Department of Chemistry & Biochemistry Seminar

Friday, April 23, 2021

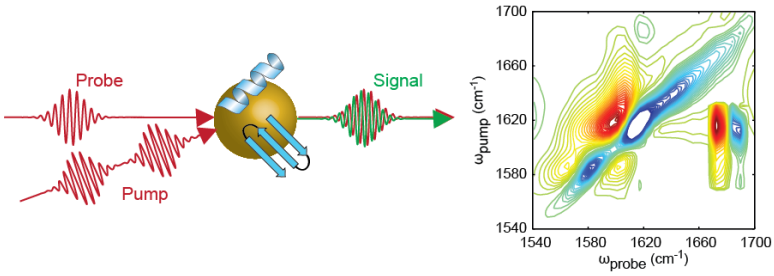
1:30pm – 2:45pm

Zoom ID: 960 452 0800

Password: Protein

Developing novel spectroscopic approaches to determine changes in protein secondary structure with high sensitivity

Speaker: ***Dr. Lauren Buchanan***, **Vanderbilt University**



Abstract: Traditional biophysical techniques often struggle to resolve changes in protein secondary structure with simultaneous high structural and temporal resolution. We are developing new methodologies for using two-dimensional infrared (2D IR) spectroscopy to sensitively monitor changes in protein secondary structure under a wide range of conditions. First, we demonstrate the label-free detection of subtle changes in monomer alignment within β-sheet-rich protein aggregates via calculation of transition dipole strength "spectra." With the addition of site-specific isotope labeling, we obtain residue specific aggregation kinetics to build a more detailed mechanistic picture of the self-assembly process. This approach is non-perturbative and allows for elucidation of distinct secondary structure variations that are invisible to other techniques. We will use this approach to further understand the formation of structural polymorphs during amyloid protein aggregation. Second, we explore the use of isotope labels to report localized structural changes in α-helical peptides. Using a model peptide with tunable helicity, the sensitivity of three distinct labeling scheme was determined by measuring changes in peak frequencies and crosspeak intensities in the 2D IR spectra. We plan to use the most successful labeling scheme, along with established schemes for monitoring β-sheet structures, to resolve changes in native structure that result when peptides adsorb onto nanoparticle surfaces.

Biography: Lauren joined the chemistry department at Vanderbilt University in 2016. She earned a B.A. in Chemistry and Mathematics from Washington University in St. Louis. As an NSF Graduate Research Fellow, she earned her Ph.D. from the University of Wisconsin Madison in the group of Professor Martin Zanni. Her graduate research work focused on using 2D IR spectroscopy to determine mechanism of amyloid aggregation. Lauren then continued her research training at Northwestern University under the mentorship of Professor Richard Van Duyne, where she worked on developing surface-enhanced femtosecond stimulated Raman spectroscopy (SE-FSRS). In her independent career, Lauren and her students have been developing exploring new methods of using 2D IR spectroscopy to study protein structure and aggregation in complex environments.