WESTERN MICHIGAN UNIVERSITY

The Department of Chemistry Presents:

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Title: High-valent Cu(III) species in bioinorganic chemistry and C-H functionalization

High-valent Cu(III) complexes have long been proposed as important intermediates in biological redox processes and organic transformations involving the activation of C-H bonds. However, the proposed high-valent Cu(III) intermediates often elude detection due to their fleeting lifetimes. In the first part of my talk, we employ a general CuII/CuIII platform to activate simple nucleophiles (Nu) toward C-H functionalization. Oxidation of CuII-Nu to formal CuIII-Nu endows the Nu moiety with hydrogen atom transfer and radical capture reactivity. Building on this platform, we have established several (electro)catalytic C-H functionalization methods that selectively produce functionalized hydrocarbon products at mild conditions.

In the second part of my talk, I will present a newly discovered reactivity of Cu(III) complexes toward deoxyhalogenation. While C–H halogenation is typically proposed to proceed via a halogen rebound mechanism, our results support an alternative stepwise pathway in which copper first mediates C–H hydroxylation—reactivity well established for copper enzymes and coordination complexes—followed by deoxyhalogenation. This mechanistic framework offers a plausible means by which nature repurposes copper cofactors for C–H hydroxylation to achieve C–H halogenation.

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