

## **How Microorganisms Breathe Metals: Molecular Mechanism of Microbial Metal Respiration**

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Metal-respiring microorganisms drive a wide range of environmentally significant and energy-related processes. Metal-respiring microorganisms are also deeply rooted and scattered throughout the domains *Bacteria* and *Archaea*, an indication that microbial metal respiration may represent an ancient metabolic process. Despite their environmental and evolutionary significance, the molecular mechanism of microbial metal respiration remains poorly understood. Metal-respiring microorganisms are presented with a unique physiological problem: they are required to respire anaerobically on metal oxides unable to contact intracellular respiratory systems. To overcome this problem, metal-respiring microorganisms employ novel respiratory strategies, including 1) direct enzymatic reduction catalyzed by metal reductases located on the cell surface or on electroactive appendages, 2) electron shuttling to external metal oxides by microbially-produced metabolites, and 3) metal solubilization by microbially-produced organic ligands followed by uptake and respiration of the soluble organic-metal complexes. The talk will present our latest findings on the molecular mechanism of microbial metal respiration, with special emphasis on the molecular details associated with the metal solubilization pathway.