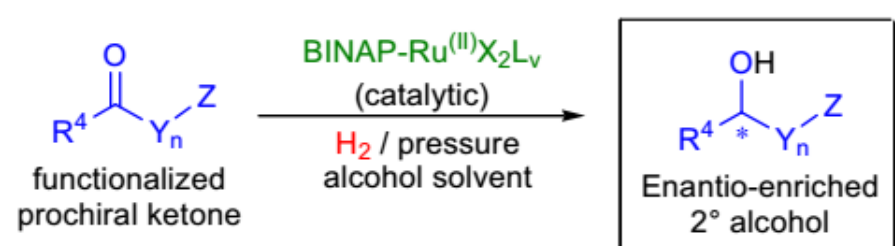
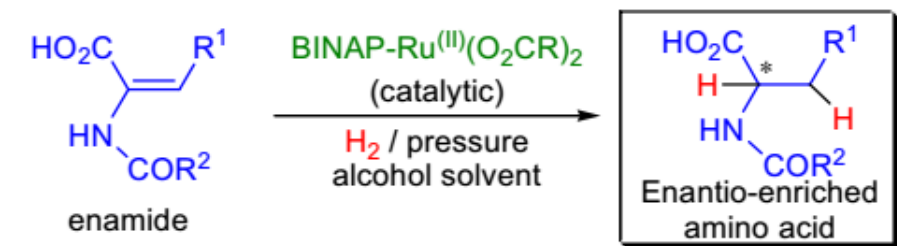
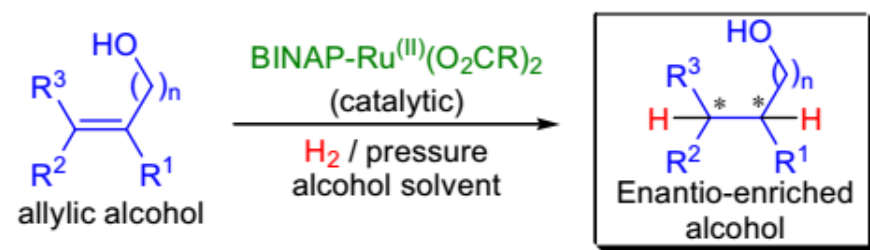
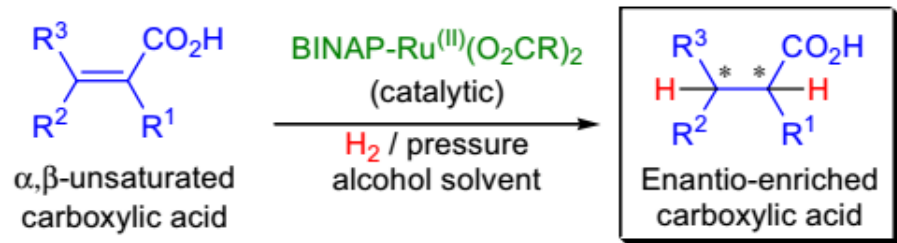




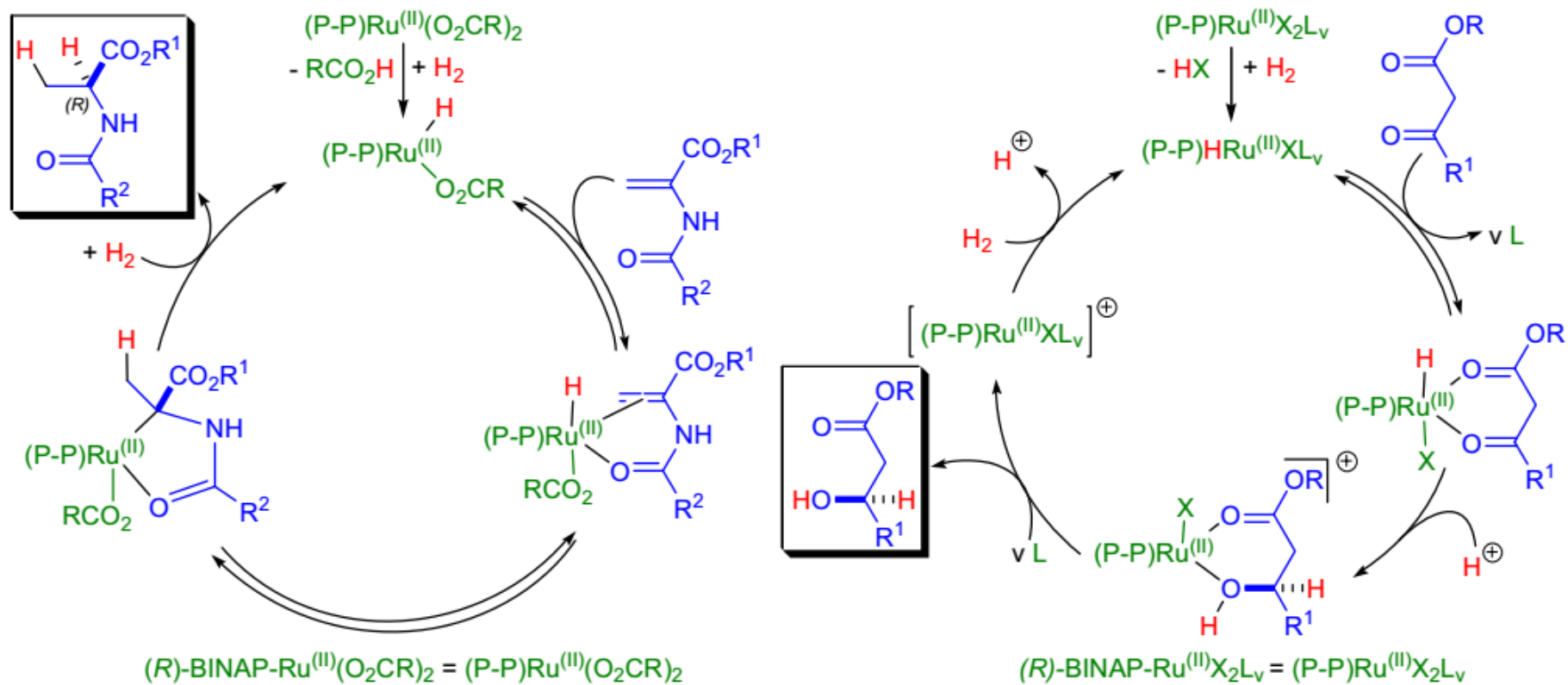
# Noyori asymmetric hydrogenation

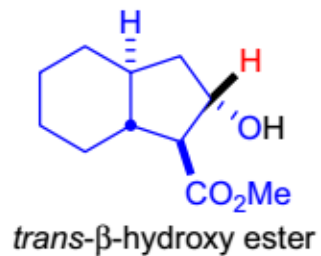
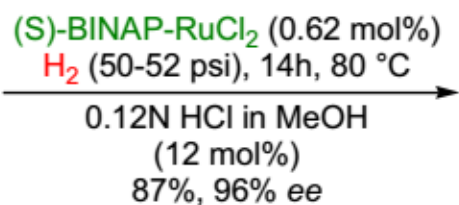
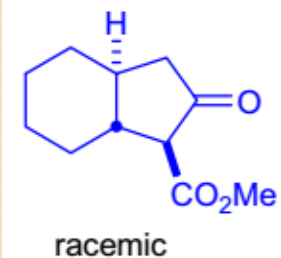


$\text{R}^{1-3}$  = H, alkyl, aryl;  $\text{R}^4$  = alkyl, aryl;  $\text{Z}$  = nitrogen, oxygen, halogen;  $\text{Y}$  =  $\text{sp}^2$  or  $\text{sp}^3$  hybridized carbon;  $n = 1-3$ ;  $\text{X}$  = halogen;  $\text{L}$  = neutral ligand or solvent;  $\text{R}$  = alkyl, aryl

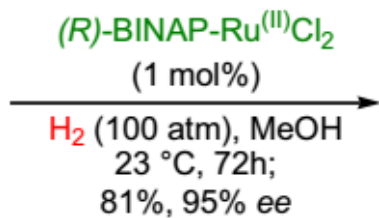
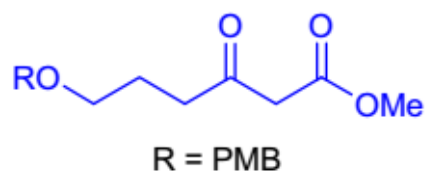
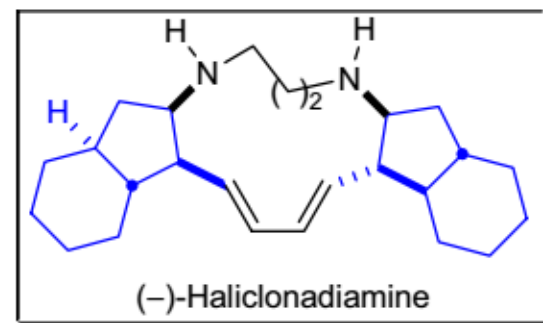
In 1980, T.S.R. Noyori and co-workers reported that cationic BINAP-Rh complexes catalyzed the asymmetric hydrogenation of acrylic acids or esters to give the corresponding amino acid derivatives in high enantiomeric excess

# Mechanism





steps



steps

