**Stereocontrol in Photochemical Reactions**

Photochemistry is intriguing as a synthetic tool because the absorption of light by an organic molecule results in the formation of exceptionally energetic reactive intermediates that can react in ways that are inaccessible to ground-state molecules. However, this high reactivity is also a challenge for stereoselective synthesis: control over the stereochemistry of photochemical reactions, particularly using enantioselective catalysts, has been a long-standing challenging synthetic problem with few general solutions. We have developed two complementary strategies to address this long-standing challenge. In one, we have developed a family of “designer” hydrogen-bonding chiral Ir photocatalysts that mediate highly enantioselective photoreactions with exceptional efficiency. In another, we have discovered that chiral Lewis and Brønsted co-catalysts can influence the rate of Dexter energy transfer from an achiral triplet sensitizer. Detailed investigations of the mechanisms of these reactions reveal a surprising diversity of catalytic activation modes, and we hope that elucidation of the distinctive features of these reactions will inform general new strategies for photochemical stereocontrol.

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