화학과 세미나

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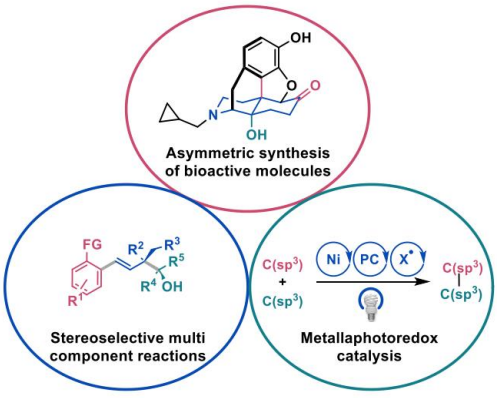
Building Structural Complexity via Transition Metal Catalysis

The efficient generation of structural complexity from simple starting inputs is one of the main goals that we stride toward in synthetic chemistry. In this regard, using transition metal-catalyzed strategies as a key bond-forming step can provide straightforward routes to synthesizing bioactive and functionalized structural motifs. In the first part of my talk, I will discuss the journey toward the asymmetric synthesis of (-)-naltrexone, an opioid antagonist used extensively for managing opioid drug abuse and addiction. Critical bond disconnections of the synthesis will be highlighted, including a Rh-catalyzed C–H alkenylation and electrocyclization, an acid-catalyzed Friedel-Craft cyclization to generate the morphinan core, and a novel late-stage Cu-catalyzed hydroxylation strategy. For the second part of my talk, I will present a facile multicomponent strategy using C-H bond substrates, dienes, and a third electrophile to access quaternary centers containing homoallylic alcohols or nitriles. This methodology employs a Cp* cobalt catalyst which enables a chair-like transition state that explains the stereoselectivity or the level of substitution of the diene component. Lastly, I will be discussing a dual Ni/photoredox catalyzed methodology to enable $C(sp^3)$–$C(sp^3)$ bond formation to generate β-functionalized amines via cross-coupling between aziridines and aliphatic alcohols activated as benzaldehyde dialkyl acetals. A detailed mechanistic study result will be discussed, elucidating that Ni(II) azametallacycle, conventionally proposed in aziridine cross-coupling, is not an intermediate in the productive cross-coupling. Rather, aziridine activation proceeds via Ni(I) oxidative addition.



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