BCHM 421/422 --2019/2020

Project outline: Oxygen is among the most common elements found in organic and biological molecules, but remains the only one that has not yet been fully utilized in nuclear magnetic resonance (NMR) studies of biological macromolecules such as proteins and nucleic acids. This is because the only NMR-active oxygen isotope, ^{17}O, has an exceedingly low natural abundance, 0.037%. Therefore, ^{17}O isotopic labeling is generally a prerequisite of ^{17}O NMR studies. While isotope labeling of proteins with ^{13}C and ^{15}N is a common technique for determination of protein structures by NMR, incorporation of ^{17}O into proteins is a new direction of research. In the past decade, significant progress has made in ^{17}O NMR spectroscopy of small organic compounds. As a result, ^{17}O NMR of proteins has become an emerging field [1]. In this project, we will prepare ^{17}O-labeled amino acids, incorporate them into proteins using recombinant techniques, and explore the boundary of ^{17}O NMR for proteins.

Supervisor: Gang Wu (Chemistry); **Co-supervisor**: Steve Smith (DBMS)

Project Title: Synthesis of ^{17}O-labeled amino acids and their incorporation into proteins

Project Goals: Prepare ^{17}O-labeled amino acids; incorporate them into proteins by using auxotrophic *E. Coli* strains DL39 and CT19.

Experimental Approaches:

- Organic synthesis (basic wet lab skills, compound characterization by spectroscopic analysis)
- Protein biochemistry (recombinant protein expression, purification, characterization, and crystallization)
- ^{17}O NMR for small molecules and proteins

References:

[1] J. Zhu and G. Wu, *J. Am. Chem. Soc*. **2011**, *133*, 920.