QCB Evenings

Thursday, November 7th • 5:00 – 6:15 PM • SI001

Free pizza and drinks! **All students and postdocs are welcome!**

Understanding Enzyme Activity Regulation by Genetically-Encoded Metal-Responsive Chemical Switches | Payal, Lewis Lab

Protein functions in biological systems are often regulated through allostery, a process where binding at one site influences activity at another. A classic example is the regulation of oxygen binding affinity in hemoglobin. Inspired by such natural systems, synthetic allosteric switches have been designed for various applications, including biosensing and cascade catalysis. Traditionally, these switches rely on redesigning existing allosteric proteins or inserting natural allosteric domains into proteins of interest (POI). However, these approaches face limitations, such as limited applicability to a wide range of POIs and the need for extensive engineering efforts. In a previous study, we developed a novel covalent linking group (LG) strategy to regulate the activity of *Pfu* Prolyl oligopeptidase (POP) based on the presence or absence of metal. Using a small Bipyridyl (Bpy) LG, we developed robust, reversible, metal-responsive protein switches for *Pfu* POP. To generalize this approach for other systems, understanding the underlying mechanism of protein switching is critical. The current study aims to investigate this mechanism using biophysical and computational tools to elucidate how switching occurs in the POP system.

Optimizing super-radiant virus-like particles (srVLPs): The role of capsid template | Kristen White, Dragnea Lab

Virus-like particles (VLPs) derived from many small viruses can spontaneously self-assemble into highly symmetric protein shells known as capsids. The capsid structure serves as a barrier, protecting encapsulated cargo from various chemical and physical stressors, and provides a template for attaching diverse molecules, such as drugs, nucleic acids, or imaging agents for added functionality. Consequently, VLPs have emerged as promising platforms for designing multicomponent nanomaterials that combine biological organization with functional components. Super-radiant VLPs (srVLPs) consist of hundreds of chromophores covalently attached to a nanoscopic virus capsid. When excited with a short laser pulse, srVLPs exhibit a picosecond burst of light at room temperature. The observed emission dynamics exhibit characteristics of super-radiance (SR), a cooperative process in which weakly coupled quantum emitters spontaneously synchronize to emit in phase. The objective of my project is to investigate the capsid template's role in supporting super-radiance and to identify the minimum number and relative locations of chromophores needed to generate srVLPs. We hypothesize that chromophores situated within the internal structure of the capsid are the active chromophores participating in SR as they occupy a more protected chemical environment with reduced chromophore mobility, that may facilitate vibronic coupling between the weakly-coupled chromophores and the virus capsid's acoustic phonon mode. To explore this, we leverage the chemical kinetics of amine modification to control bioconjugation of the capsid using a two-step approach. to original srVLPs. These findings will help elucidate the relationship between the capsid-chromophore positioning and emission characteristics.