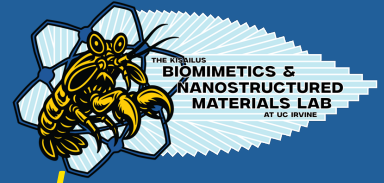




Special Seminar - Biomimetics and Nanostructured Materials Lab



Iron-ing out the Details: Microbial Transformations of Earth's Most Abundant Element

Dr. Isabel Baker
Johns Hopkins University

For more than 1 billion years, life on a young Earth evolved in oceans that were essentially devoid of oxygen and rich in dissolved, reduced iron. However, with the advent of oxygenic photosynthesis and the ensuing rise in oxygen, the trajectory of life and its co-evolution with Earth was irrevocably changed; oxidized iron came crashing out of solution in the form of solid iron (oxyhydr)oxide minerals, the contemporary sulfur cycle's domination became imminent, and in a foreseeably oxidizing ocean, bioavailable iron became a scarce commodity. Vestiges of these evolutionary contexts persist in almost all life today in the form of hemes, iron-sulfur proteins, and iron-scavenging molecules. The organisms whose evolution was undoubtedly the most dramatically impacted were the iron-respiring prokaryotes; that is, bacteria and archaea that “breathe” iron as a means of gaining energy, either oxidizing it as an electron donor or reducing it as an electron acceptor. In doing so, these metabolisms and the adaptations that support them can also impact the bioavailability of iron, oxygen, and the biogeochemical cycles of other elements with which they intersect. In today's generally oxidizing world, iron-respiring metabolisms must contend with challenges brought on by the reactivity between iron and oxygen, the cell-impermeability of solid iron-bearing minerals, and the influence of the sulfur cycle on iron. These challenges go far beyond energy metabolism, as all life on Earth requires iron as a vital nutrient. Given the rich dramatic evolution of iron's form and availability on Earth's surface, I use biological and geochemical interactions with iron as a model for the broader co-evolution of life and Earth. In this presentation, I will discuss case studies from my work on iron and the insights they have yielded into microbial transformations of iron, the impact of iron cycling on other biogeochemical cycles, and the environmental signals recorded by iron minerals.

Friday, November 7, 2025

2:00pm – 3:00pm PT

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