RISE Talks Series

Who?	Adam Cassano, Associate Professor of Chemistry
What?	Modeling Enzyme Catalysis via Metal-Catalyzed Phosphodiester Hydrolysis
When?	12:00-1:00 on Wednesday, March 18
Where?	Hall of Sciences, Room 326

Enzymes exhibit tremendous catalytic power, increasing the rate of biologically necessary chemical reactions by, in some cases, more than 1×10^{17} fold. Our laboratory investigates how this level of catalysis can be achieved by studying the mechanisms of model non-enzymic catalysts in aqueous solution. In particular, we study metal catalyzed cleavage of phosphodiester bonds, the bonds which hold together our genetic material. Because many enzymes which catalyze this reaction utilize metal ion co-factors, determining the extent of catalysis by metal ions in the absence of enzymes provides a lower limit for the contribution they make to overall catalysis. Our experimental strategy uses chemical kinetics to determine the chemical mechanism of catalysis by a metal ion in aqueous solution, determine the overall catalytic effect of the metal ion, and finally compare catalysis to enzymes which employ similar mechanisms. I will review our work focusing on the Mg^{2+} and Ca^{2+} catalysis of both DNA and RNA model systems. Results indicate that the mechanism of catalysis can vary with both the identity of the metal ion catalyst and whether the phosphodiester model corresponds to DNA or RNA. I will discuss the results in the context of enzymes which utilize similar mechanisms.