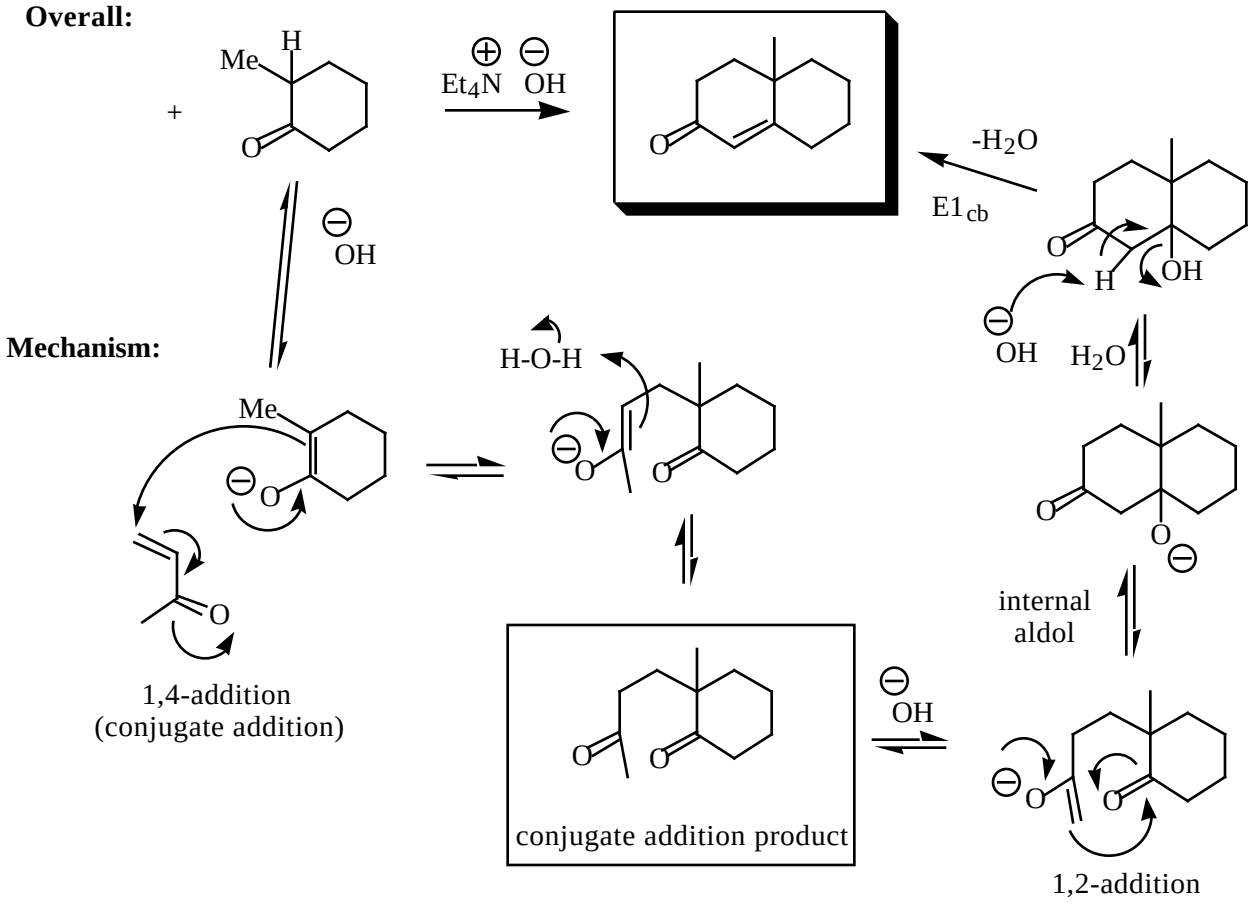
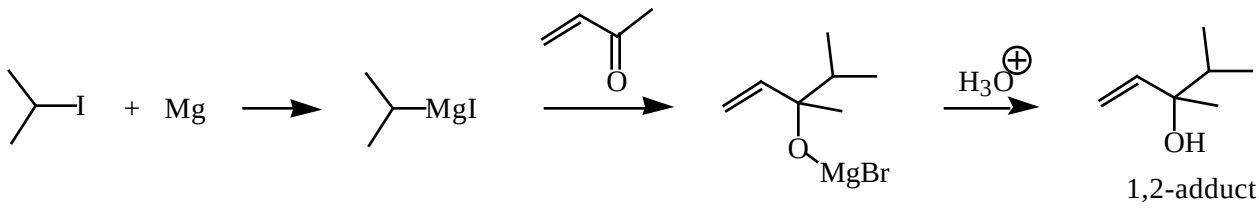
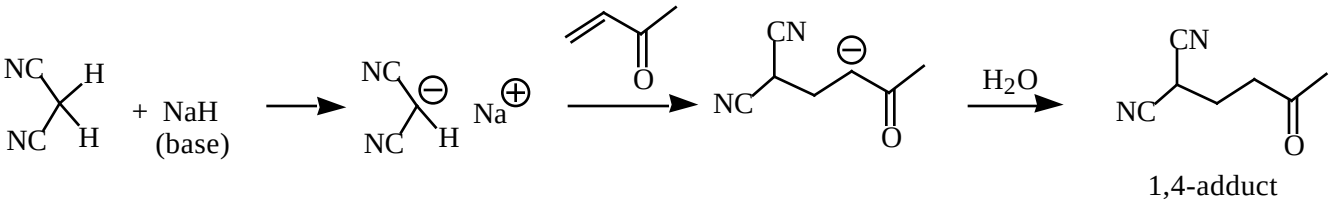
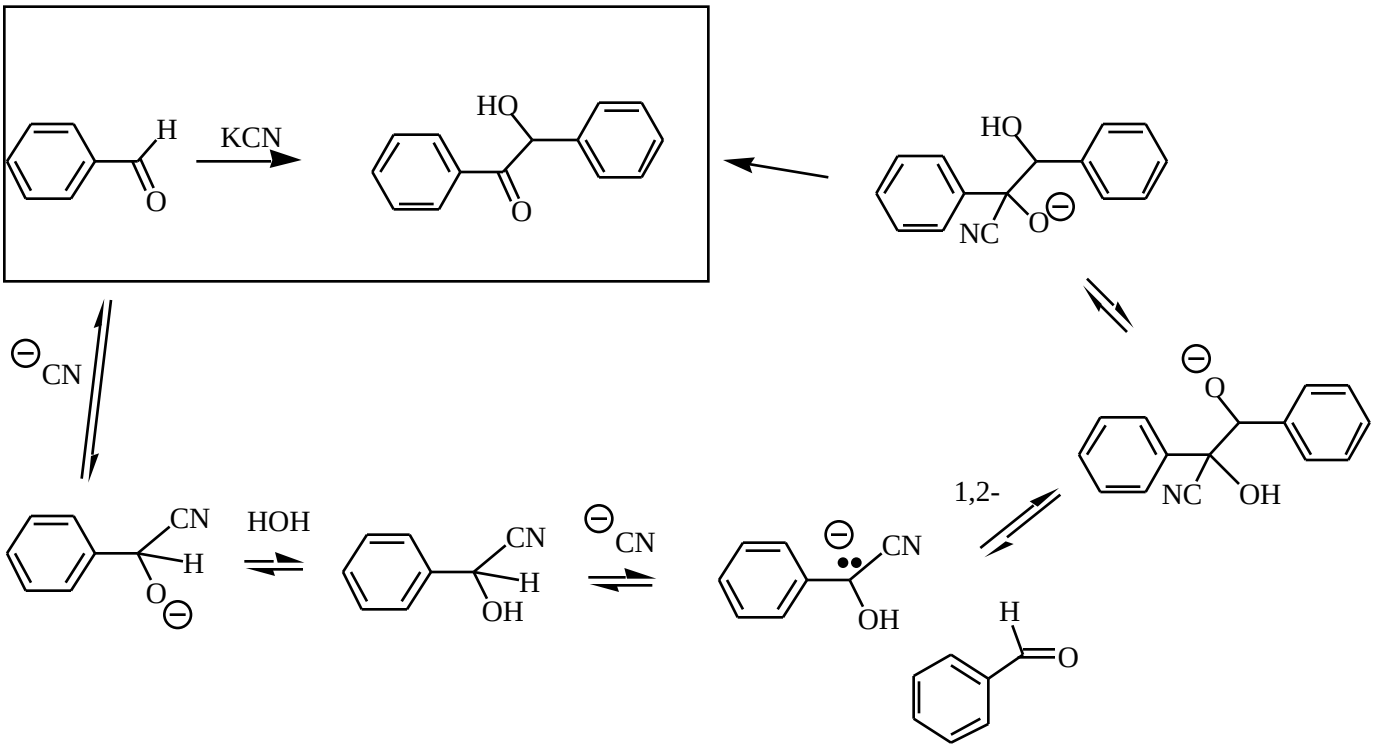
Review: Sorry about the sloppy presentation of this important reaction and mechanism: Lets try it again...
Combination condensation reactions: **Robinson Annulation**



Note: Reactive Anions tend to add "1,2" at the carbonyl carbon and not reverse (no conjugate addition)

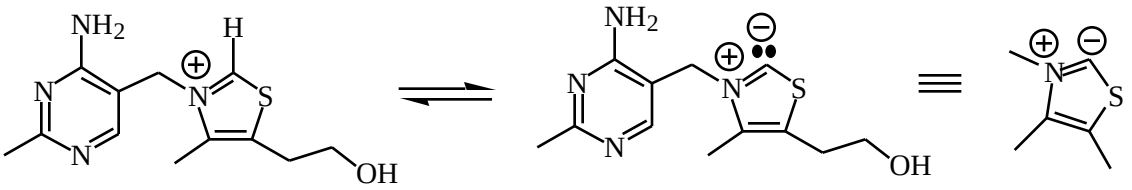






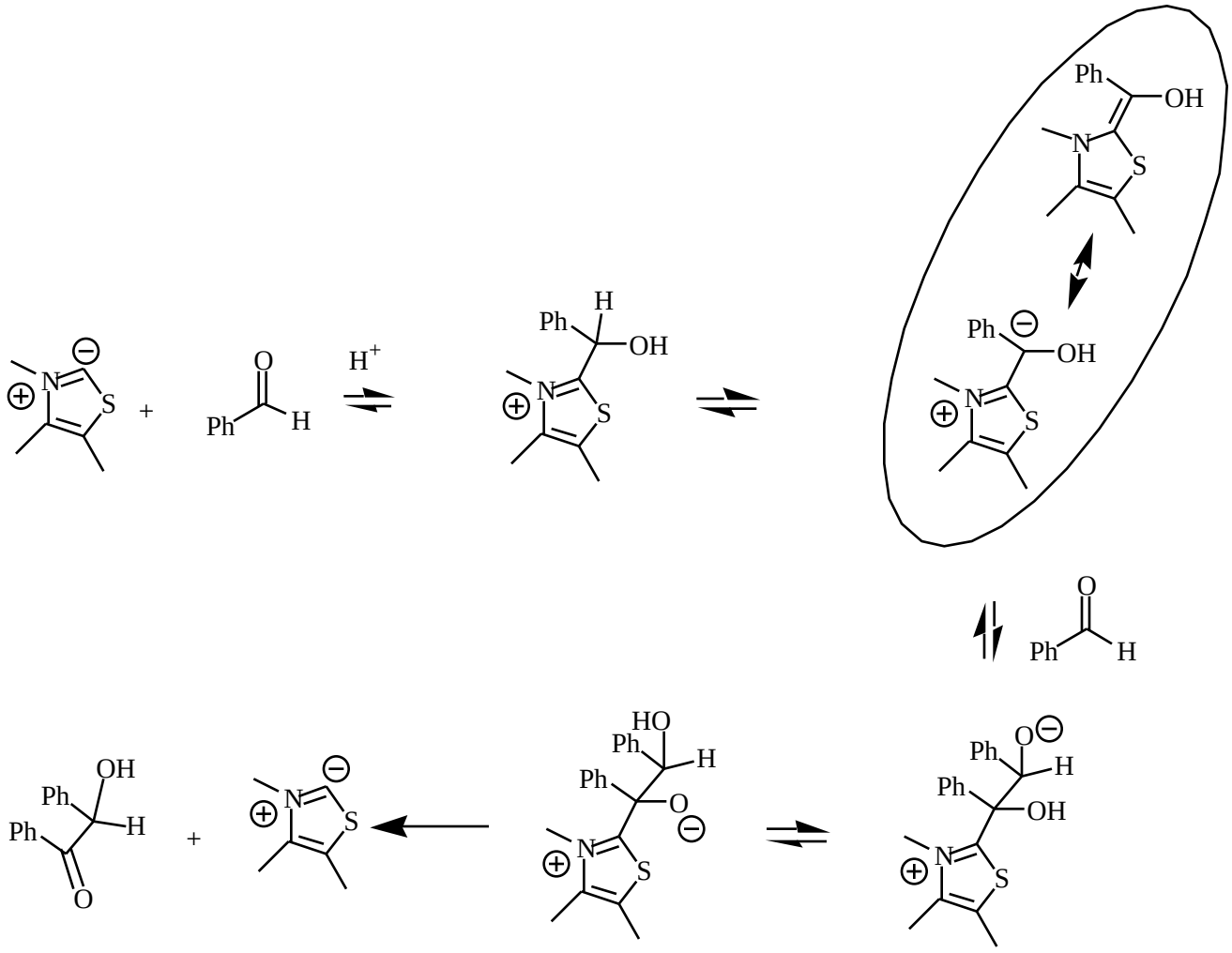
Role of CN: Add to C=O; favor deprotonation of α-H
Easily formed nucleophile and then a good electron-withdrawing group.
[e.g., HO^- does not do the same job. Why?]

Nature's analog of CN: Thiamine--pKa 12.7



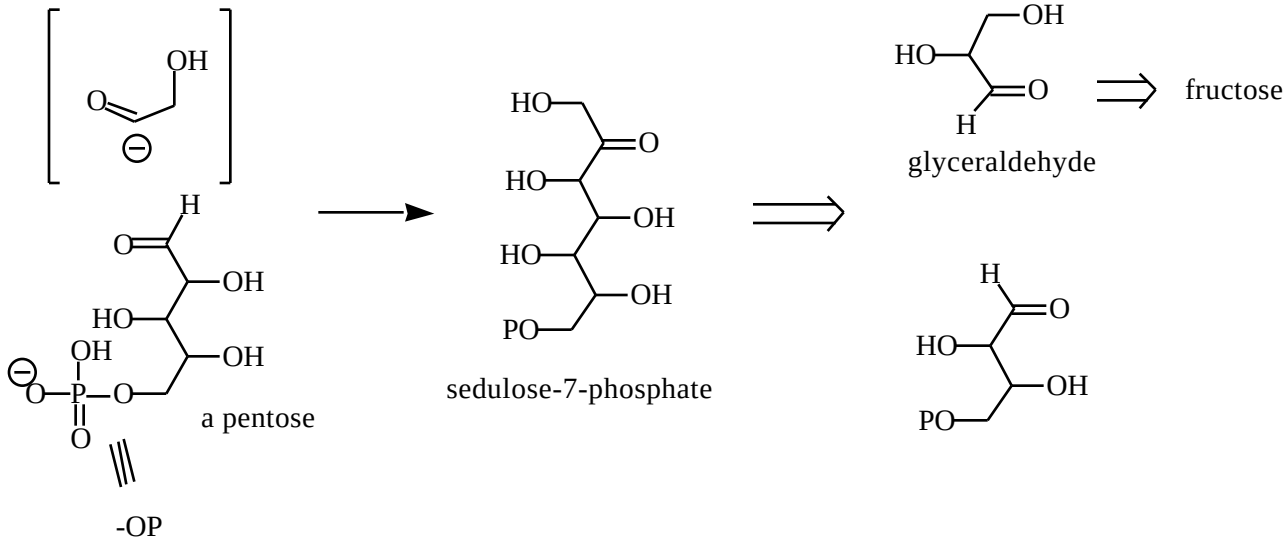
highly stablilized carbanion

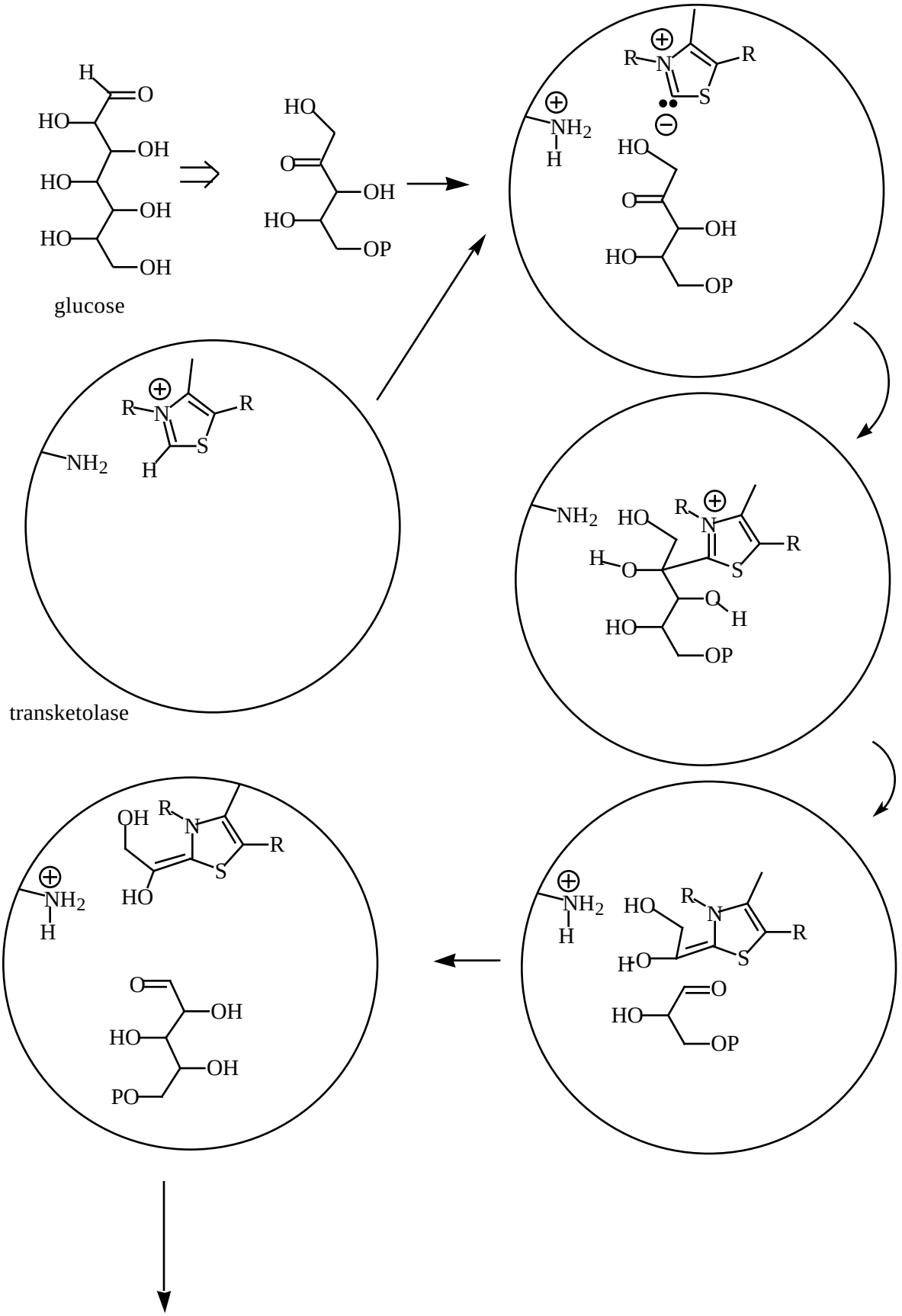
\

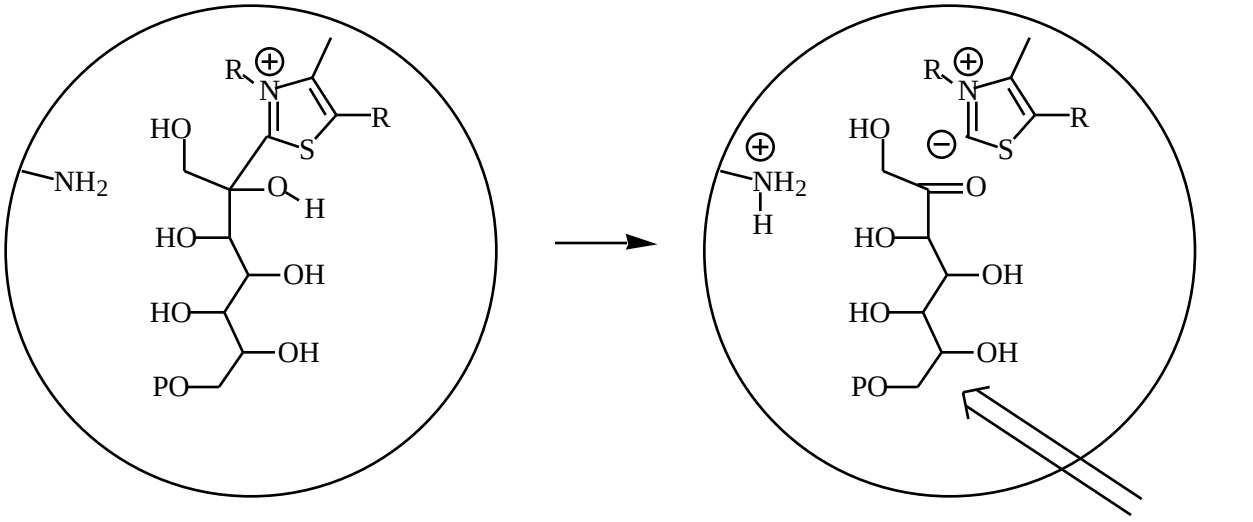


Biological CARBANION Reactions: The Pentose Phosphate Pathway

Overall: 3 Glucose → 2 Fructose + glyceraldehyde + 3 CO_2
C_6 C_6 C_3

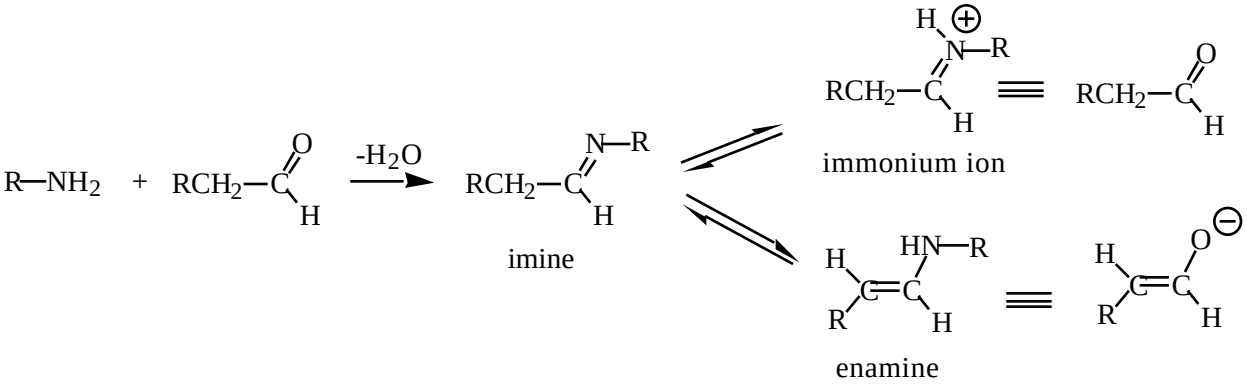



glucose
transketolase

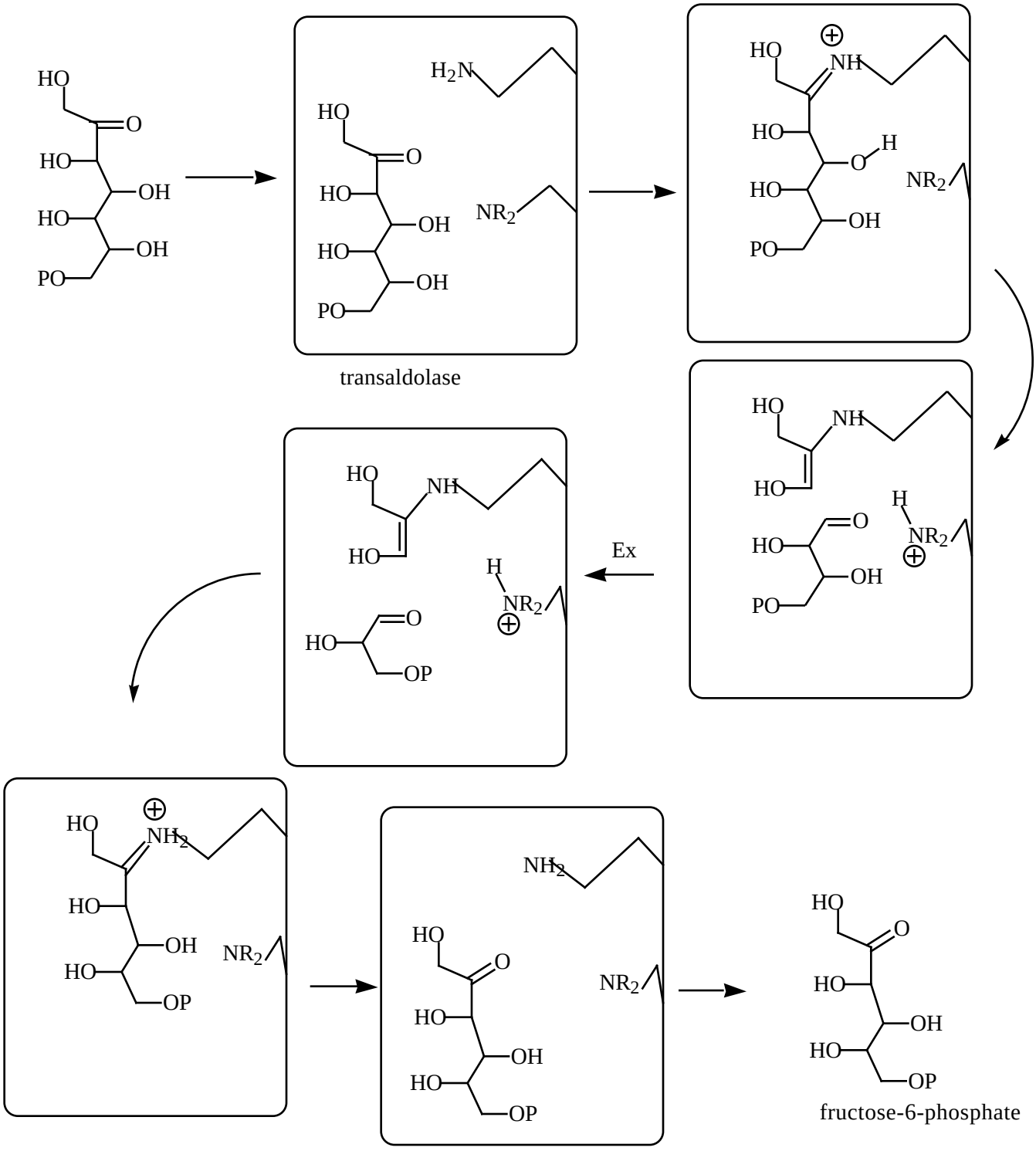


sedulose-7-phosphate

Parallel Role of Imines/immonium ions/enamines:



Aldol reactions with imines/enamines


transaldolase
Ex
fructose-6-phosphate