

61st Friend E. Clark Lecture Series



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Elizabeth R. Young, Ph.D.

*Associate Professor
Department of Chemistry
Lehigh University*

From Photodynamic Therapy to Controlling Excited- State Dynamics with Protons: Photophysics of Pd(II)biladiene, Azo Dyes, and Re(I)carbonyl complexes

April 1st at 4:00 pm

Clark Hall 104

Solar light harvesting and interconversion of solar energy into either electricity or driving force for small molecule activation reactions are critical to the production of energy and other processes that our society requires to function. In this talk, I will discuss three projects united by photochemistry, each with their own application. In the first vignette, I will discuss a porphyrinoid complex, called a Pd(II)biladiene. This Pd(II)biladiene moiety was designed for use as a photosensitizer drug for photodynamic therapy. Up until this point, the excited-state dynamics of such biladiene complexes have been virtually unexplored. During our work on this moiety, we discovered that while excitation into the lowest-energy absorption feature of the Pd(II)biladiene complexes produces expected photophysics, interestingly, excitation into higher-lying excited states resulted in an additional, unexpected lifetime. I will discuss our work to propose the cause of this unexpected behavior. In the second vignette, I will discuss our recent work on a ubiquitous industrial dye that is a major cause of pollution in developing countries. Azo dyes are a class of organic molecules defined by an N=N double bond connecting two aromatic moieties. They are the single most common dyes used in industrial processes, found in everything from colorants and cosmetic additives to textile reagents, biologic indicators, and organic synthons. They present a significant pollution problem because untreated dyes released into waterways can be ingested and are toxic to humans and animals. Our recent studies shed light on their photophysics and how we can manipulate their photophysical evolution. In the third vignette, I will discuss a Re-carbonyl complex that we designed for use in excited-state proton-coupled electron transfer (PCET) mechanistic investigations. PCET mechanisms can be employed to improve energetic and kinetic favorability of chemical transformations or to direct chemical reactivity, and we can seek additional energetic advantage by using solar energy to drive such coupled reactions. This Re-carbonyl complex has demonstrated an unexpected photophysical dependence on the ligand protonation state that we rationalize using density functional theory calculations.