**Title:** Nucleophilic Cobalt Photocatalysis and Organic Photoreductants: Two Enabling Approaches to Organic Synthesis

**Abstract:**

While carbon-centered radicals have become an increasingly important tool in organic synthesis, the breadth of radical precursors available to synthetic chemists remains underdeveloped. Many of the radical precursors employed in these methods require pre-functionalization of the initial feedstock chemical, adding undesired synthetic steps while generating additional byproducts after radical formation. Our lab’s research focuses on the development and advancement of nucleophilic cobalt photocatalysis and organic photoreductants, with the unifying theme of these programs being the expansion of the breadth of carbon radical precursors available to practitioners of the field. Our nucleophilic cobalt photocatalysis strategy leverages the unique reactivity of cobalt square planar complexes, like Vitamin B12, which can engage with electrophiles in SN2 reactions, generating Co(III)-alkyl intermediates that can be photolyzed under visible-light irradiation to generate carbon-centered radicals. Our contributions in this area leverage 1,2-dichloroalkyl electrophiles for the preparation of cyclopropanes. Our lab also focuses on utilizing organic photoreductants, such as halogen-bonding photocatalysts and organic anions, for the generation of carbon-radicals from alkyl and aryl halides and carbonyl compounds, circumventing the use of tin hydrides and ground state metal reductants generally required for activation of these substrates. Our contributions leveraging substituted hydroquinone photocatalysts and 1,4-dihydropyridine anions as organic photoreductants will be presented.