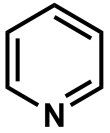
Pyridine based nucleophile shuttle

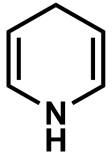
Reporter: Li Li
Supervisor: Yong Huang
2016-11-14

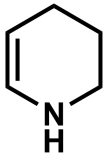
Pyridine derivative

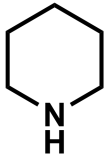
pyridine



dihydro- and tetrahydropyridines, piperidines



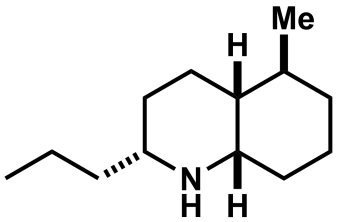




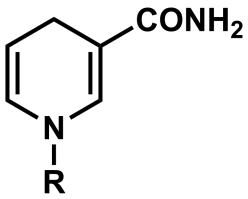
alkaloid synthesis

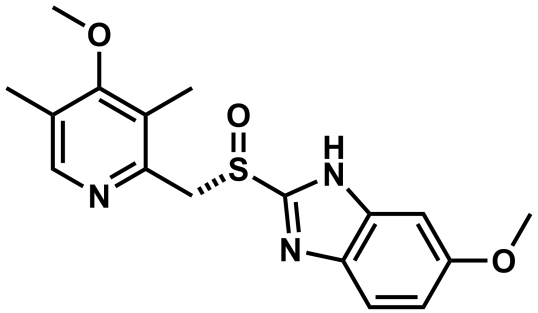
NADH models

biologically active structures



(+)-pumiliotoxin

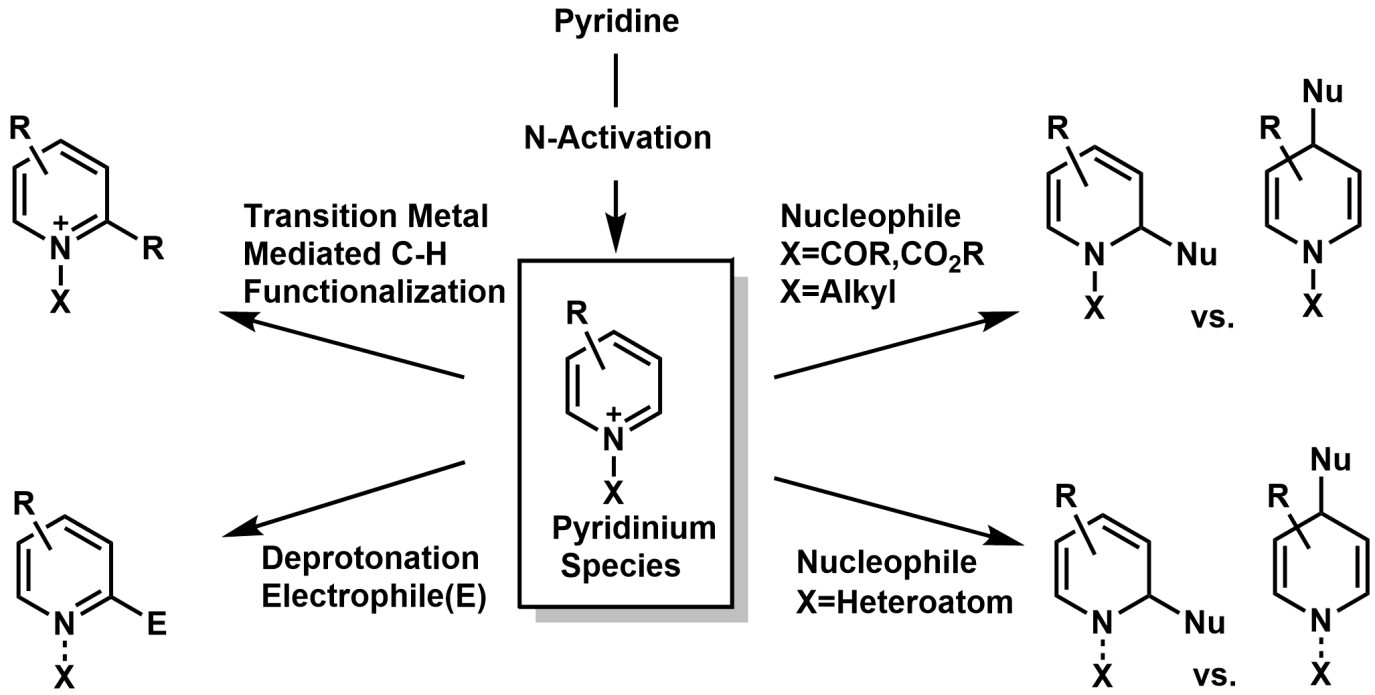




Esomerazole

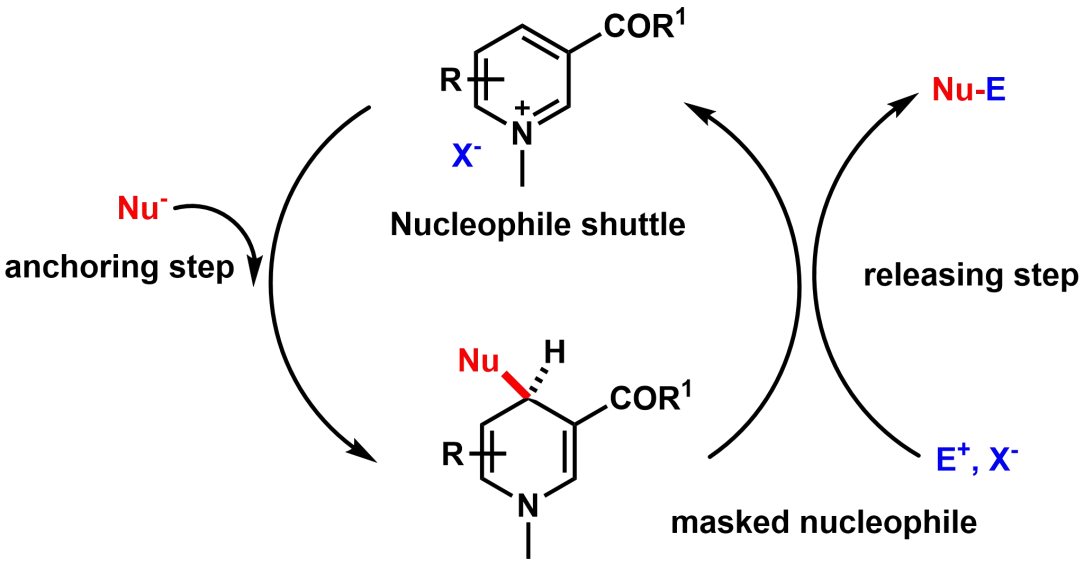
Chem. Rev. **2012**, *112*, 2642.

Functionalization of N-activated pyridinium species



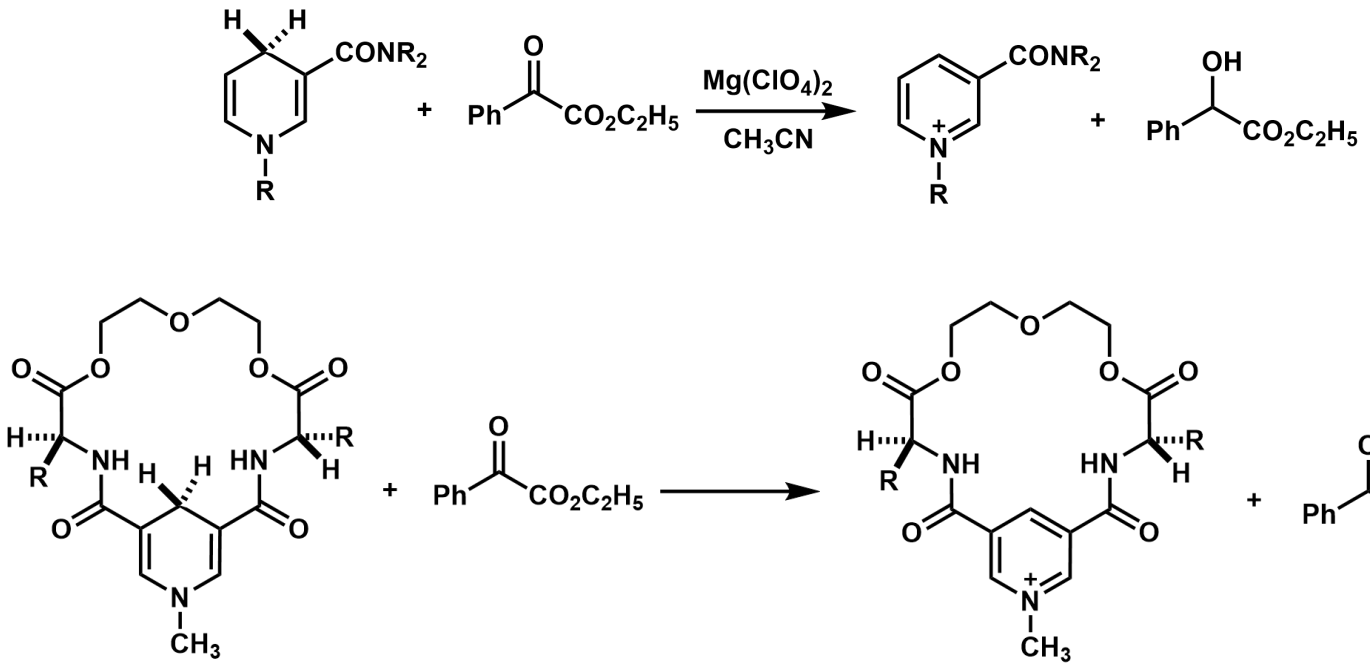
Chem. Rev. **2012**, *112*, 2642.

Nucleophile shuttle



Nu^-= CN-, RS-, RO-, R_2N-, PR_3,enolate

Hydrogen-transfering agents

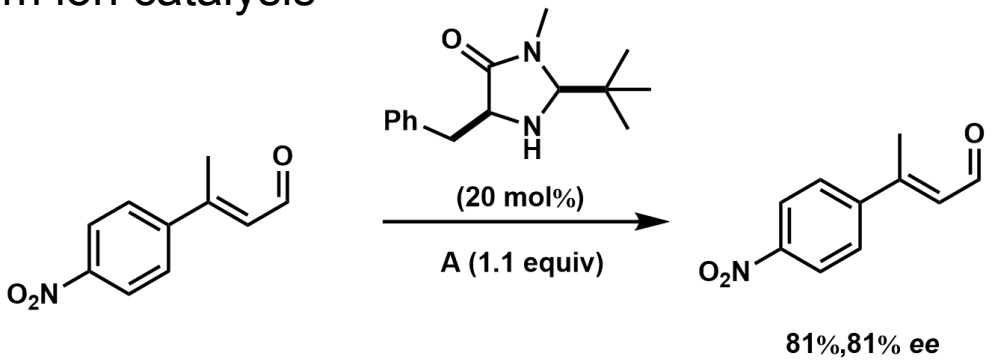


R	*ee*
CH_3	61
$C_6H_5CH_2$	86
$(CH_3)_2CH$	87

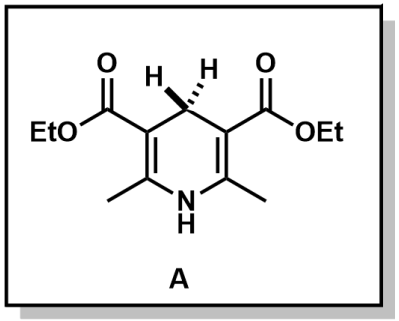
J . Am. Chem. Soc. **1981**,*103*, 2091. *J. Am. Chem. Soc.* **1979**, *101*, 2759.

Hydrogen-transfering agents

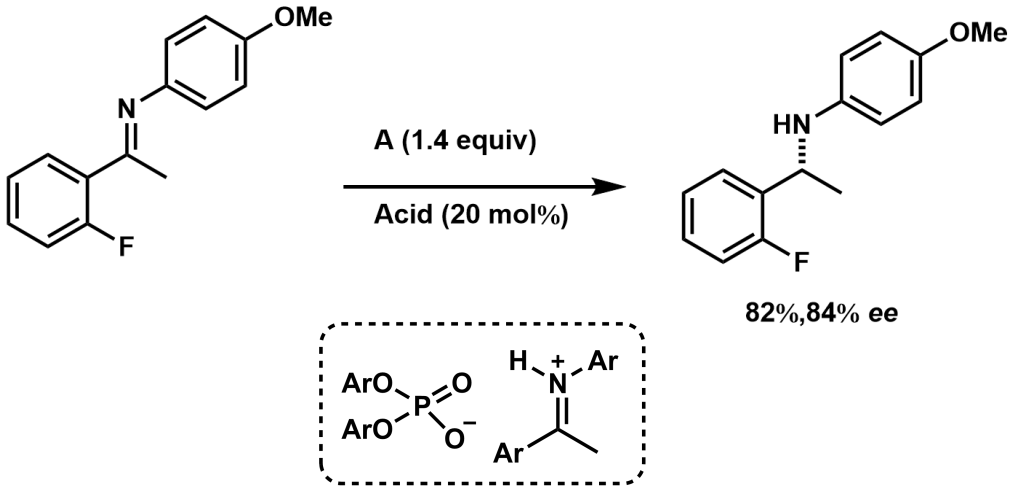
Iminium ion catalysis



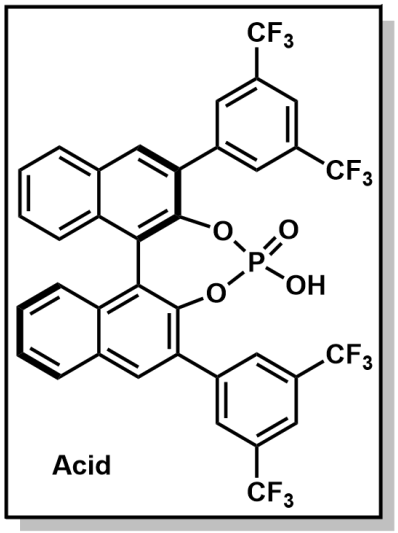
81%,81% *ee*



Brønsted acid catalysis of enantioselective imine reduction



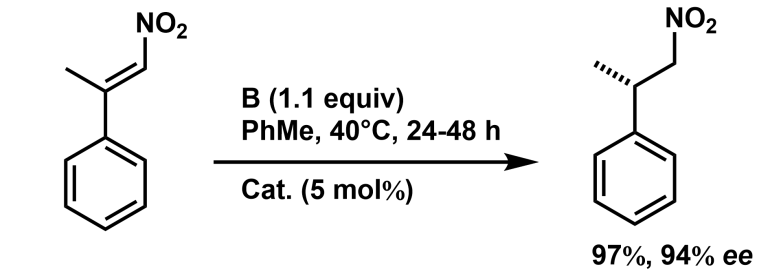
82%,84% *ee*

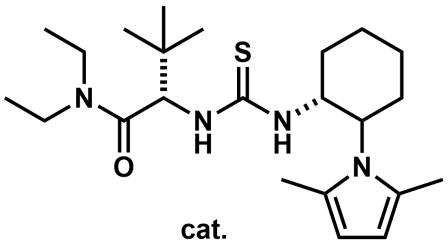


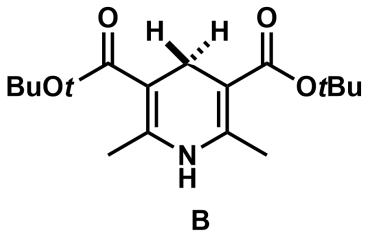
Angew. Chem. Int. Ed., **2004**, *43*, 6660. *Org. Lett.*, **2005**, *7*, 3781.

Hydrogen-transfering agents

(Thio)urea mediates catalysis of asymmetric organocatalytic reductions

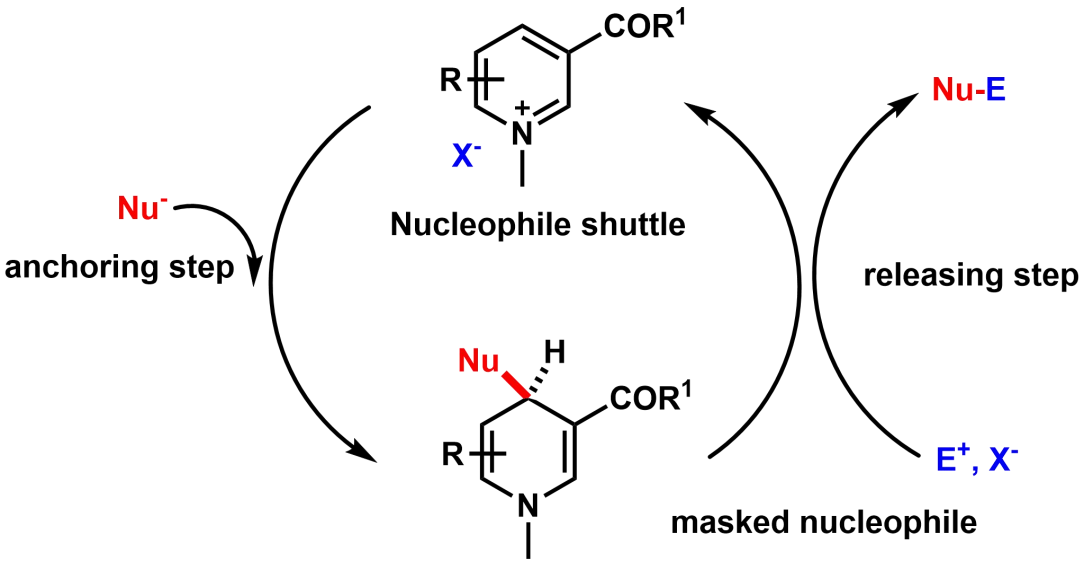






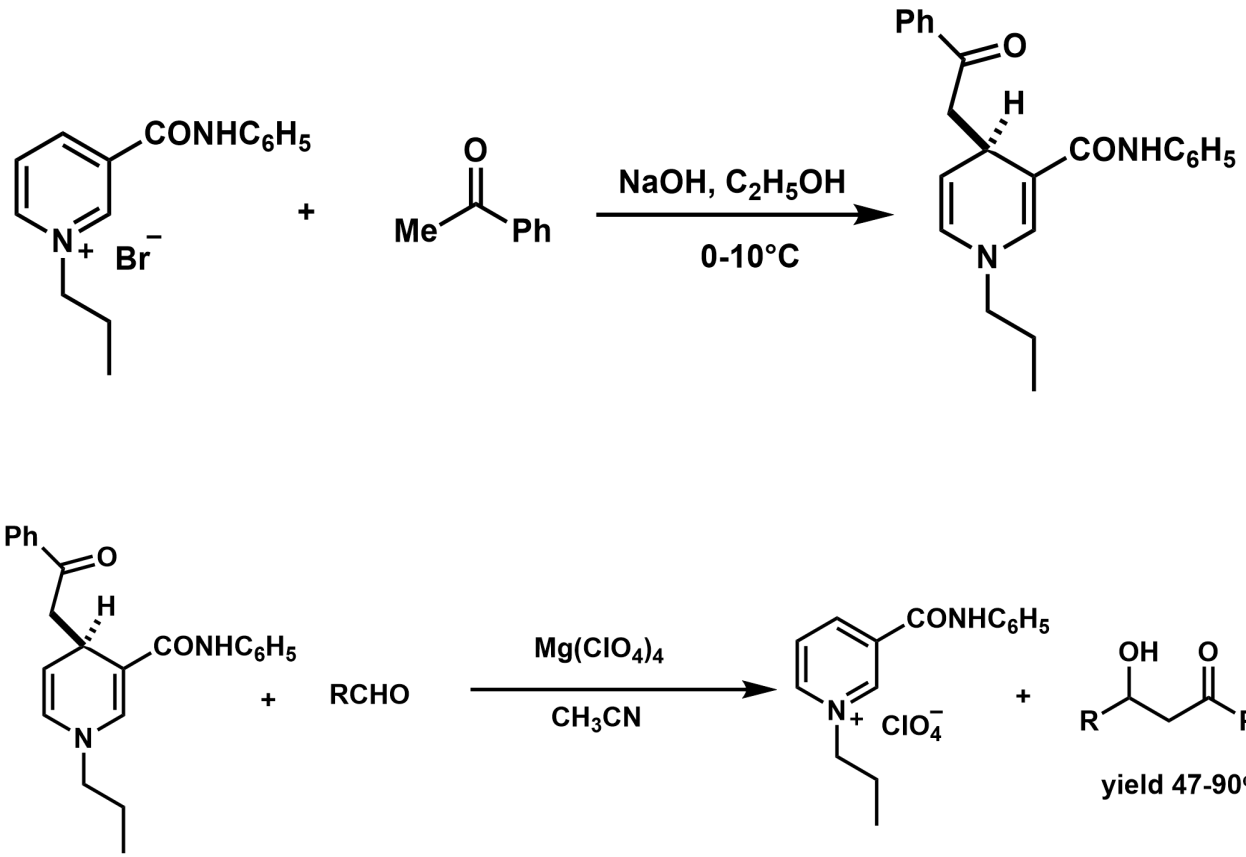
J. Am. Chem. Soc., **2004**, *126*,10558.

Carbon-transfering agents



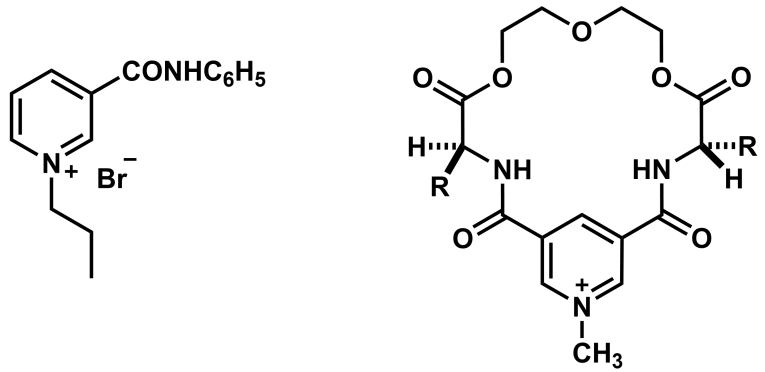
Nu^-= CN-, RS-, RO-, R_2N-, PR_3,enolate

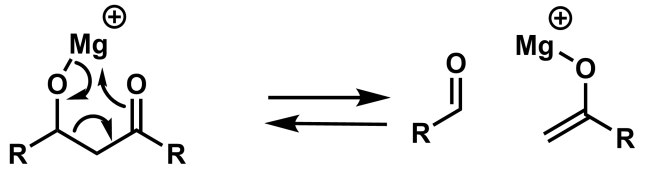
Carbon-transfering agents

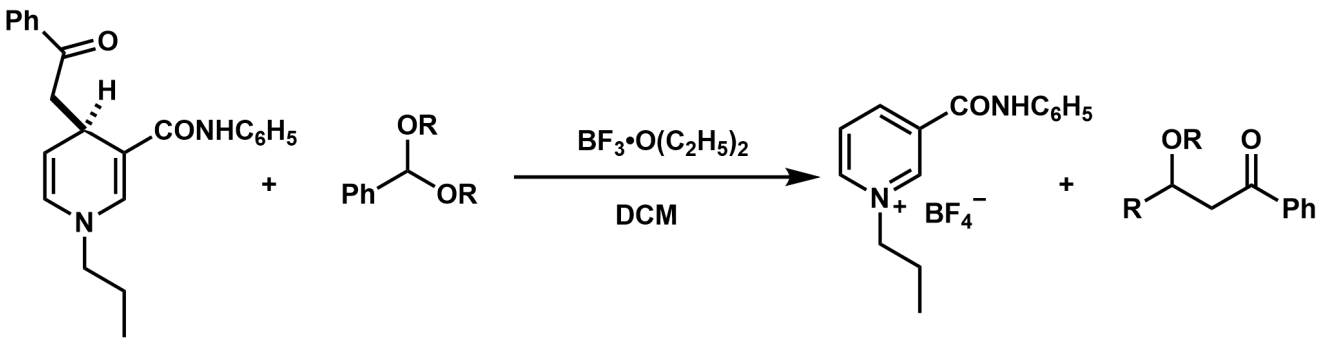


J. Am. Chem. Soc. **1983**,*105*, 7792.

Carbon-transfering agents

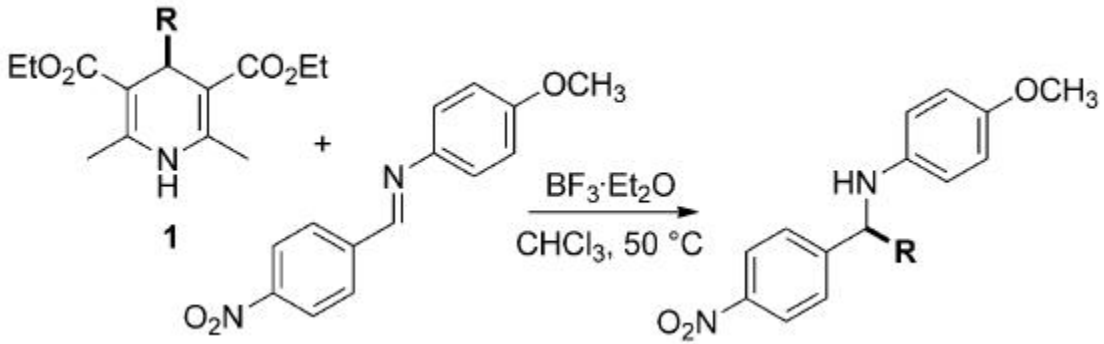


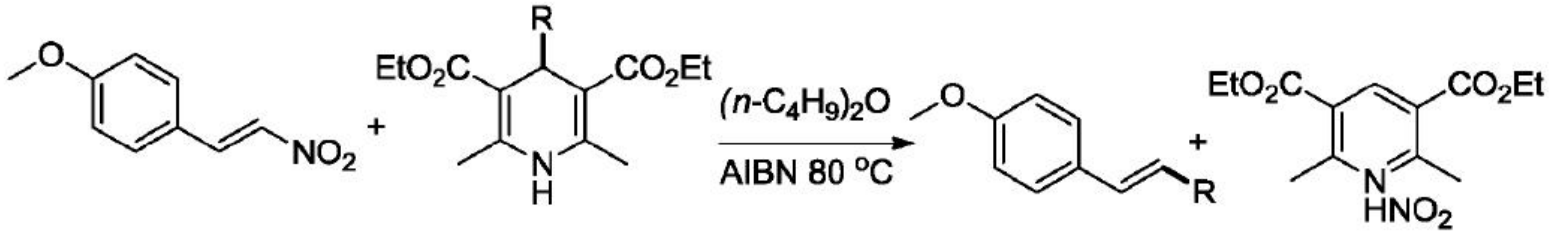




Chem. Lett. **1973**,1011.

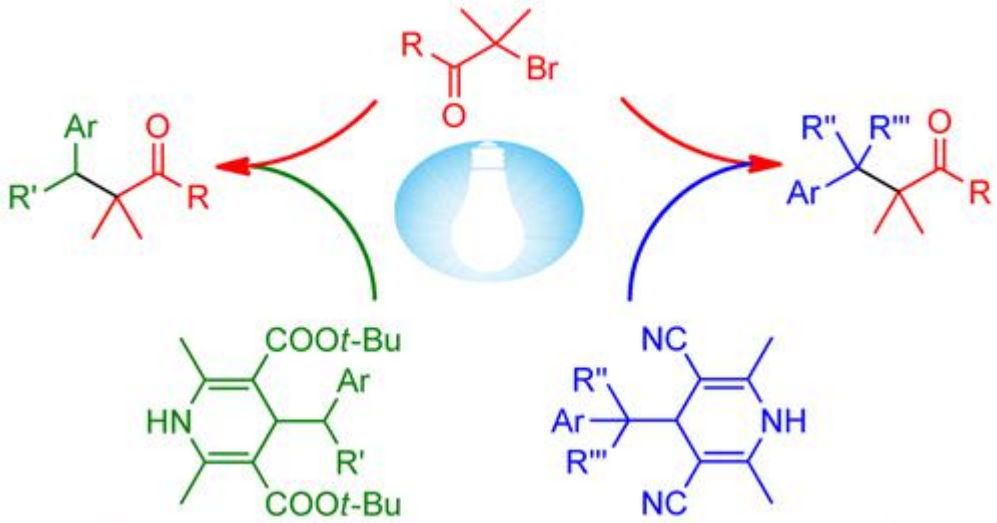
Carbon-transfering agents

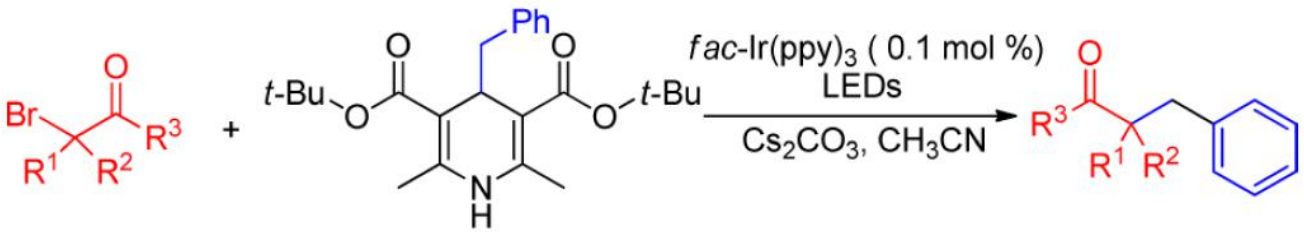




Angew. Chem. Int. Ed. **2013**, *52*, 8432. *Chem. Commun.*, **2014**, *50*, 6246.

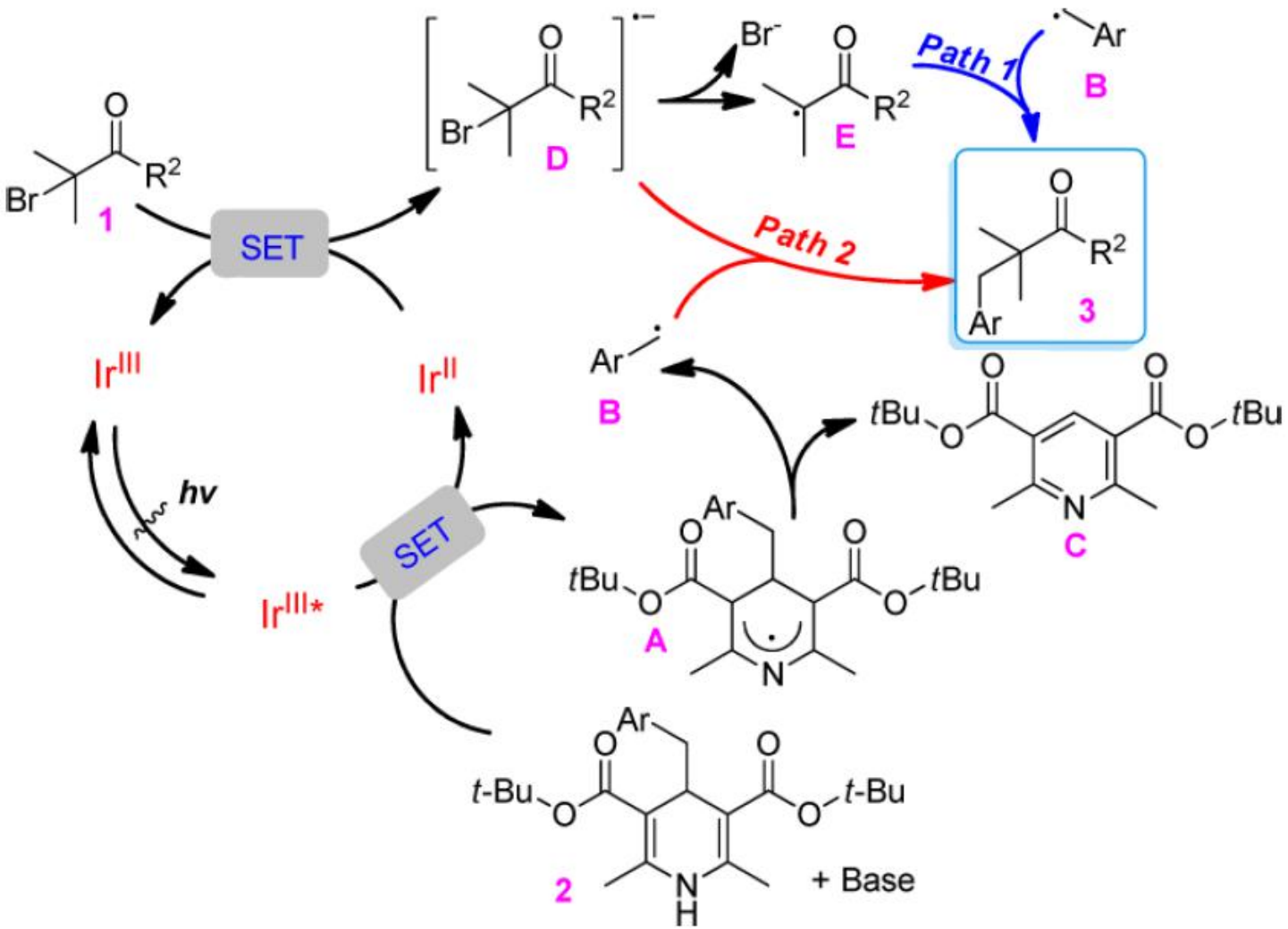
Carbon-transfering agents





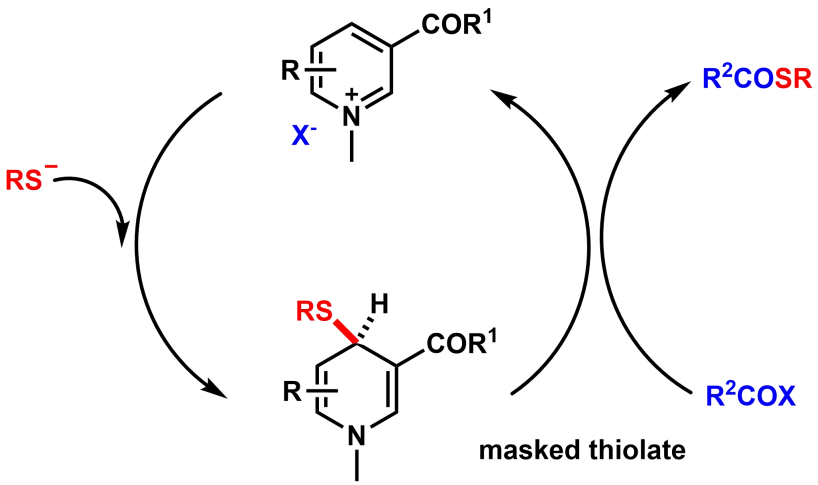
J. Am. Chem. Soc. **2016**, *138*, 12312.

Carbon-transfering agents

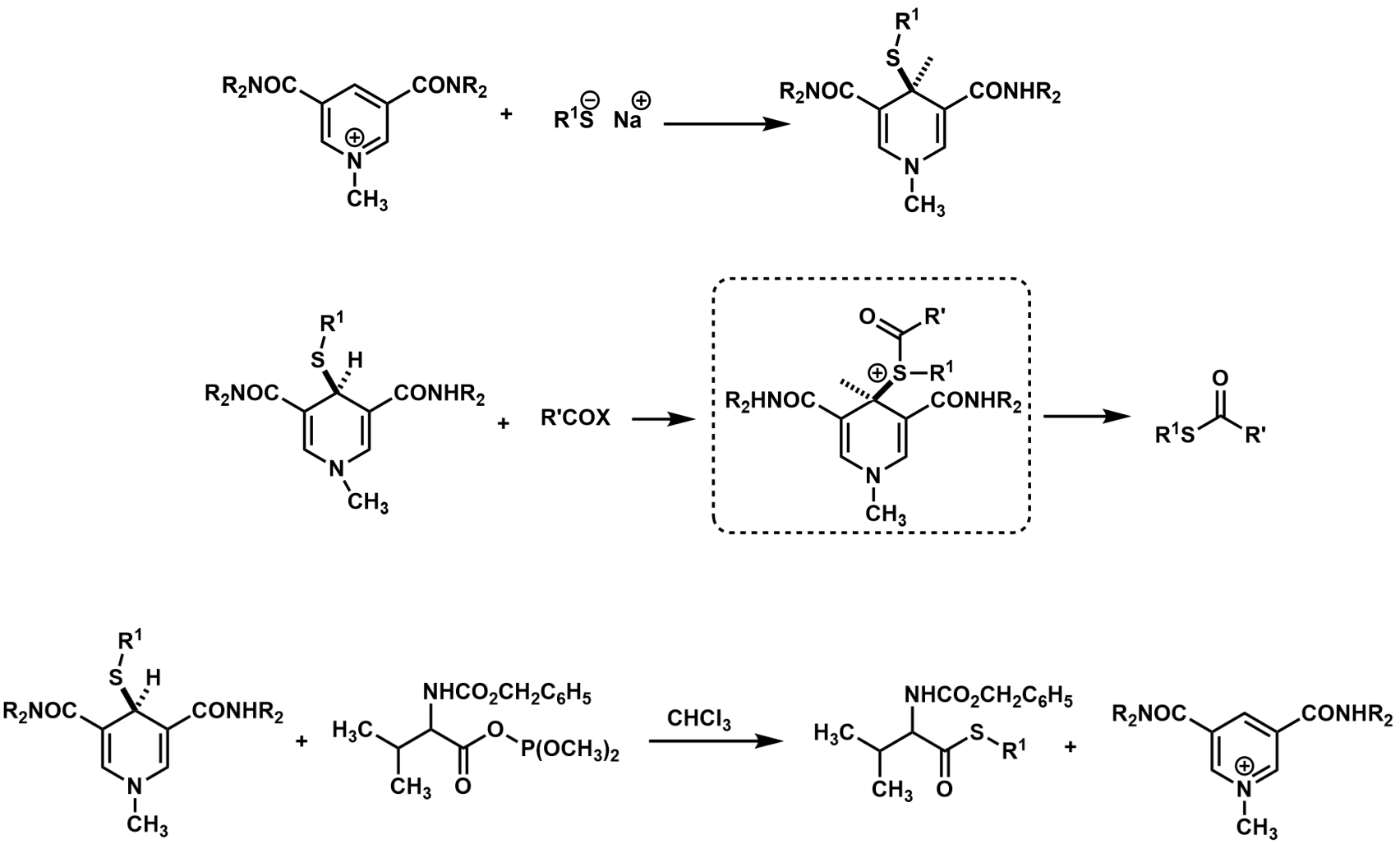


J. Am. Chem. Soc. **2016**, *138*, 12312.

Sulfur-transfering agents

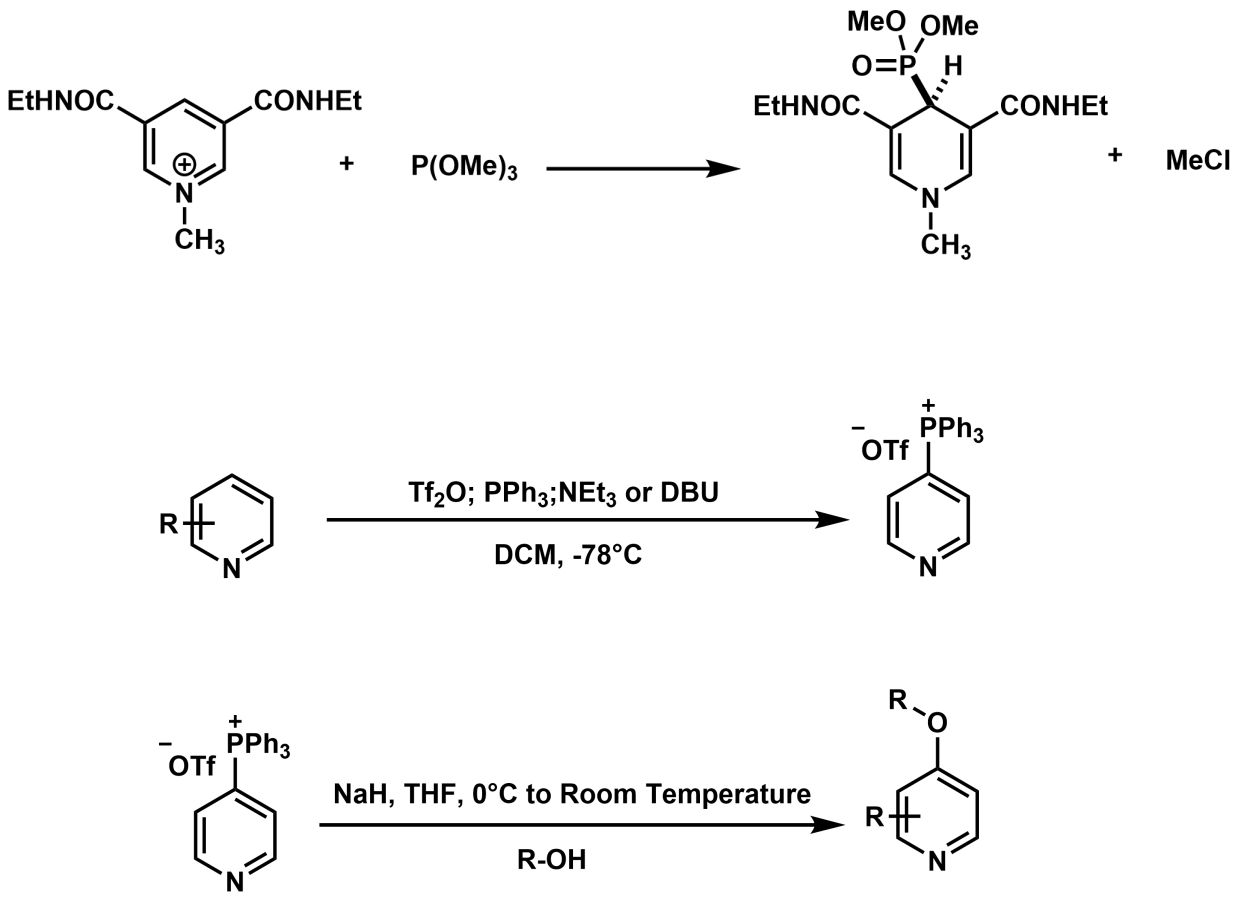


Sulfur-transfering agents



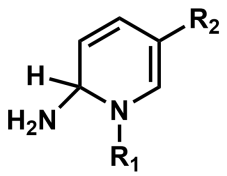
*J. Chem. Soc. Chem. Commun.***1980**, 1147.

Phosphorus-transfering agents



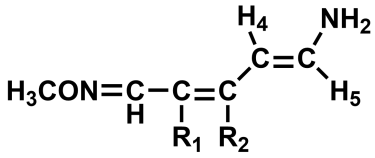
*J. Chem. Soc. Chem. Commun.***1980**,1147. *J. Am. Chem. Soc.* **2016**, *138*, 13806.

Amide-transfering agents



R_1	R_2
CH_3	$CONH_2$
CH_3	CO_2CH_3
CH_3	CF_3
$CH_2C_6H_5$	$CONH_2$
$CH_2C_6H_4NO_2$-*p*	$CONH_2$
$CH_2C_6H_5$	$COCH_3$
CH_3	CN
$CH_2C_6H_5$	CN
$CH_2C_6H_4NO_2$-*p*	CN

R_1	R_2
CH_3	Cl
CH_3	I
$CH_2C_6H_5$	I
CH_3	CN
$CH_2C_6H_5$	CN
$CH_2C_6H_4NO_2$-*p*	CN
OCH_3	$CONH_2$



V a, R_1=$CONH_2$, R_2=H

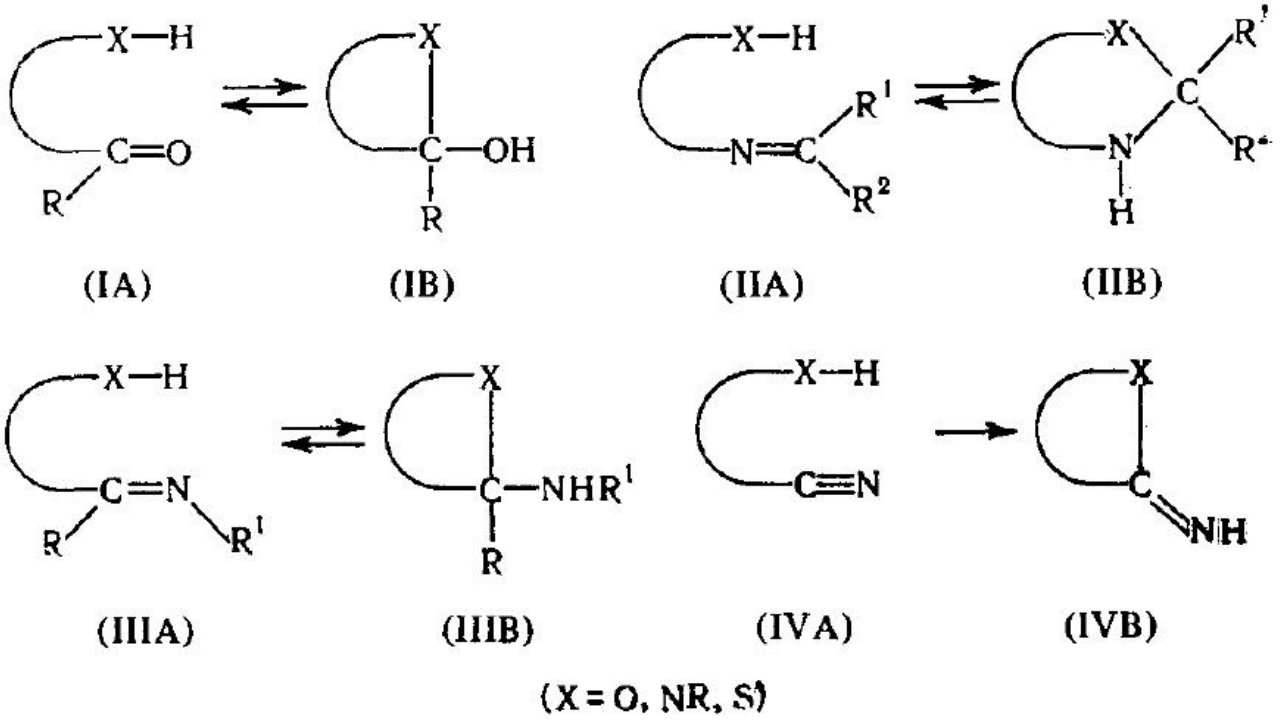
b, R_1=CO_2 , R_2=H

c, R_1=H, R_2=CO_2CH_3

low boiling point, -33 C.

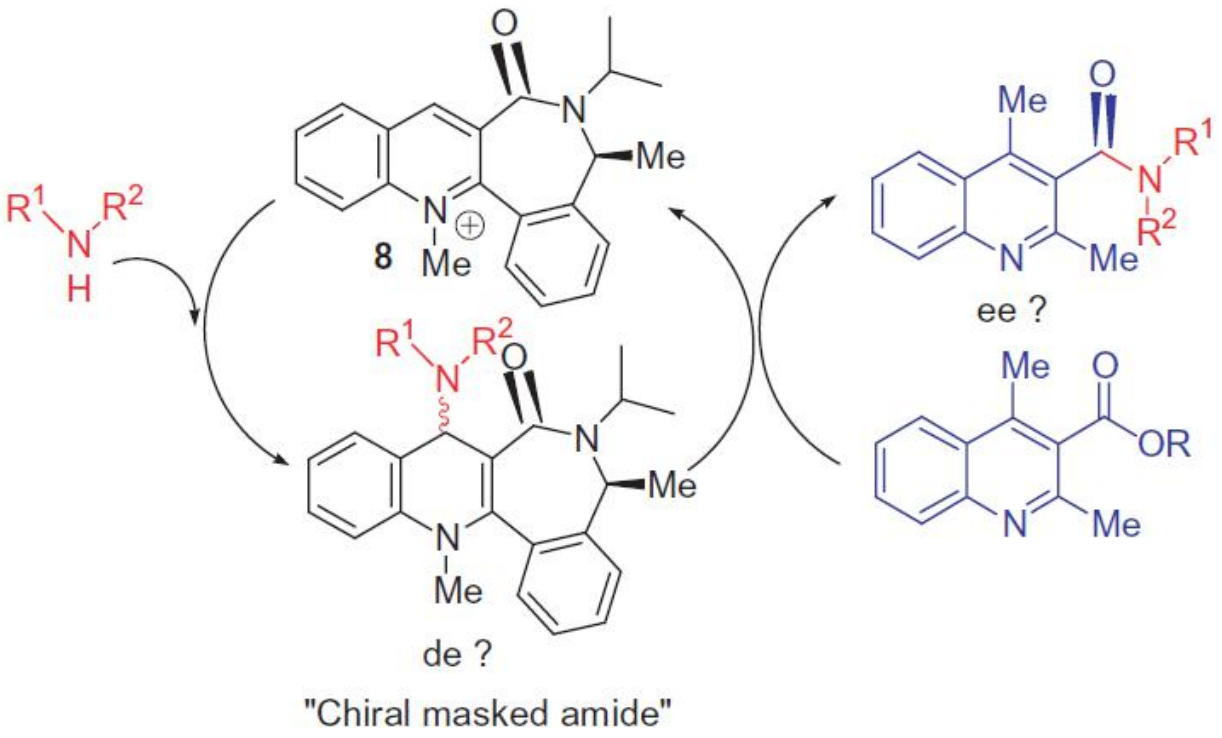
J.Org.Chem. **1976**, *41*, 1303.

Ring—chain tautomerism



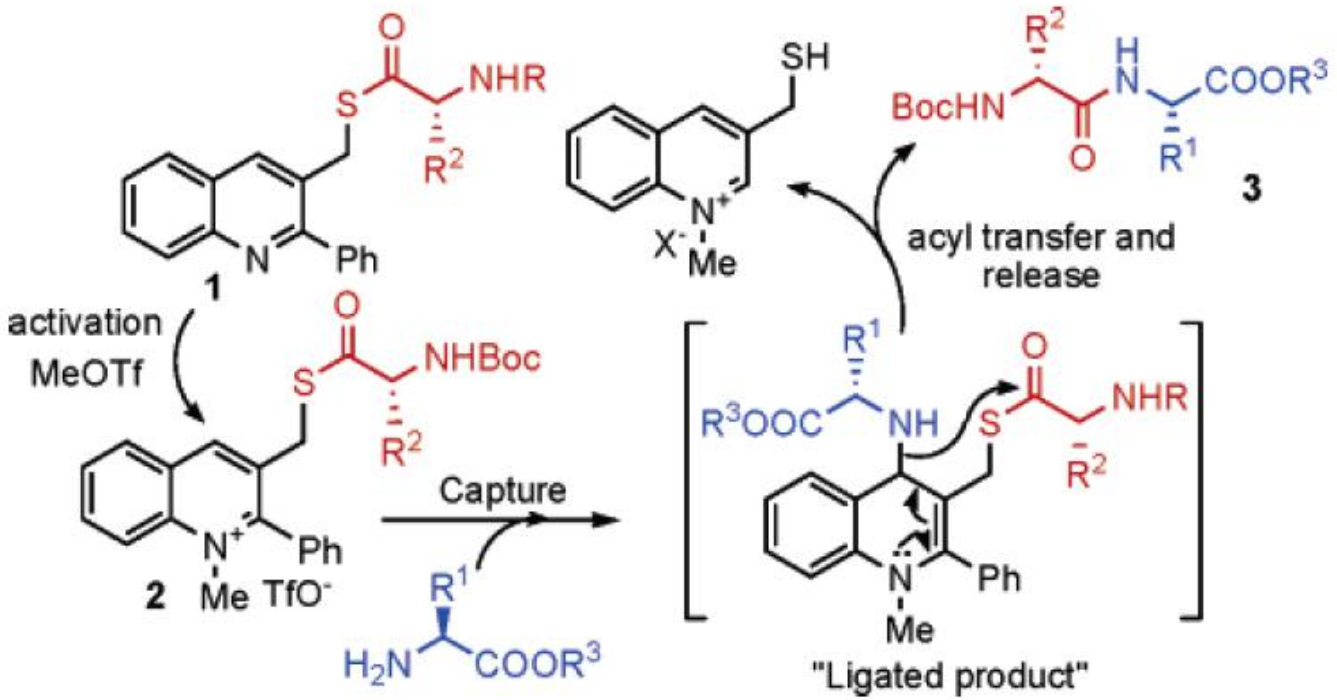
Russ. Chem. Rev., **1974**, *43*, 665.

Amide-transfering agents



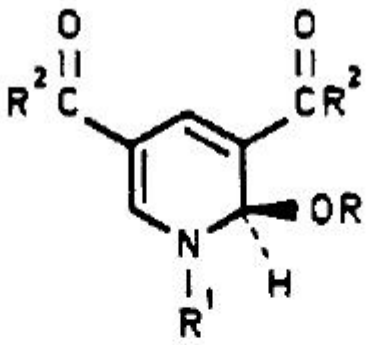
Tetrahedron: Asymmetry, **2004**,*15*, 3919.

Amide-transfering agents



J. Am. Chem. Soc. **2005**, *127*, 15668.

Oxygen-transfering agents



13

a) $R^1 = CH_3$, $R^2 = NHC_2H_5$

b) $R^1 = CH_3$, $R^2 = N(C_2H_5)_2$

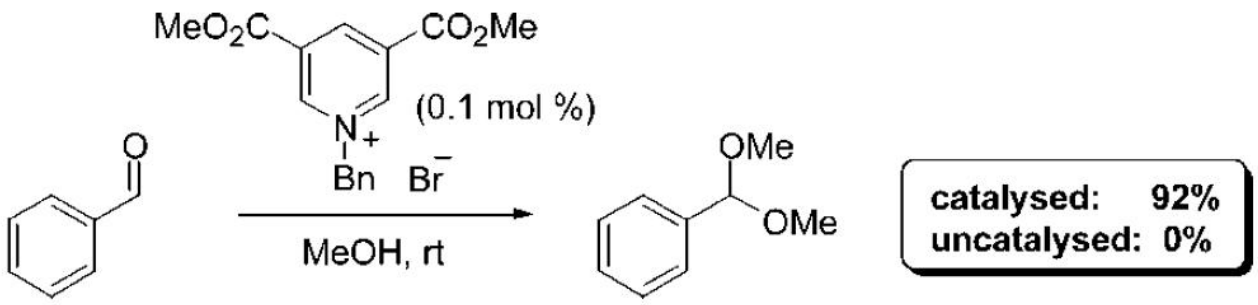
c) $R^1 = CH_2C_6H_5$, $R^2 = NHC_2H_5$

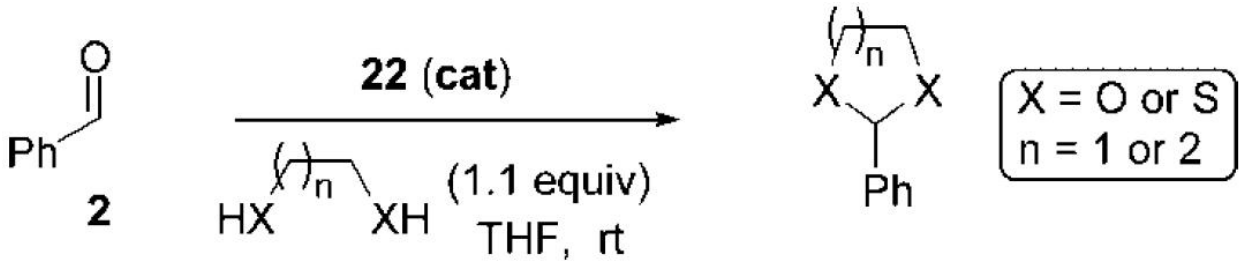
d) $R^1 = CH_2C_6H_5$, $R^2 = N(C_2H_5)_2$

e) $R^1 = CH_3$, $R^2 = OC_2H_5$

*J. Org. Chem.***1990**, *55*, 647.

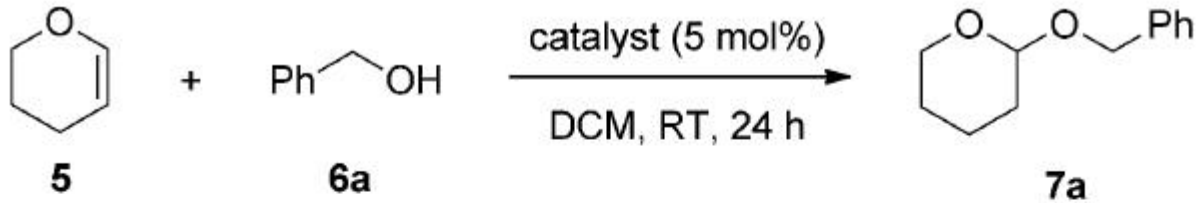
Oxygen-transfering agents



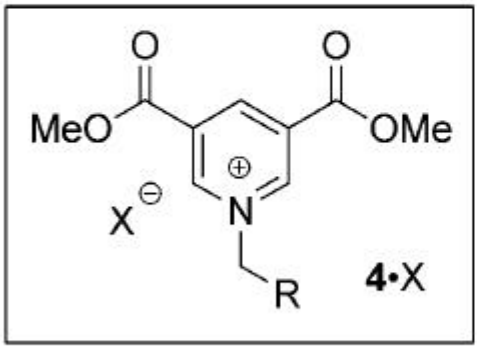


Org. Lett. **2008**,*10*, 4935.

Oxygen-transfering agents

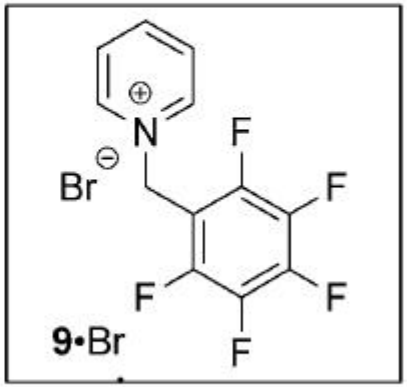


5 **6a** **7a**



catalytically active pyridinium salts

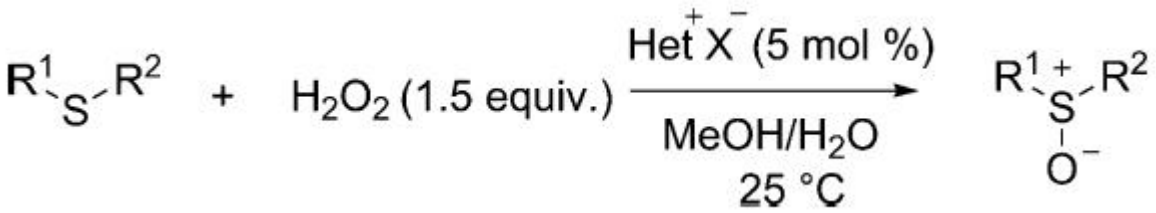
4a·Br: R = CN, X = Br
4b·Br: R = CO_2Me, X = Br
4c·Br: R = CO_2Et, X =Br
4d·Br: R = C_6F_5, X = Br
4d·Cl: R = C_6F_5, X = Cl
4d·NTf_2: R = C_6F_5, X = NTf_2
4d·BPh_4: R = C_6F_5, X = BPh_4

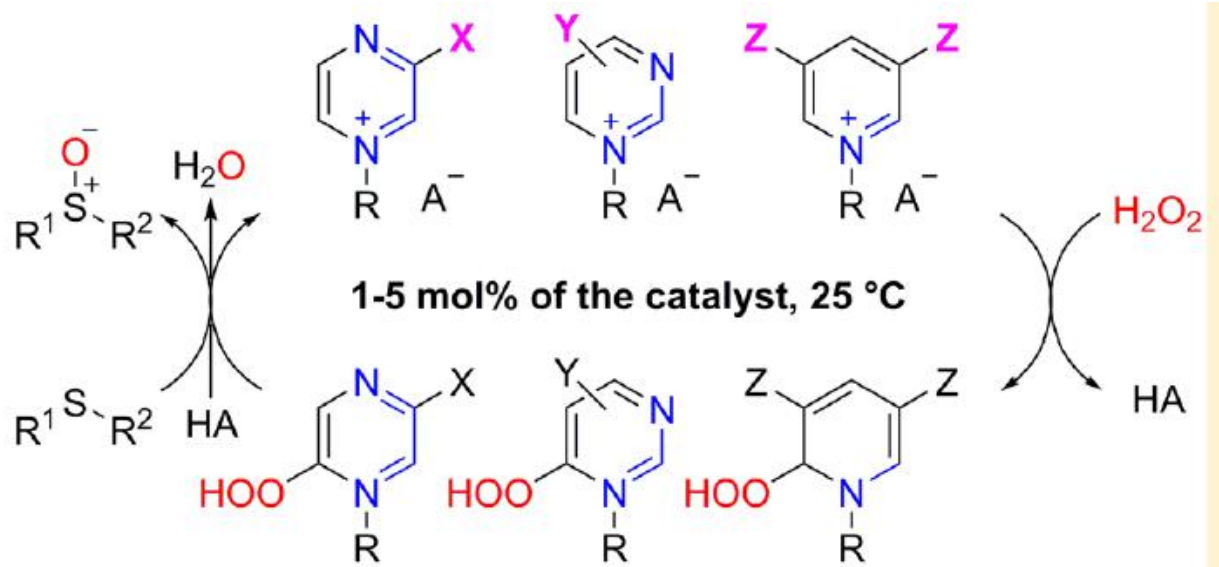


catalytically inactive pyridinium salt

Angew. Chem. Int. Ed. **2015**, *54*, 12479.

Oxygen-transfering agents

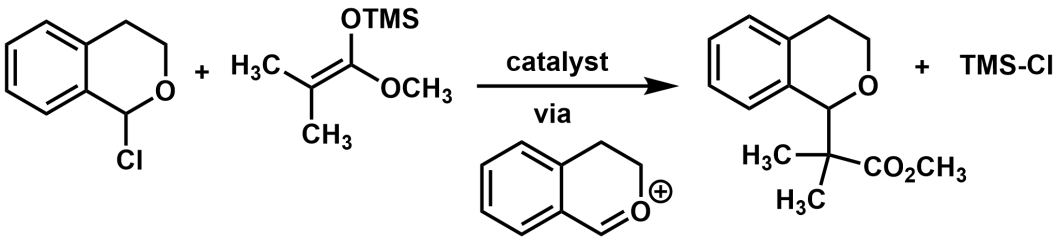


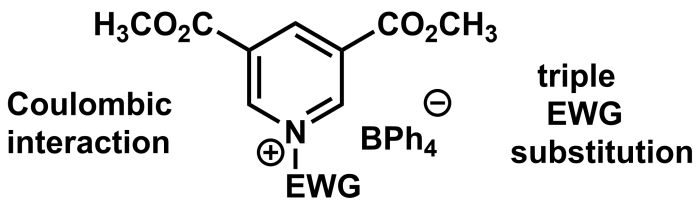


The most efficient catalysts: X = CN, COOR Y = CN, CF_3 Z = NO_2, CN

J. Org. Chem. **2015**, *80*, 2676.

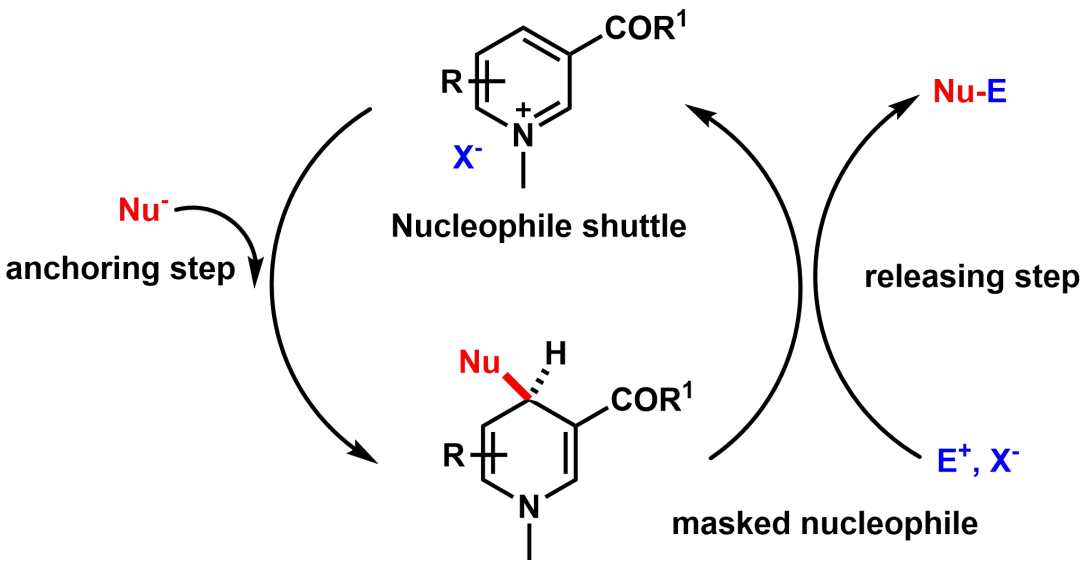
Anion-Binding Catalysis





Angew. Chem. Int. Ed. **2014**, *53*, 11660.

Summary



Nu^-= CN-, RS-, RO-, R_2N-, PR_3,enolate

Acknowledgments

- **Prof. Huang**
- **All members here**

Thanks for your attention!