FURMAN

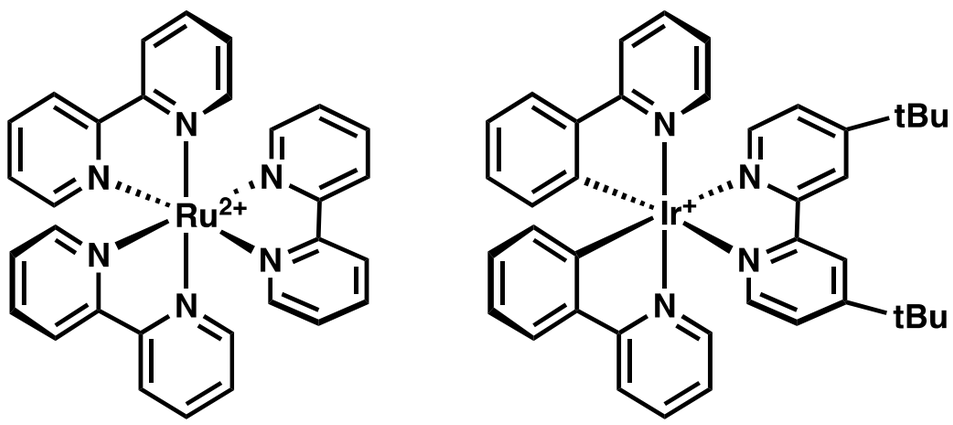
Chemistry Department
2021 Summer Research Program

Mary Beth Daub Research Group

Research in the Daub group aims to develop photocycloaddition reactions and apply them to the synthesis of biologically active natural products. With the "post-antibiotic era" rapidly approaching, both the CDC and the WHO have identified drug-resistance in microorganisms as a major threat to public health.[1] This emergence of antibiotic-resistant bacteria exposes a critical need for the development of new antibiotics. Organic synthesis continues to play an important role in drug discovery, as natural products provide inspiration for new targets and advances in synthetic methodology enable novel bond construction. Synthetic routes to potential drug candidates are particularly vital, as the synthesis of unnatural analogues enables the determination of structure-activity relationships.

Photochemistry in natural product synthesis has provided unique opportunities for the rapid construction of molecular complexity, often by way of reactivity that would be inaccessible using traditional thermal chemistry.[2] Historically, such reactions have required the use of high energy ultraviolet light. Recent developments in visible light photocatalysis, however, have vastly increased the accessibility of photochemical reactions to standard synthetic organic laboratories.[3] Functioning as single electron oxidants or reductants and triplet photosensitizers upon excitation with *visible light*, transition metal photocatalysts can serve as catalysts for a variety of reactions.

Figure 1. Common transition metal photocatalysts.



$Ru(bpy)_3^{2+}$ $Ir(ppy)_2(dtbbpy)^+$

The goals of the Daub group during the 2020 Summer Research Program are to investigate the use of visible light photocatalysts as oxidants in photocycloaddition reactions of heterocycles and as photosensitizers in tandem photocycloaddition–ring fragmentation reactions. After demonstrating the feasibility of the proposed methods, the synthesis of biologically active natural products will be initiated.

[1] Michael, C. A.; Dominey-Howes, D.; Labbate, M. *Front Public Health* **2014**, *2*, 145.
[2] Kärkäs, M. D.; Porco, J. A., Jr.; Stephenson, C. R. J. *Chem. Rev.* **2016**, *116*, 9683.
[3] Prier, C. K.; Rankic, D. A.; MacMillan, D. W. C. *Chem. Rev.* **2013**, *113*, 5322.