In Vivo Characterization of Bacteria-mediated Extracellular Reduction of Chromium

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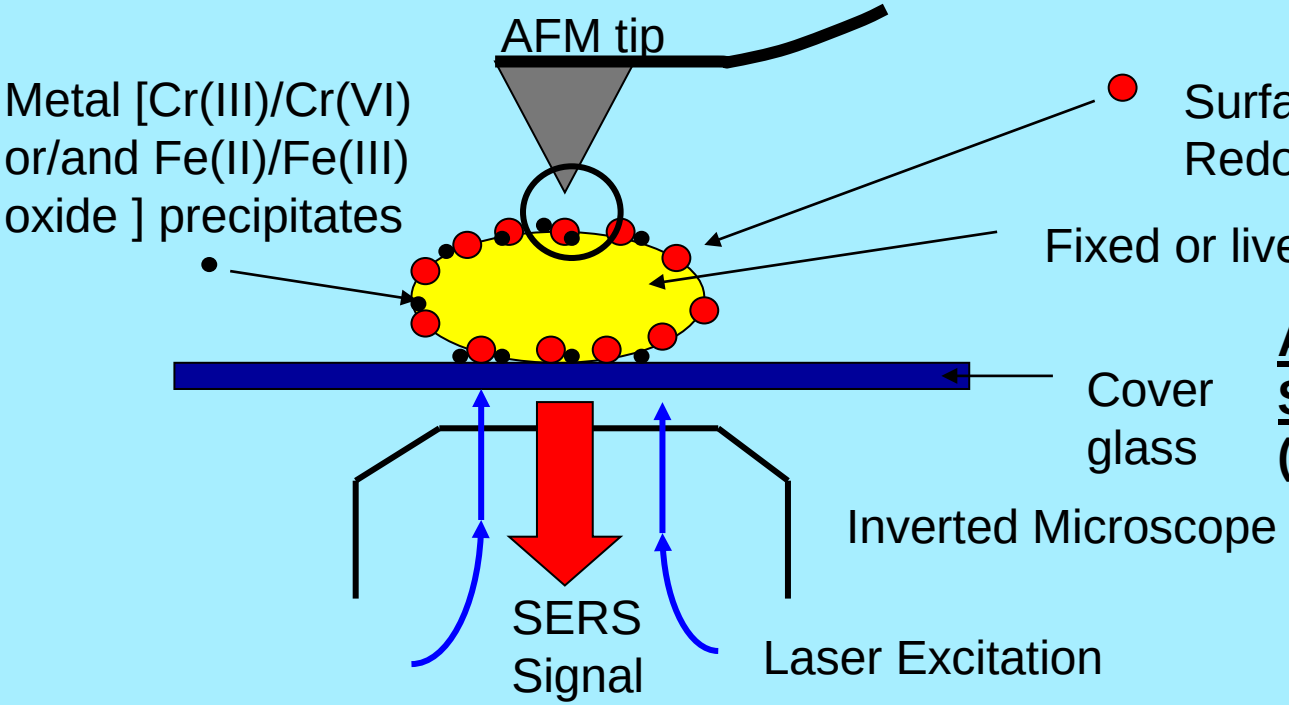

AFM-Correlated SERS Imaging Microscopy (AFM-CSIM)

Chromium (VI) contamination of soil and groundwater

Chromium (VI)

toxic, soluble in water

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Chromium (III)

low toxic, non-soluble oxide

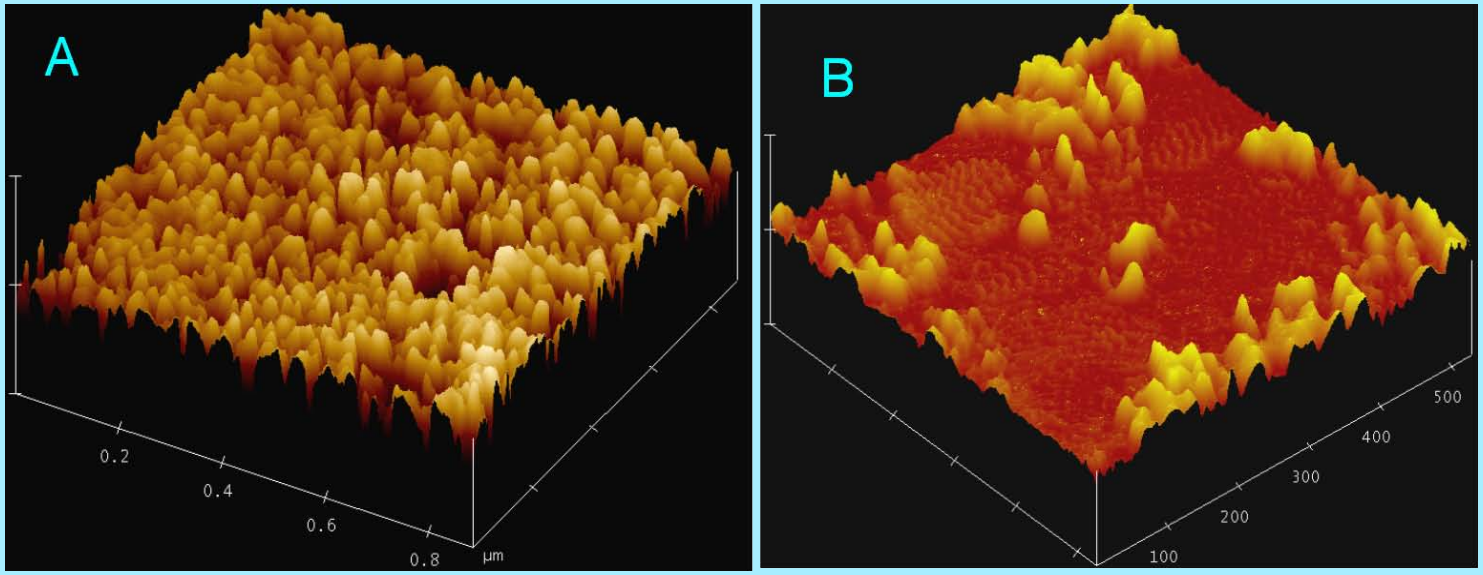
Primary strategy of bioremediation

From mobile toxicity to fixed low toxicity

By biological or chemical means

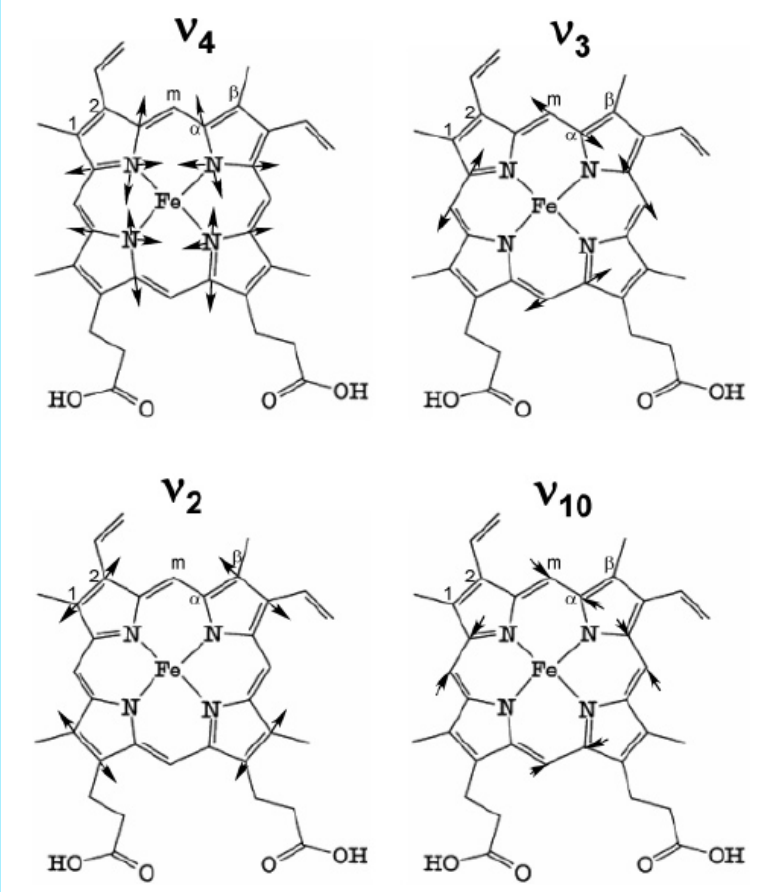
AFM-CSIM Analysis of MtrC/OmcA Proteins, Fe(III)/Fe(II) and Cr(VI)/Cr(III)

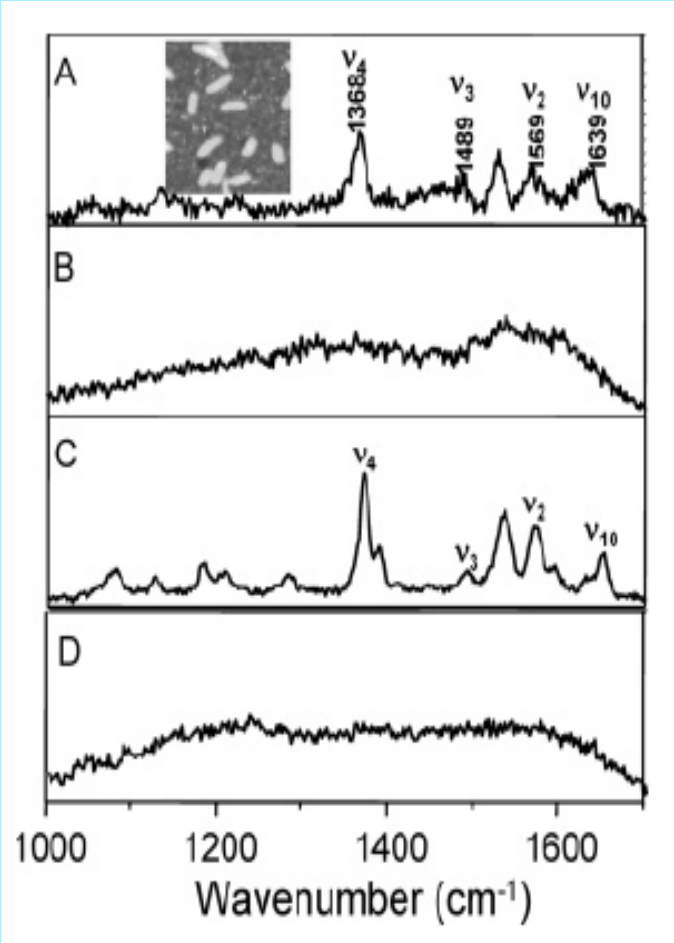
Protein nano-domains on cell surfaces



V. Biju, D. Pan, Yuri A. Gorby, Jim Fredrickson, J. Mclean, D. Saffarini and H. Peter Lu , "Correlated Spectroscopic and Topographic Characterization of Nanoscale Domains and Their Distributions of a Redox Protein on Bacterial Cell Surfaces," *Langmuir* 23, 1333-1338 (2007).

Cell surface domains: Cytochrome proteins are *redox proteins*





Summary:

1. **Cr(VI) can be reduced to Cr(III) by *Shewanella oneidensis MR1***

2. **MtrC and OmcA were demonstrated to be surface proteins that perform the reduction reactions**

3. **The cooperation of surface protein OmcA and MtrC makes the reduction reaction most efficient**

3. **Direct microbial Cr (VI) reduction and Fe (II)-mediated Cr (VI) reduction mechanisms are to co-exist in the bioremediation process**

Acknowledges: NIH/NIEHS
Dr. Yuanmin Wang and Papatya C. Sevinc (BGSU)
Dr. Sara M. Belchik (PNNL)