

Massachusetts Institute of Technology
Organic Chemistry 5.512

April 6, 2005
Prof. Rick L. Danheiser

Unit 3
Stereocontrolled Conjugate Addition

★ Catalytic Asymmetric Conjugate Addition I: *Unstabilized Nucleophiles*

Hayashi-Miyaura Rh-Catalyzed Conjugate Addition Reactions

Cu-Catalyzed Conjugate Addition of Organozinc Compounds

Organocatalytic Conjugate Addition of Activated Aromatic Compounds

★ Catalytic Asymmetric Conjugate Addition II: *Conjugate Reduction*

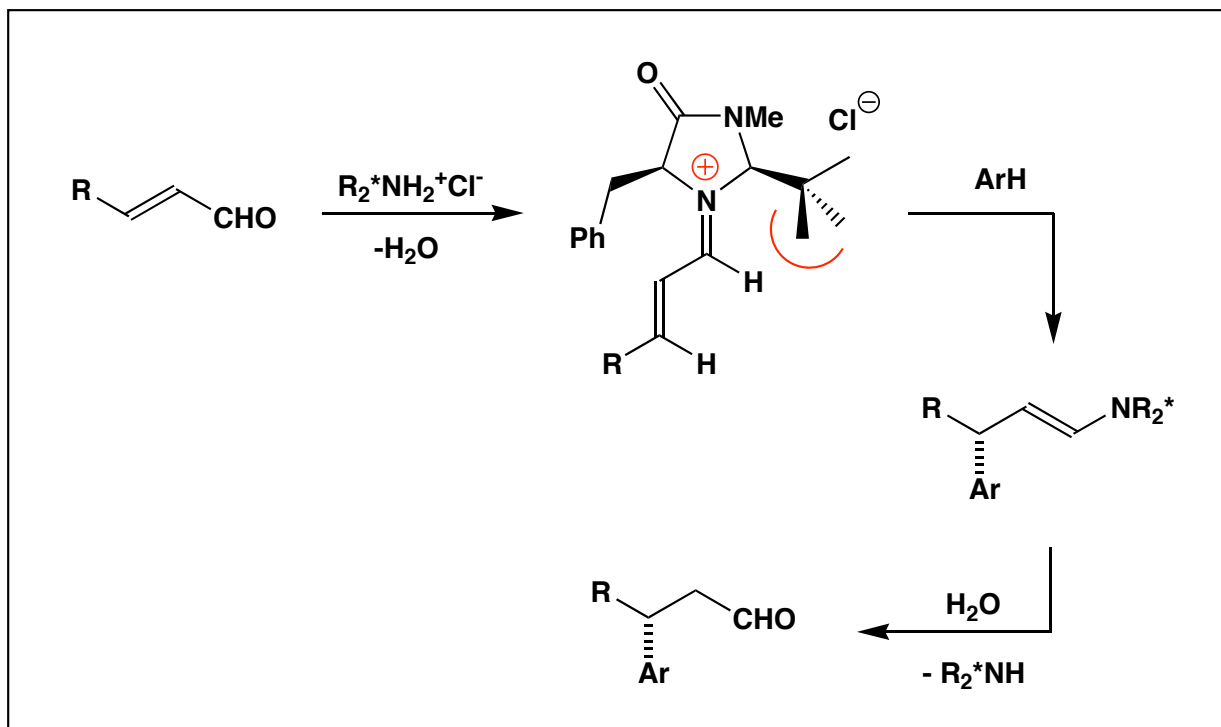
★ Catalytic Asymmetric Conjugate Addition III: *Stabilized Nucleophiles*

Michael Reactions Using Heterobimetallic Catalysts (Shibasaki)

Organocatalytic Michael Reactions (Jorgensen)

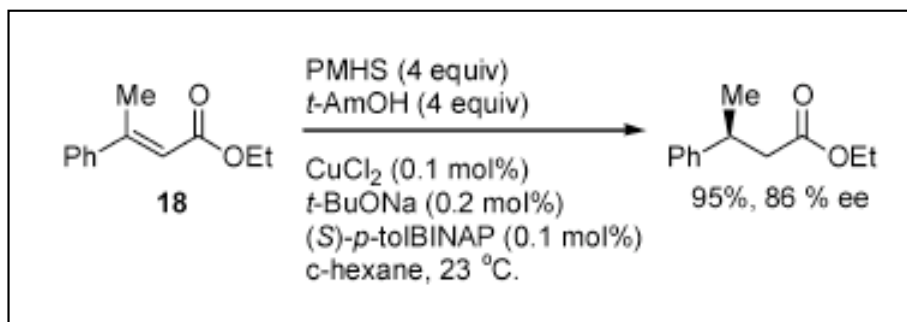
Organocatalytic Conjugate Addition of Activated Aromatic Compounds

Reviews: See Berkessel and Gröger



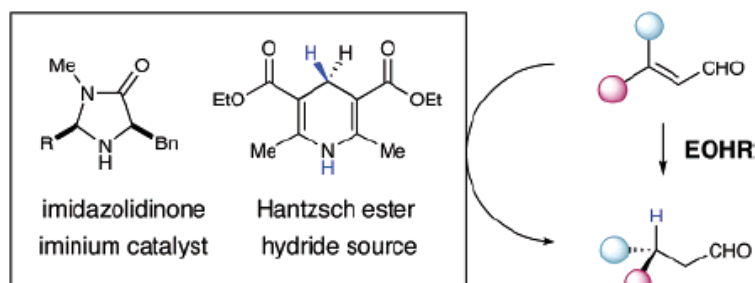
Catalytic Asymmetric Conjugate Reduction

Buchwald Cu-Catalyzed Conjugate Reduction: *J. Am. Chem. Soc.* **2003**, *125*, 11,253 and refs cited

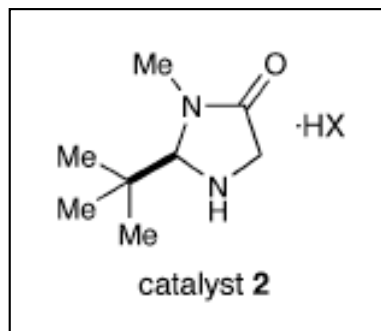
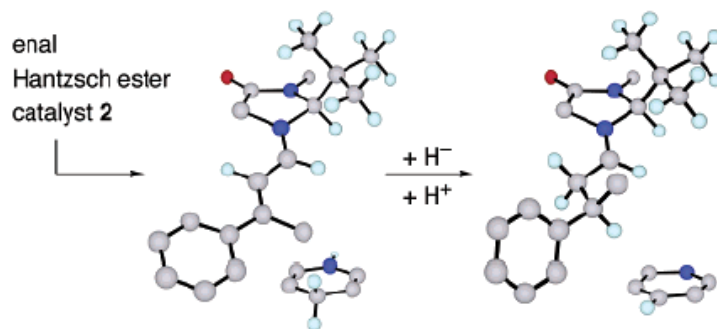


MacMillan Organocatalytic Conjugate Reduction: *J. Am. Chem. Soc.* **2005**, *127*, 32

Enantioselective Organocatalytic Hydride Reduction (EOHR)



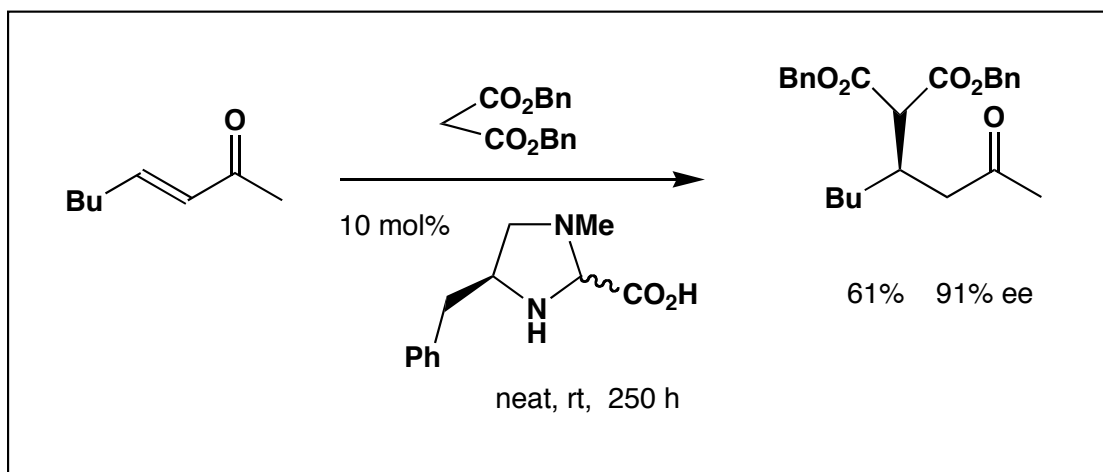
EOHR: Origins of Enantiocontrol with Catalyst 2



Catalytic Asymmetric Conjugate Addition of Stabilized Nucleophiles

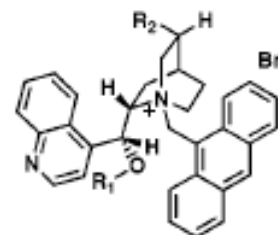
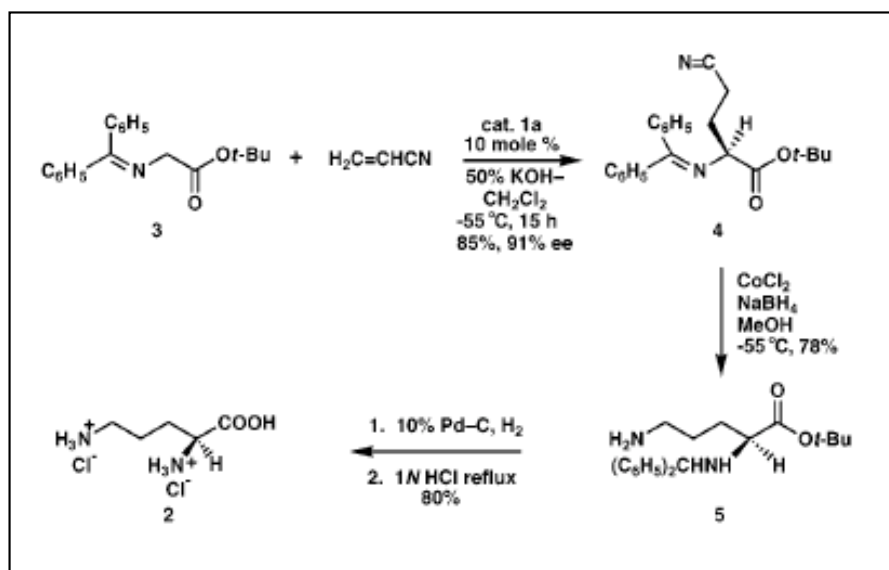
I. Shibasaki: "Heterobimetallic Catalysts

II. Jorgensen: Organocatalytic Conjugate Addition *Angew. Chem. Int. Ed.* **2003**, 42, 661 and 4955



III. Jacobsen: Enantioselective Conjugate Additions Catalyzed by (Salen)Al Complexes *J. Am. Chem. Soc.* **2005**, 127, 1313

IV. Corey: Organocatalytic Conjugate Addition of Imino Esters *Org. Lett.* **2000**, 2, 1097



1a $\text{R}_1 = \text{CH}_2\text{CH}=\text{CH}_2$, $\text{R}_2 = \text{H}_2\text{C}=\text{CH}$