



CHEMISTRY &  
BIOCHEMISTRY

DATE                      TIME                      LOCATION  
03/15/2024 | 01:30pm | COB1 110

## CHEMISTRY & BIOCHEMISTRY SEMINAR SERIES: Development of Magnetic Nanomaterials for Imaging and Sensing Applications

### Abstract:

The importance of magnetic materials is evident in various fields, including industrial processing, data storage, sensing, and biomedical science. Magnetic resonance imaging (MRI) plays a vital role in visualizing soft tissues and organs, with over 90 million procedures performed annually worldwide. Magnetic material-based contrast agents, notably iron oxide magnetic nanoparticles (MNPs), are commonly used in clinical MRI.

My presentation will discuss the synthesis and evaluation of advanced MRI contrast agents. Smaller MNPs (<5.5 nm) are preferred for translational science as they produce bright MRI signals and enable kidney clearance, but such small MNPs were absent. Previously guided by Dr. Mounji Bawendi, I used and optimized a similar method to create exceedingly small MNPs (ES-MNPs) measuring 4.7 nm, akin to his 2023 Nobel Prize-winning synthetic method of fluorescent quantum dots. ES-MNPs exhibit bright contrast and kidney clearance features, for the first time of their kind. These ES-MNPs and novel single-nanometer iron oxide (SNIO) were later used to develop smart nano-sensors, selectively detecting neurochemicals and disease markers by inducing significant MRI signal changes in vitro and in vivo.

More recently, we have employed an integrative approach that combines Monte Carlo simulation, synthesis, X-ray spectroscopy, and MRI techniques to understand and utilize new magnetic nanostructures. Our strategy aims to advance analytical and material chemistry while translating MNP research knowledge into practical sensing and environmental applications.

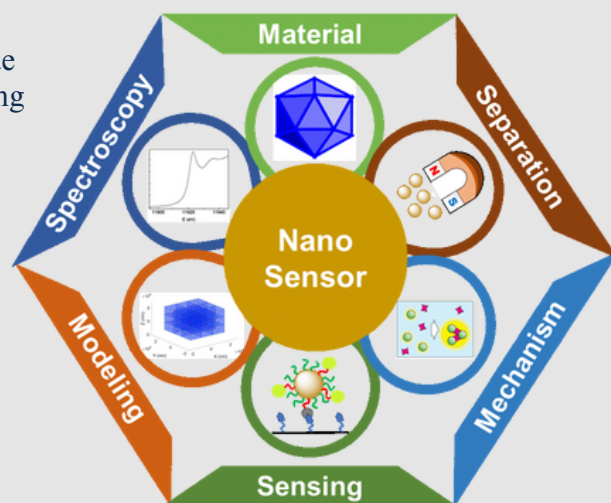
### About the Speaker:

I specialize in nanomaterials, analytical chemistry, spectroscopy, and their biomedical applications. Previously, I obtained my Ph.D. from the Department of Chemistry at the Massachusetts Institute of Technology (MIT). Before joining Fresno State, I worked as a Postdoctoral Associate, Senior Postdoctoral Associate, and a Research Associate in MIT's Department of Biological Engineering. At Fresno State, our Nano Analytics Lab currently develops and characterizes metal-oxide nanomaterials for practical applications ranging from sensing to carbon-neutral energy to environmental remedy.



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