Abstract
Our research program is focused on using nature as an inspiration for the development of novel catalytic tools for organic synthesis. In the active site of enzymes, multiple metal centers often cooperate to lower the barrier to oxidative and reductive processes, thus enabling efficient catalysis in very challenging organic transformations. Our group is designing and developing heterobimetallic catalysts where metal-metal interactions and cooperativity can lead to enhanced catalysis and novel transformations. Our efforts have led to the development of Pd–Ti and Pt–Ti catalysts that display exceptional reactivity in allylic amination and cycloisomerization reactions respectively. This seminar will describe our current efforts to develop chiral Ti–M complexes for enantioselective catalysis and heterobimetallic M–Ni complexes for nickel catalysis applications. In separate pursuits, we have also developed peptide-based multifunctional catalysts that enable enzyme-like cooperative catalysis. The small peptide scaffold brings multiple non-natural catalysts into close proximity, enabling faster catalyst turnover, novel selectivity based on substrate binding and proximity, and the development of novel two-catalyst transformations. The development and use of these catalysts to achieve novel reaction rates and selectivity and for new reaction discovery will also be presented.