

# Desymmetrization Through Enantioselective Catalysis

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THE UNIVERSITY  
*of* NORTH CAROLINA  
*at* CHAPEL HILL

# Introduction

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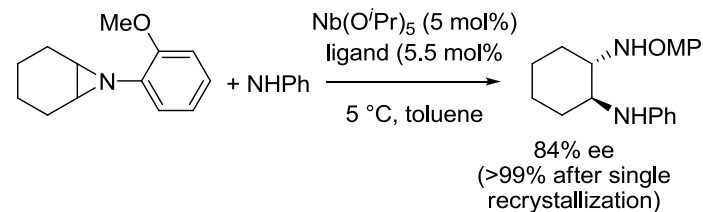
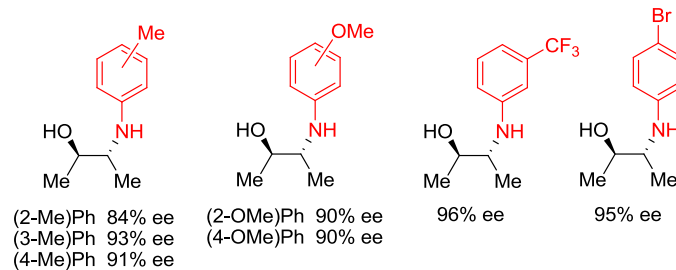
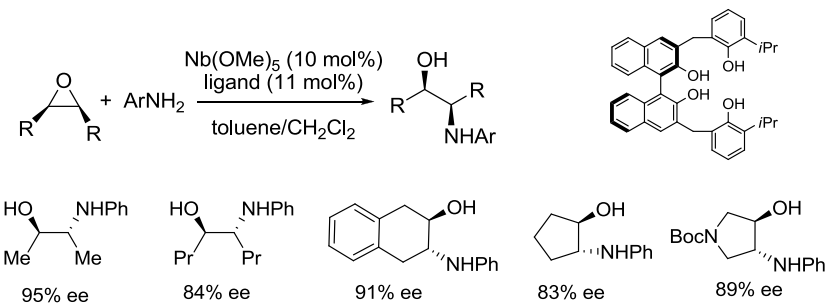
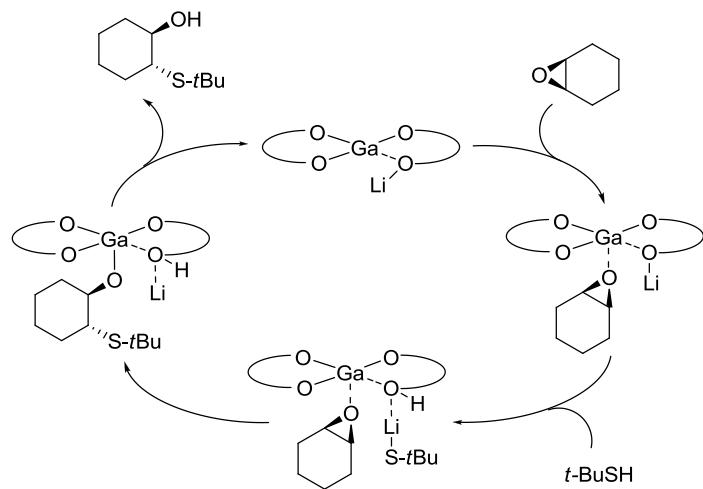
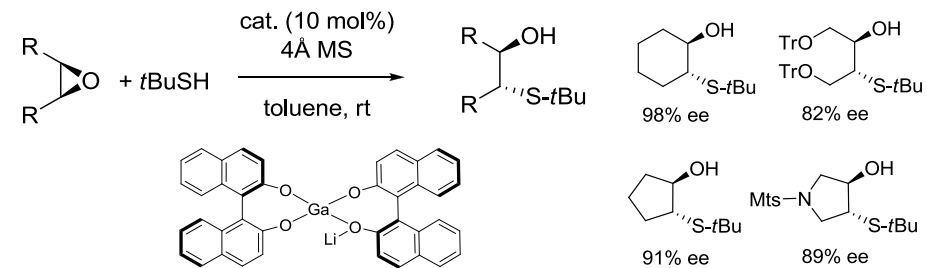
Desymmetrization reactions of meso compounds through enantioselective catalysis are a powerful strategy for the synthesis of chiral molecules with multiple stereocenters.

To achieve an enantioselective symmetry breaking synthetic operation **two enantiotopic functional groups must be differentiated**

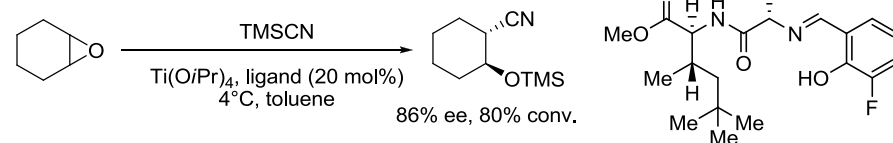
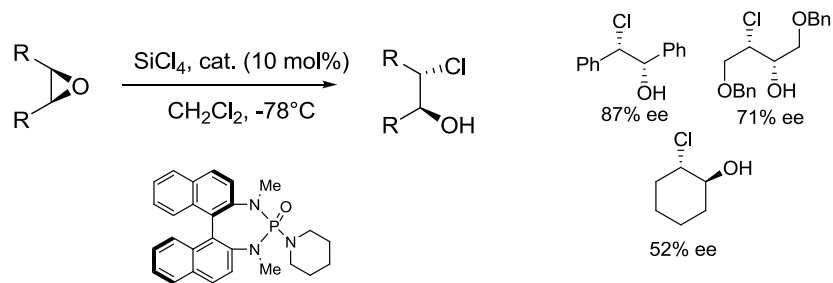
This can be achieved by the use of:  
**a chiral reagent**  
or **a chiral catalyst**



# Desymmetrization of Epoxides



K. Arai, S. Lucarini, M Salter, K Ohta, Y. Yamashita and S. Kobayashi, *J. Am. Chem. Soc.*, 2007, **129**, 8103.

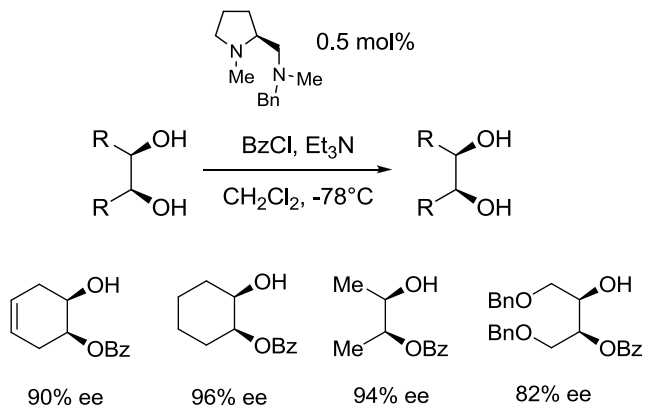


B.M. Cole, K. D. Shimizu, C.A. Krueger, J. P. A. Harrity, M. L Snapper and A. H. Hoveyda, *Angew. Chem., Int. Ed. Engl.*, 1996, **35**, 1668.

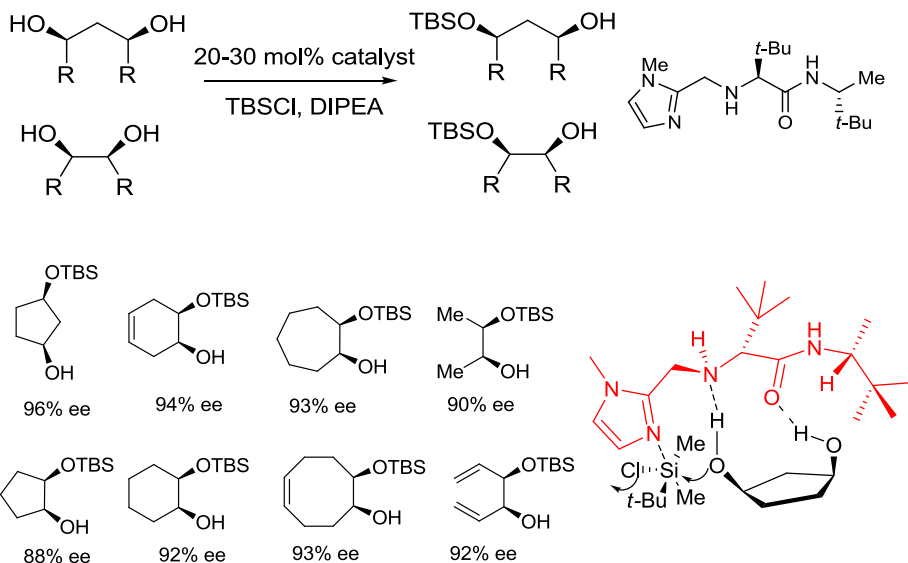
T. Iida, N. Yamamoto, S. Matsunaga, H. -G. Woo and M. Shibasaki, *J. Org. Chem.*, 1997, **119**, 4783.

S.E. Denmark, P.A. Barsanti, K.-T. Wong and R.A. Stavenger, *J. Org. Chem.*, 1998, **63**, 2428.

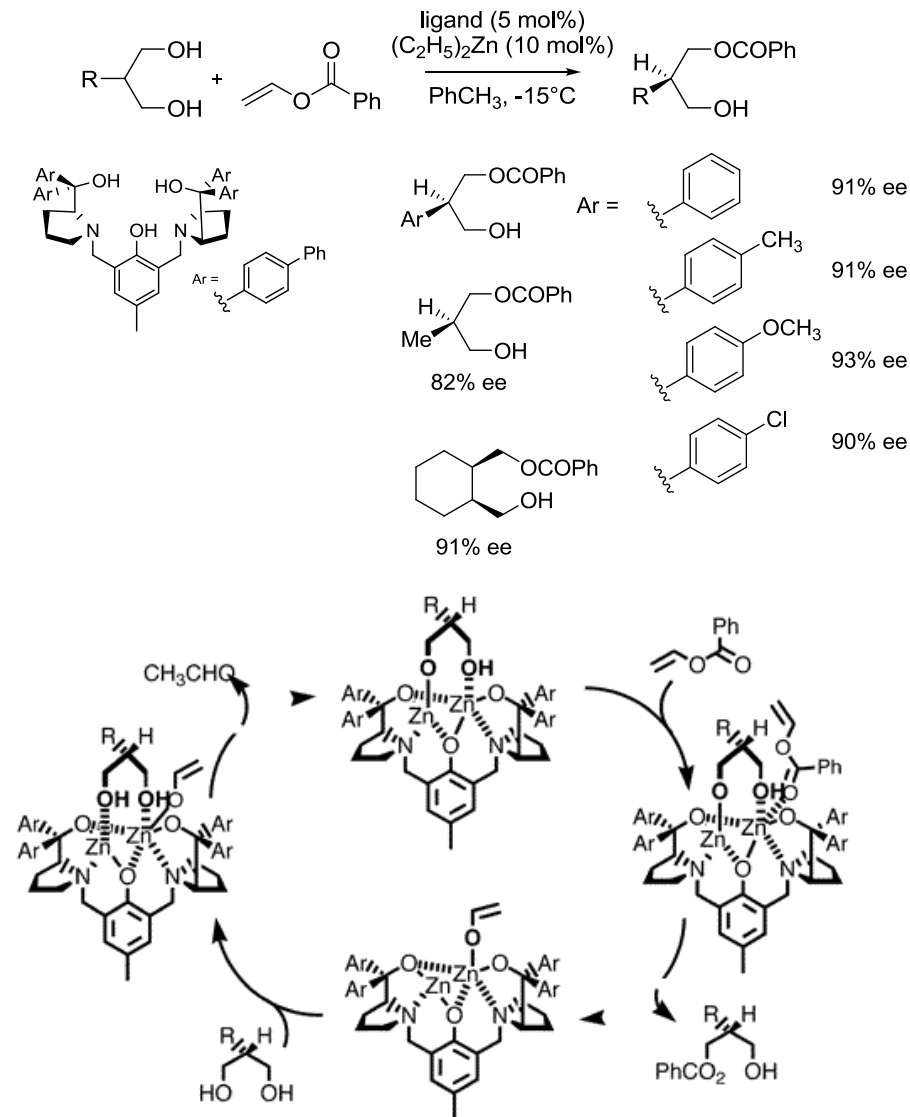
# Desymmetrization of Diols



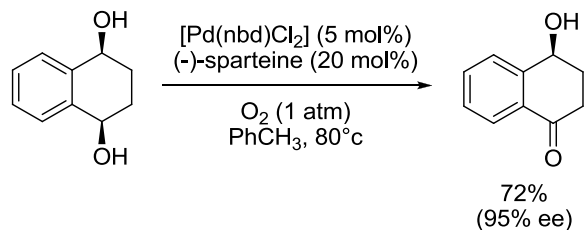
T. Oriyama, K. Imai, T. Sano and T. Hosoya, *Tet. Lett.* 1998, **31**, 397.



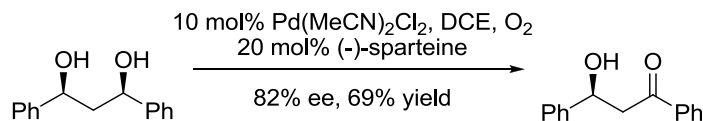
Yu Zhao, Jason Rodrigo, Amir H. Hoveyda and Marc L. Snapper, *Nature* 2006, **443**, 67.



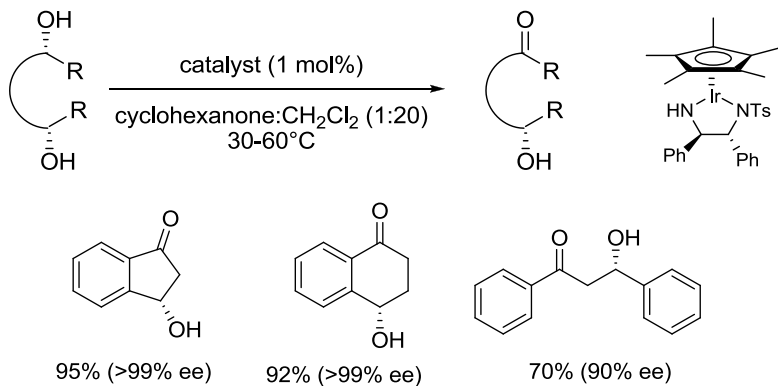
# Desymmetrization of Diols



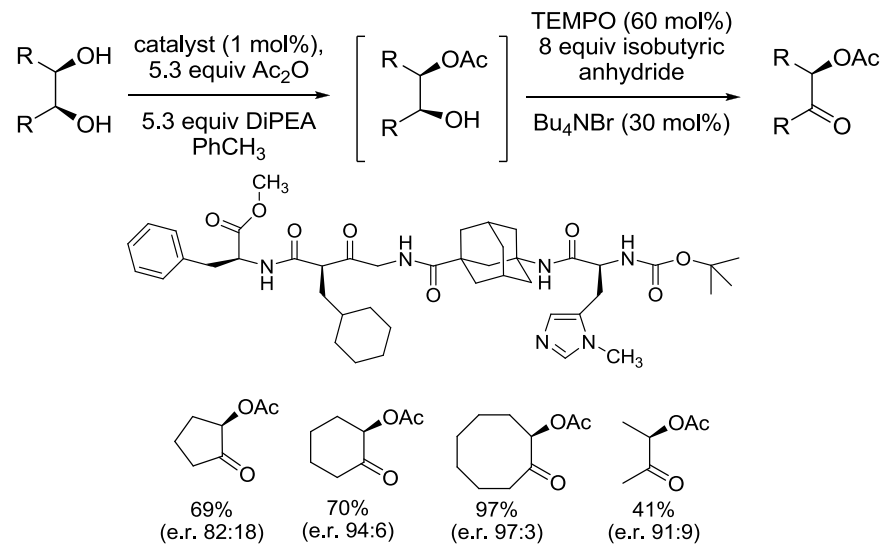
D.C. Ebner, J.T. Bagdanoff, E.M. Ferreira, R.M. McFadden, D.D. Caspi, R.M. Trend, and B.M. Stoltz. *Chem. Eur. J.* 2009, **15**, 12978.



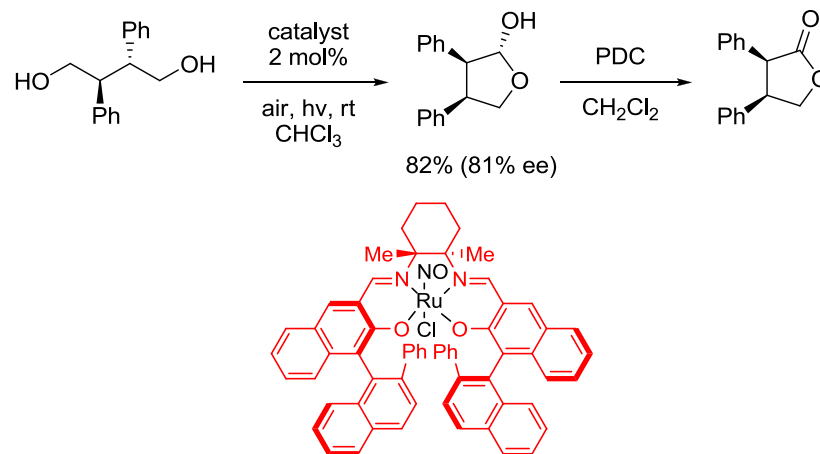
D. R. Jensen, J. S. Pugsley, and M. S. Sigman. *J. Am. Chem. Soc.* 2001, **123**, 7475.



T. Suzuki, K. Ghozati, T. Katoh, and H. Sasai. *Org. Lett.* 2009, **11**, 4286.

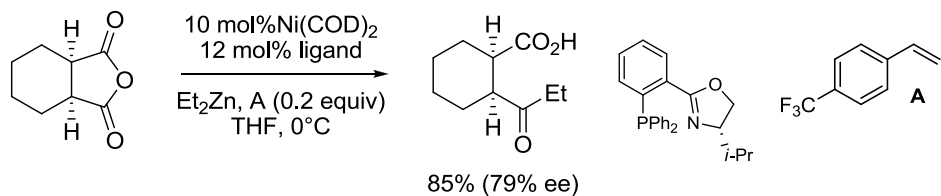


Christian E. Mller, Daniela Zell, and Peter R. Schreiner, *Chem. Eur. J.* 2009, **15**, 9647

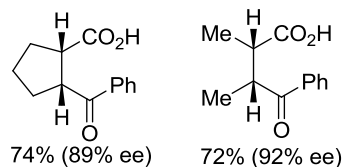
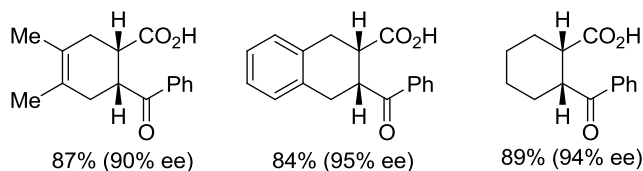
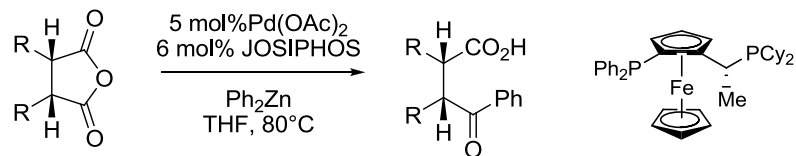


H. Shimizu, S. Onitsuka, H. Egami, and T. Katsuki, *J. Am. Chem. Soc.* 2005, **127**, 5396.

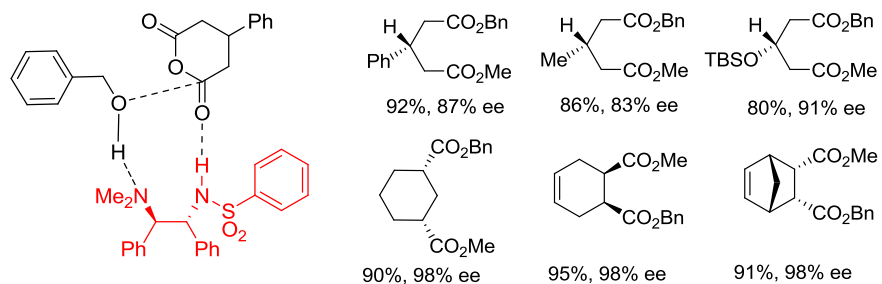
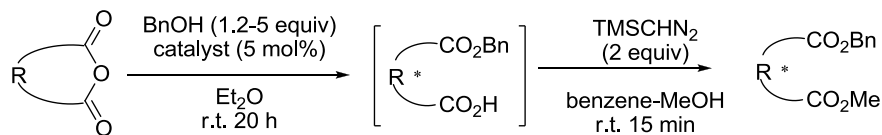
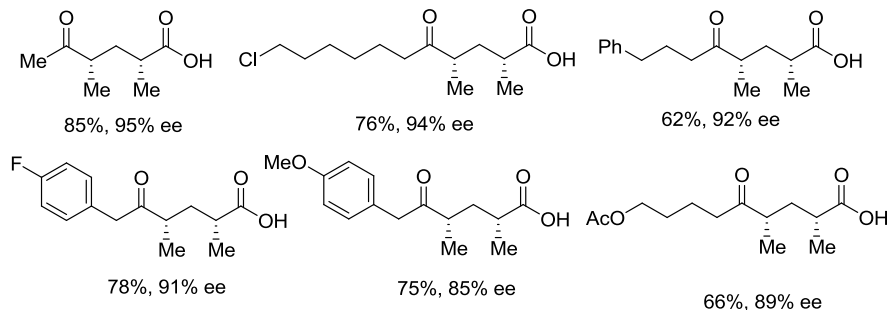
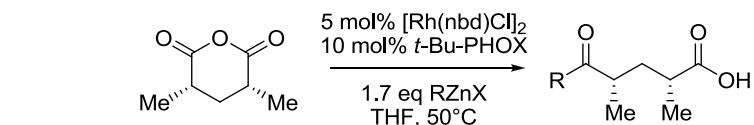
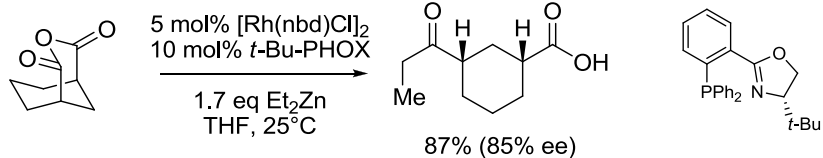
# Desymmetrization of Anhydrides



E. A. Bercot and T. Rovis. *J Am. Chem. Soc.* 2001, **124**, 174.

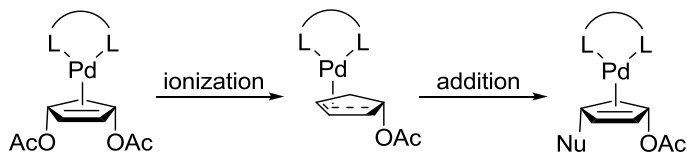
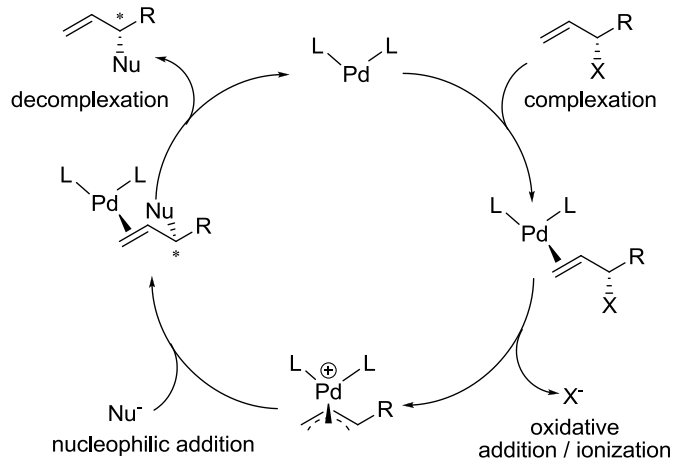


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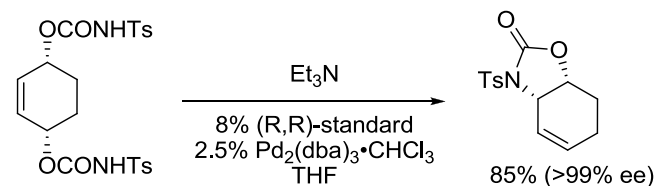
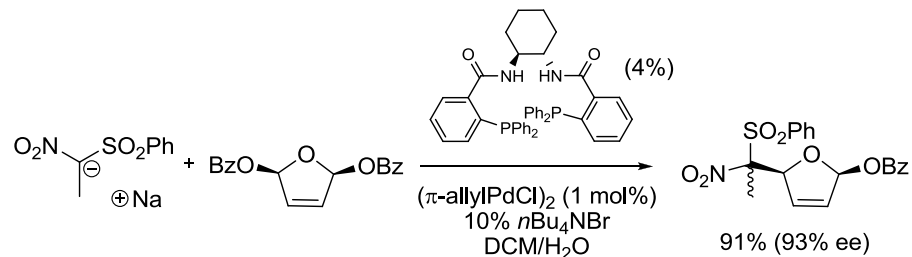
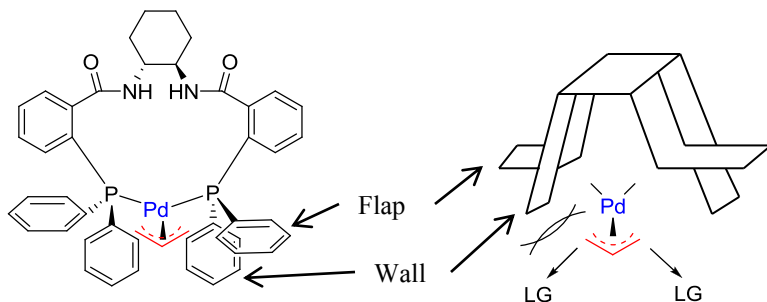


# Trost Asymmetric Allylic Alkylation

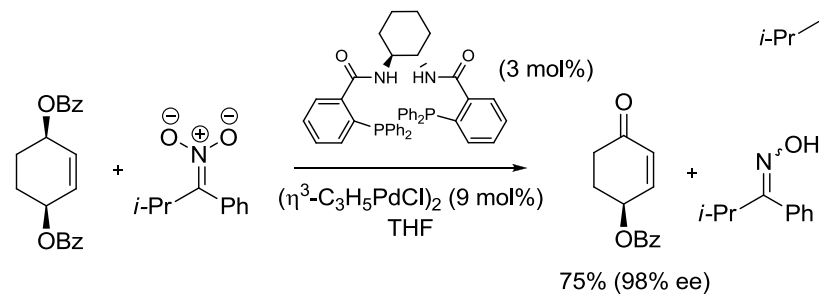
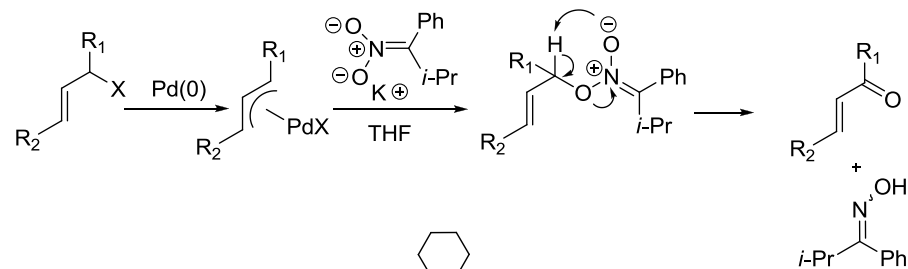
## Pd-catalyzed Asymmetric Allylic Alkylation



The catalyst differentiates two enantiotopic leaving groups in the ionization step.



M. R. Machacek, A. Aponick, and B. Trost, *Acc. Chem. Res.*, 2006, **39**, 747.



K. Yong, J. Richardson, and B. Trost, *J. Am. Chem. Soc.*, 2006, **128**, 2540.