AGRONOMY SEMINAR SERIES
SPRING 2025

Monday, April 21, 2025
2:30 p.m. LILY 2-425

Attend virtually via Zoom
Seminar links will be posted at: purdue.ag/agryseminars

KATERYNA ZHALNINA

RESEARCH SCIENTIST
LAWRENCE BERKLEY NATIONAL LABORATORY
Faculty Host: Dr. Roland Wilhelm

Kateryna Zhalnina is a Research scientist at Lawrence Berkeley National Laboratory, specializing in soil microbial ecology and biochemistry. Leveraging microbial genomics and metabolomics, she investigates mechanisms underlying plant-microbe-, microbe-microbe interactions, and ecosystem services, to devise nature-based solutions for sustainable agriculture. Dr. Zhalnina earned her Ph.D. from the University of Florida in 2014, focusing on the physiology and ecology of ammonia-oxidizing archaea in soils. Subsequently, her postdoctoral work at UC Berkeley and Lawrence Berkeley National Lab pioneered innovative research linking plant exudate chemistry with plant microbiome dynamics and functionality, advancing our understanding of plant microbiome assembly mechanisms. Her current research encompasses diverse areas, including studies focusing on plant-microbial drivers of nitrification and nitrous oxide emissions; research exploring the role of biodiversity in carbon sequestration; and DOE Earthshots for soil carbon restoration.

Metabolic Handshakes: How Plant-Exuded Metabolites Shape the Rhizosphere Microbiome

Plants release substantial quantities of soluble carbon, known as exudates or rhizodeposits, into the soil surrounding their roots. These small organic molecules, or metabolites, can attract beneficial microorganisms, suppress undesirable microbial groups, and repel plant pathogens. In 'return' for plant-exuded carbon, microorganisms can enhance plant nutrition, improve water availability, or protect against pathogens. These exudate-driven interactions shape microbial activity and play a key role in carbon and nutrient transformations in soils. While these relationships have been recognized for over a century, the mechanisms underlying plant selection for beneficial microorganisms and the specific roles of plant metabolites in this process remain largely unknown. In our studies, we use exometabolomics, microbiome dynamics analysis, and culture-based approaches to uncover links between plant-exuded metabolites, microbial taxa, environmental conditions, and nutrient cycling in the rhizospheres of grasses. We demonstrate that a group of underexplored rhizosphere molecules can act as keystone metabolites, shaping the composition and activity of the rhizosphere microbiome and modulating plant metabolism in response to nutrient availability. These metabolic exchanges between plants and their microbiomes highlight the potential of harnessing plant-metabolite-microbe interactions to optimize the root microbiome, enhance plant health and ecosystem services, and open new avenues for soil microbiome research.