Physiology and Ecology Research Team

Matthew Fields

Director, Center for Biofilm Engineering
Professor, Microbiology & Immunology
Biofilm Physiology & Ecology Team Leader

I am interested in environmental signals that are sensed by cells to mediate control over physiology and modes of growth. In particular, we are interested in the genes used to sense environmental changes in response to biotic and abiotic parameters, and how microbial cells respond in order to optimize metabolism. We study both monocultures and indigenous microbial communities to better understand the interrelationships between genomic content and phenotype at different levels of resolution (i.e., DNA to community), and how these attributes contribute to stress and survival of biological cells. Within the contexts of cellular responses, we study bacterial systems important for heavy metal bioremediation, metal corrosion, extremophilic lifestyles, and bio-energy.

Lauren Franco

Ph.D. Candidate
Microbiology & Immunology

My project focuses on chromium responses, biofilm formation, and extracellular structures produced by the sulfate-reducing bacterium, *Desulfovibrio vulgaris* RCH-1. *D. vulgaris* RCH-1 was isolated from a chromium-contaminated site in Hanford, Washington and is of interest for its ability to reduce the soluble and toxic Cr(VI) to the insoluble and less toxic Cr(III). I am also interested in the extracellular matrix produced by RCH-1 grown as a biofilm and the function that this matrix plays in electron transfer and metal reduction.

Laura Camilleri

Ph.D. Candidate
Microbiology & Immunology, IGERT Fellow

I am currently working on two different projects. The first project is physiological characterization of *Pelosinus* JBW45, isolated from Hanford, Washington. The Hanford site is chromium contaminated and understanding the physiology of JBW45 will help in bioremediation efforts. My second project deals with further understanding the syntrophic interaction between a sulfate-reducing bacterium, *Desulfovibrio vulgaris*, and a methanogen, *Methanococcus maripaludis*. Through cooperation they form a biofilm and produce methane. Understanding the role of biofilm will give us insight into microbial communities and methane cycling.

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Gregory Krantz

Ph.D. Candidate
Microbiology & Immunology

Microbially Induced Corrosion (MIC) is a major concern for industrial ferrous metal oil pipelines and can result in pipeline failure. Sulfate Reducing Bacteria (SRB) have been implicated in contributing to MIC due to their production of corrosive H_2S gas. *Desulfovibrio alaskansis* G20 (G20) is a SRB isolated from a producing oil well in Ventura, California. My project focuses on characterizing G20 growth physiology on glass and steel substrates as well as using a G20 transposon library to select for mutants necessary for biofilm formation.

Anna Zelaya

Ph.D. Candidate
Microbiology & Immunology

I am interested in microbial ecology and the interactions between microorganisms and their environment. My work has primarily focused on environmental sampling, sequence analysis using computer programming and related tools, and multivariate statistical techniques to study the structure and potential ecology of in-situ microbes. Increasing our understanding of microbial community structure, function, and ecology will aid in future eco-engineering efforts aimed at the management and maintenance of healthy environmental systems.

Luisa Corredor-Arias

Ph.D. Candidate
Microbiology & Immunology, Fulbright Scholar

Microalgae under variable stress conditions can produce considerable amounts of lipids that can be used to produce biodiesel as an alternative to fossil fuels. I am focused on the study of microalgae physiology and growth to provide lipid-rich cultures as a sustainable energy source for biodiesel production. My research project is to determine the optimal growth conditions for lipid production of a green algae isolate from coal bed methane water, and its complete genome sequence and annotation. I am also interested in studying biofilm growth and alternative methodologies in pursue of the same goal.

Hannah Schweitzer

Ph.D. Candidate
Microbiology & Immunology

My interests and heart are in Montana. My project focuses on characterization of the coal bed microbial communities of the Powder River Basin in southeastern Montana to better understand their production of methane. The methane produced from coal beds can be used for electrical generation, heat and transportation fuel. Compared to other hydrocarbon fuels, methane produces less carbon dioxide per unit of heat released. By better understanding the methane produced in the Powder River Basin there is a potential to enhance methane production in an environmentally responsible way.

Katie Davis

Ph.D. Candidate
Environmental Engineering

Coal bed methane (CBM) is natural gas and can be used for transportation fuel, heat, and electricity generation. Combustion of CBM produces significantly less CO_2 and other undesirable by-products per kWh than burning coal. My work focuses on the microbial conversion of coal to CBM. This process occurs naturally in the deep subsurface coal seams in the Powder River Basin in eastern Montana and Wyoming and is slower than the rate of conventional natural gas collection. I am interested in investigating methods for enhancing the coal to methane conversion to an economically viable rate to allow the use of the energy stored in these coal reserves without the need to mine the coal itself.

Chiachi Hwang

Industrial Research Scientist

My projects are focused on applying concepts in molecular ecology to study microbially driven processes that may be of interest in industrial settings. For instance, various microbial activities can influence product synthesis and industrial waste management. With the combined knowledge of ecophysiology, microbial ecology offer opportunities to examine interactions among different microbial populations and how microbes response to changes in the environment (*e.g.,* engineering controls). Ultimately, the goal is to use this knowledge to help industry improve management in process control, product quality, and cost or risk assessment.

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Kristen Brileya

Research Scientist

I am a microbial ecophysiologist and my interest is how and why bacteria and archaea interact in complex microbial communities My research focuses on multiple scales to address this broad question. At the cellular level I am trying to understand how bacteria and archaea sense and respond to environmental stimuli, which currently involves characterizing two-component signal transduction systems important for sensing in *Desulfovibrio vulgaris* and *Methanococcus maripaludis*. On a broader scale, I am working to understand nitrogen flux in a biofilm consortium.

Sara Altenburg

Research Lab Manager

Primary duties include management of the Fields Lab and ENIGMA projects funded by the Department of Energy, coordinating biofilm growth for ENIGMA collaborators and in house projects, as well as reactor designs for each unique project. Current work is focused on SRB growth on particles.

Undergraduate Students

Marty Boyl-Davis
Zackary Eddy
KaeLee Massey

Previous Lab Members and Current Position

Dr. Natasha Mallette – University of Wisconsin, Madison
Dr. Elliott Barnhart – USGS Helena, Montana
Dr. K. DeLeon – University of Missouri
Dr. K. Brileya – Montana State University
Dr. J. Valenzuela – Institute for Systems Biology, Seattle, Washington
Dr. M.E. Clark – University of Virginia
Dr. C. Hwang – Montana State University
Dr. A. Sundararajan – National Center for Genomic Resources
Dr. A. Sabalowsky – Benedict College
Kelly O'Shea – Rampart High School, Colorado Springs, Colorado