



# CHEMISTRY SEMINAR 291

## Using Biophysical Chemistry to Probe Nitrogenase and the Mechanism of Biological Nitrogen Fixation

**Dr. Christine Morrison**

Department of Chemistry  
University of California, San Diego

Date: 4/27/18

Time: 1:30 PM

Location: COB1 267

For more information contact:

Erik Menke  
emenke@ucmerced.edu

### ABSTRACT

Nitrogenase has captured the minds of scientists for decades, as it contains two unique iron-sulfur clusters and is the only enzyme capable of reducing nitrogen to ammonia. Industrially, nitrogen fixation is accomplished using the Haber-Bosch process, and we are dependent on it to produce enough fertilizer to feed the world's ever-increasing population. While the importance of the Haber-Bosch process cannot be overstated, several drawbacks exist such as high natural gas consumption and nitrate runoffs from excess fertilizer. These could be mitigated by learning and applying how nitrogenase forms and operates under ambient conditions. My work contributes to our understanding of biological nitrogen fixation through biophysical characterization of nitrogenase, including identification of the central atom in the "FeMo-cofactor" at the heart of nitrogenase, substrate pathways, and a protonated resting state. As we continue to learn more about nitrogenase, we may one day elucidate the enigmatic mechanism of biological nitrogen fixation. This knowledge could contribute to the development of more efficient nitrogen-fixing catalysts for industrial fertilizer synthesis or the design of de novo nitrogen-fixing proteins that could be expressed in plants so crops could essentially fertilize themselves.

### BIO:

Dr. Christine Morrison grew up near Detroit, Michigan. She received her B.S. in Chemistry from the University of Michigan in 2010 as an astronaut scholar while working with Prof. Adam Matzger. During the following year, she was a Fulbright scholar at the Karlsruhe Institute of Technology in Germany in the laboratory of Prof. Dr. Annie Powell. She then moved to California to earn her Ph.D. in Chemistry from Caltech, which she completed in June 2017 under the direction of Prof. Doug Rees and with a National Science Foundation Graduate Research Fellowship. She is currently a UC President's and a Ruth L. Kirschstein postdoctoral fellow in the laboratory of Prof. Seth Cohen at UC San Diego. Her research interests include bioinorganic, biophysical, and medicinal chemistry. More specifically, she is interested in how metals can interact with proteins to either form functional metalloenzymes or create new protein-based therapeutics. She is also passionate about improving chemistry education and advocating for gender equality in STEM fields.

