Controls on Metal Behavior in Complex Mineral-Aqueous Systems

Time	Topic	Location	Presenter
8:30 a.m. – 8:35 a.m.	Welcome and Introduction	EMSL Auditorium & Online Via Zoom	Gregory Vandergrif <i>Chemist, EMSL</i> Vanessa Garayburu-Caruso <i>Earth Scientist, PNNL</i>
8:35 a.m. – 9:20 a.m.	Natural Organic Matter and Metal Capacity in Complex Systems		Will Kew <i>Chemist, EMSL</i>
9:20 a.m. – 9:50 a.m.	Metabolites and Small Molecules: Mobility, Selectivity, Redox		Nathalie Munoz Chemist, EMSL (Virtual)
9:50 a.m. – 10:20 a.m.	Advanced Methods for Understanding Critical Minerals and Materials Biogeochemistry		Eric Walter <i>Chemist, EMSL</i>
10:20 a.m. – 11:00 a.m.	Proteins and Macromolecules: Directionality and Rate Control		Ashley Ives <i>Postdoctoral Researcher, EMSL</i>
11:00 a.m. – 11:15 a.m.	Networking Break <i>(Refreshments provided)</i>		
11:15 a.m. – 12:00 p.m.	Keynote: Discovery of lanthanide-binding proteins and metabolites in <i>Pseudomonas putida</i> via high-throughput computational and experimental workflows	EMSL Auditorium & Online Via Zoom	Kalen Rasmussen <i>National Laboratory of the Rockies</i>
12:00 p.m. – 1:00 p.m.	Working Lunch Professional Development Panel Q&A	EMSL 1077	Gregory Vandergrif <i>Chemist, EMSL</i> Vanessa Garayburu-Caruso <i>Earth Scientist, PNNL</i>
1:00 p.m. – 2:25 p.m.	Analytical Workshop		
2:25 p.m. – 2:40 p.m.	Networking Break <i>(Refreshments provided)</i>		
2:40 p.m. – 4:00 p.m.	Experimental Design Workshop	EMSL 1077	Gregory Vandergrif <i>Chemist, EMSL</i> Vanessa Garayburu-Caruso Earth Scientist, PNNL
Adjourn for the day <i>TC Black will pick up the students outside Discovery Hall at 4:30 p.m.</i>			

Thursday, July 30, 2026

The Role of Genomics and Transcriptomics in Understanding Critical Mineral Biology

Time	Topic	Location	Presenter
8:30 a.m. – 8:35 a.m.	Welcome and Introduction	EMSL Auditorium & Online Via Zoom	Josue Rodriguez-Ramos <i>Post Doctorate Researcher, EMSL</i> Bill Nelson <i>Computational Scientist, EMSL</i>
8:35 a.m. – 9:20 a.m.	Mining Biological Information: Multi-Omics Insights into Critical Mineral Metabolism		Pranav Dawar <i>Postdoctoral Researcher, EMSL</i>
9:20 a.m. – 9:55 a.m.	Environmental Genomics and Metagenomics		Young Song <i>Postdoctoral Researcher, EMSL</i>
9:55 a.m. – 10:25 a.m.	Basic Functional Annotation and Genome-Scale Metabolic Modeling		Amy Zimmerman <i>Computational Biologist, PNNL</i>
10:25 a.m. – 10:40 a.m.	Networking Break <i>(Refreshments provided)</i>		
10:40 a.m. – 11:20 a.m.	Modern protein annotation techniques	EMSL Auditorium & Online Via Zoom	Bob Danczak <i>Data Scientist, PNNL</i> <i>Virtual</i>
11:20 a.m. – 12:00 p.m.	Transcriptomics and Meta Transcriptomics		Christian Ayala-Ortiz <i>Postdoctoral Researcher, PNNL</i>
12:00 p.m. – 1:00 p.m.	Working Lunch <i>User Program Discussion</i>	EMSL 1077	Rick Washburn <i>Project Manager, EMSL</i>
1:00 p.m. – 2:25 p.m.	Analytical Workshop		Young Song <i>Postdoctoral Researcher, EMSL</i> Christian Ayala-Ortiz <i>Postdoctoral Researcher, PNNL</i>
2:25 p.m. – 2:40 p.m.	Networking Break <i>(Refreshments provided)</i>		
2:40 p.m. – 4:00 p.m.	Experimental Design Workshop	EMSL 1077	Josue Rodriguez-Ramos <i>Post Doctorate Researcher, EMSL</i> Bill Nelson <i>Computational Scientist, EMSL</i>
Adjourn for the day <i>TC Black will pick up the students outside Discovery Hall at 4:30 p.m.</i>			

Friday, July 31, 2026

Multimic Analyses—An Integrative Framework for Understanding and Manipulating Bio-Mineral Systems

Time	Topic	Location	Presenter
8:30 a.m. – 8:35 a.m.	Welcome and Introduction	EMSL 1077	Josue Rodriguez-Ramos <i>Post Doctorate Researcher, EMSL</i> Bill Nelson <i>Computational Scientist, EMSL</i>
8:35 a.m. – 9:35 a.m.	Keynote: Microbial Systems for Critical Mineral Recovery and Refinement Spanning the Fundamental-to-Applied Continuum		Kitt Bagwell <i>Earth Scientist, EMSL</i>
9:35 a.m. – 10:20 a.m.	Integration of Data Types and Advanced Modeling		
10:20 a.m. – 10:35 a.m.	Networking Break <i>(Refreshments provided)</i>		
10:35 a.m. – 11:00 a.m.	EMSL Summer School Student Project Working Stations	EMSL 1077	All Students
11:00 a.m. – 11:15 a.m.	Group Photo		All Attendees
11:15 a.m. – 1:00 p.m.	Working lunch EMSL Summer School Student Project Presentations		All Students
1:00 p.m. – 3:05 p.m.	EMSL Tour		

EMSL Tour Tracks		
	Group A <i>Heather Roney</i>	Group B <i>Odeta Qafoku</i>
1:00 p.m. – 1:05 p.m.	Travel to 1526	Travel to 1206
1:05 p.m. – 1:25 p.m.	Multiomics tour (Paul Piehowski) <i>20 minutes</i>	MONet Soil Processing Lab (Sarah Leichthy) <i>20 minutes</i>
1:25 p.m. – 1:30 p.m.	Travel to 1621	Travel to 1229
1:30 p.m. – 1:50 p.m.	ICR MALDI Tour (Kevin Zemaitis) <i>20 minutes</i>	Automation Lab (Caroline Simonsen) <i>20 minutes</i>
1:50 p.m. – 1:55 p.m.	Travel to 1649	Travel to 1526
1:55 p.m. – 2:15 p.m.	Plant Lab Terraforms Tour (Jayde Aufrecht, Sandy LaBonte & Cayden Perdue) <i>20 minutes</i>	Multiomics tour (Paul Piehowski) <i>20 minutes</i>
2:15 p.m. – 2:20 p.m.	Travel to 1229	Travel to 1621
2:20 p.m. – 2:40 p.m.	Automation Lab (Caroline Simonsen) <i>20 minutes</i>	ICR MALDI Tour (Kevin Zemaitis) <i>20 minutes</i>
2:40 p.m. – 2:45 p.m.	Travel to 1206	Travel to 1649
2:45 p.m. – 3:05 p.m.	MONet Soil Processing Lab (Sarah Leichthy) <i>20 minutes</i>	Plant Lab Terraforms Tour (Jayde Aufrecht, Sandy LaBonte & Cayden Perdue) <i>20 minutes</i>
3:05 p.m. – 3:10 p.m.	Travel to 1075	
3:10 p.m. – 4:10 p.m.	Closing Remarks Badge Return and Certificates	EMSL 1075
Adjourn <i>TC Black will pick up the students outside EMSL at 4:30 p.m.</i>		