CHEM 539

Molecular Metabolism: Pathways and Regulation

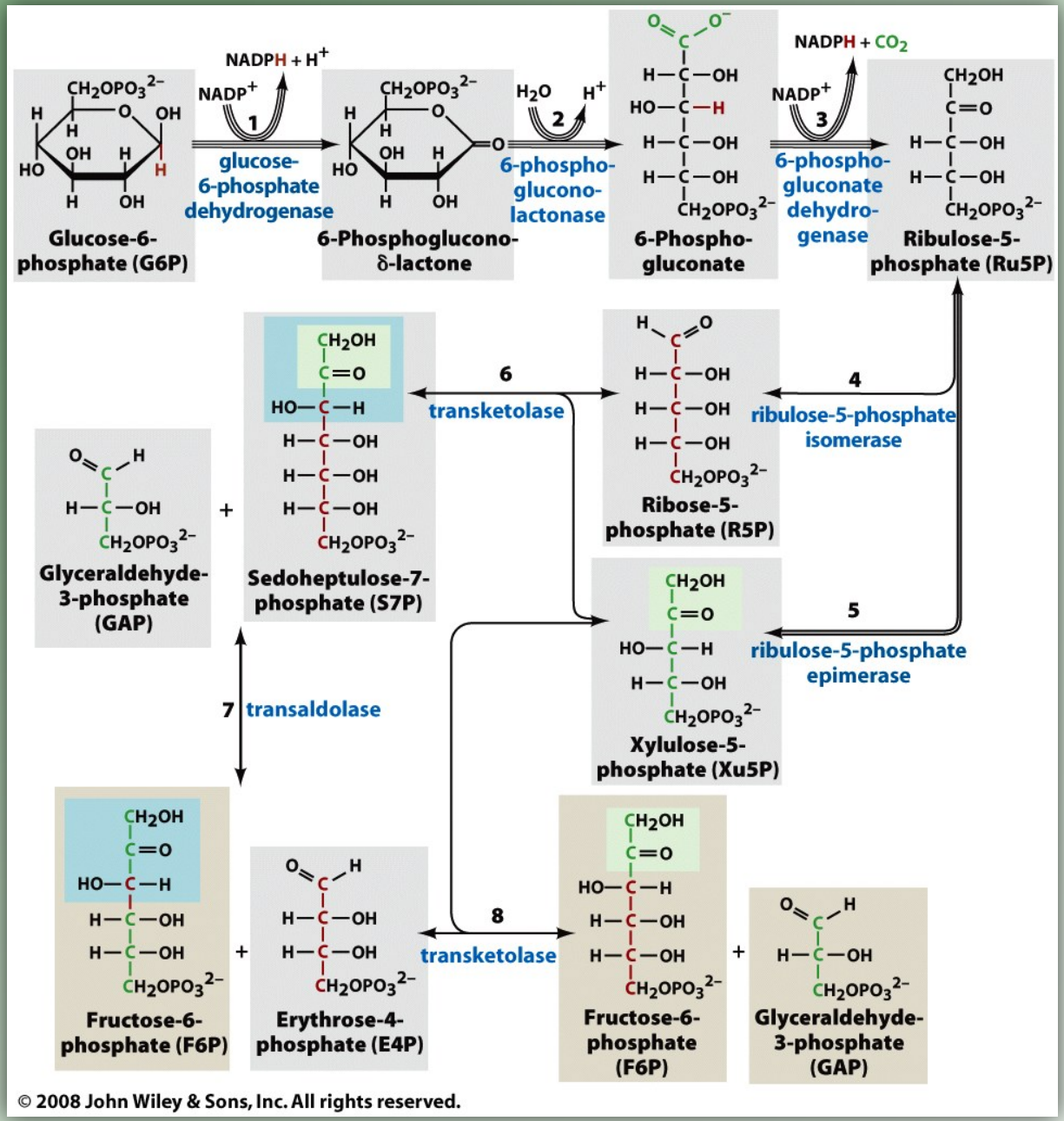
PPT Set 3: The pentose phosphate pathway

(shunt pathway from glycolysis)

Primary functions of the PPP

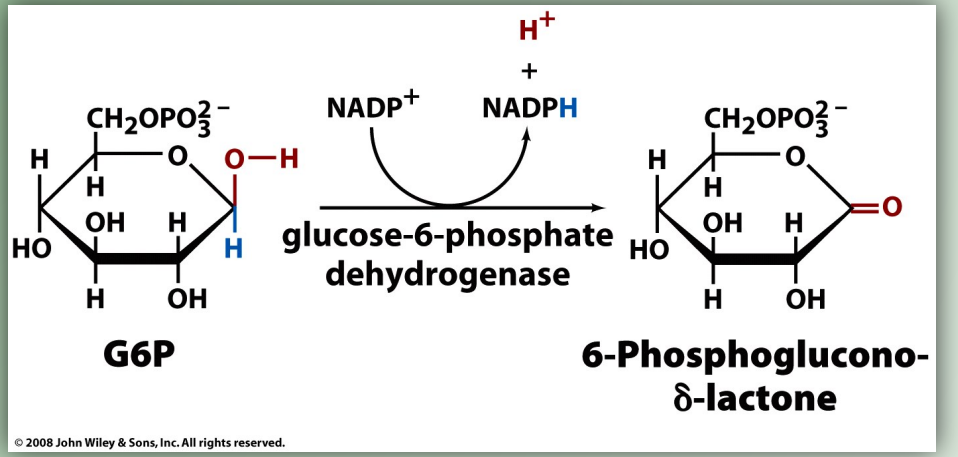
Production of NADPH; reducing equivalents that drive biosynthesis in the cytosol

Production of pentose phosphates for the synthesis of RNA and DNA



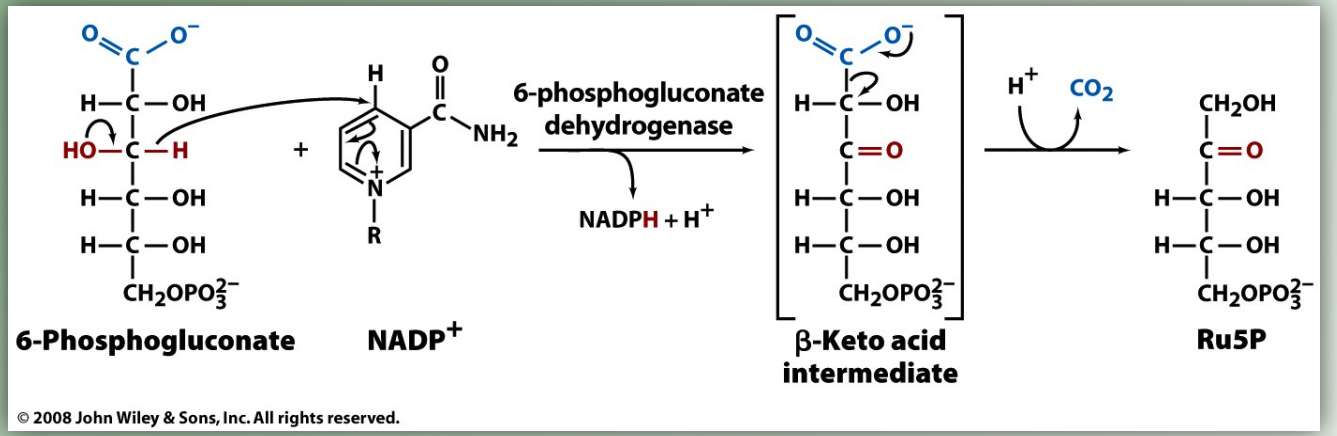
Overview of the pentose phosphate pathway

G6P dehydrogenase

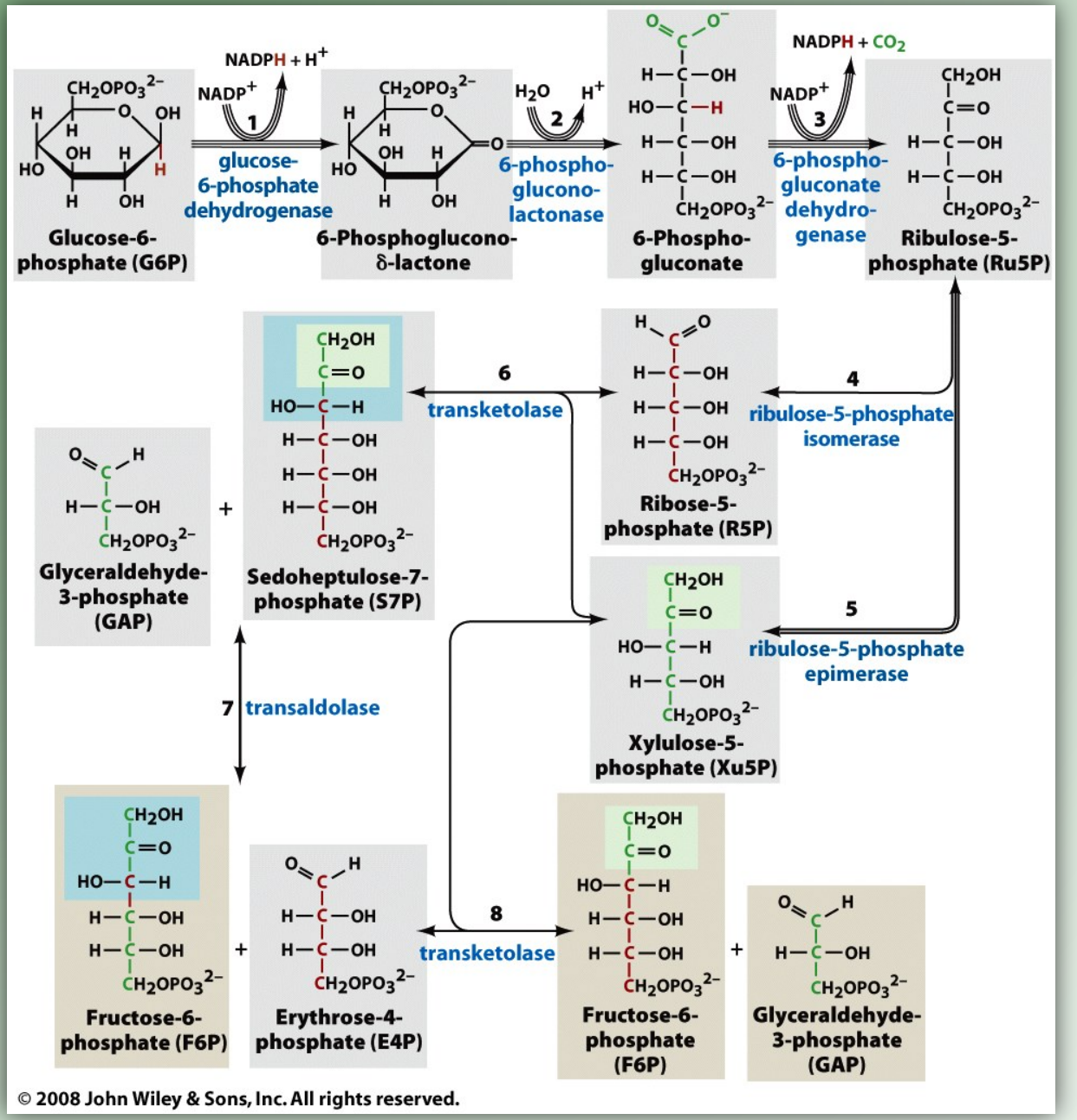


The lactone product needs to be hydrolyzed to the aldonate salt by 6-phosphogluconolactonase before the pathway can continue.

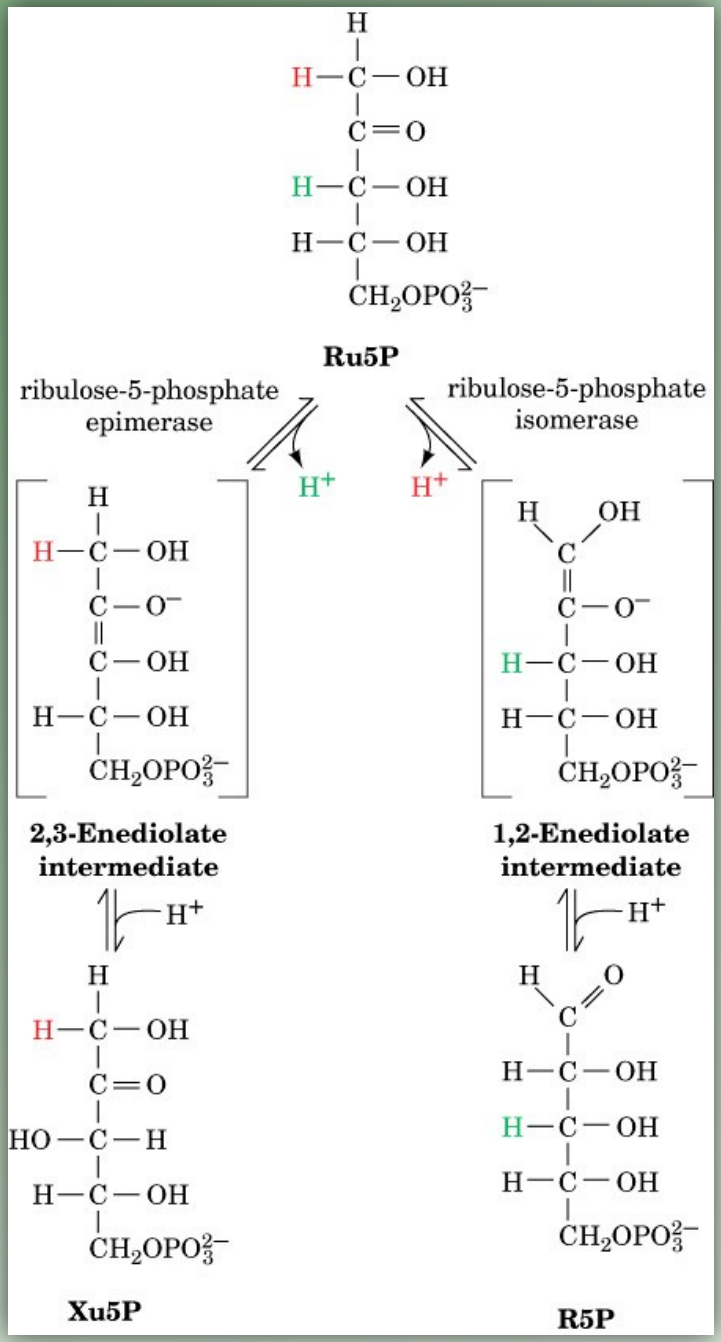
6-Phosphogluconate dehydrogenase



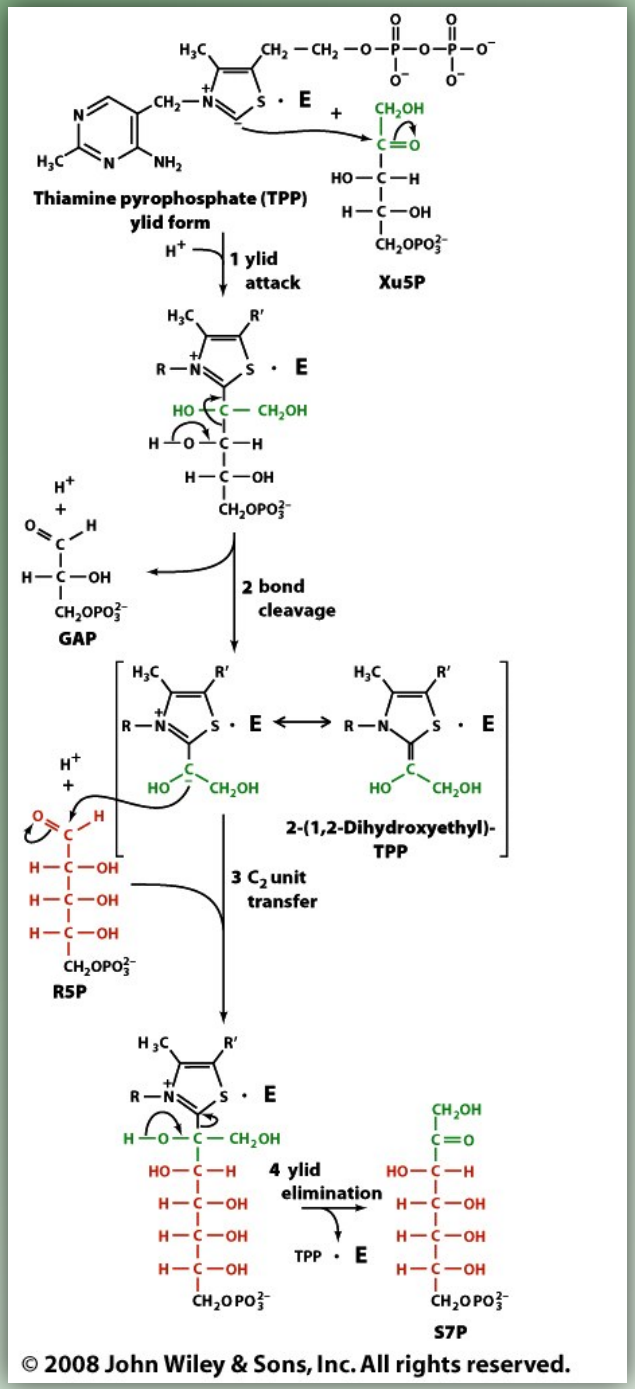
Oxidation at C3 to give the intermediate β-ketoacid, which undergoes subsequent decarboxylation.



Overview of the pentose phosphate pathway



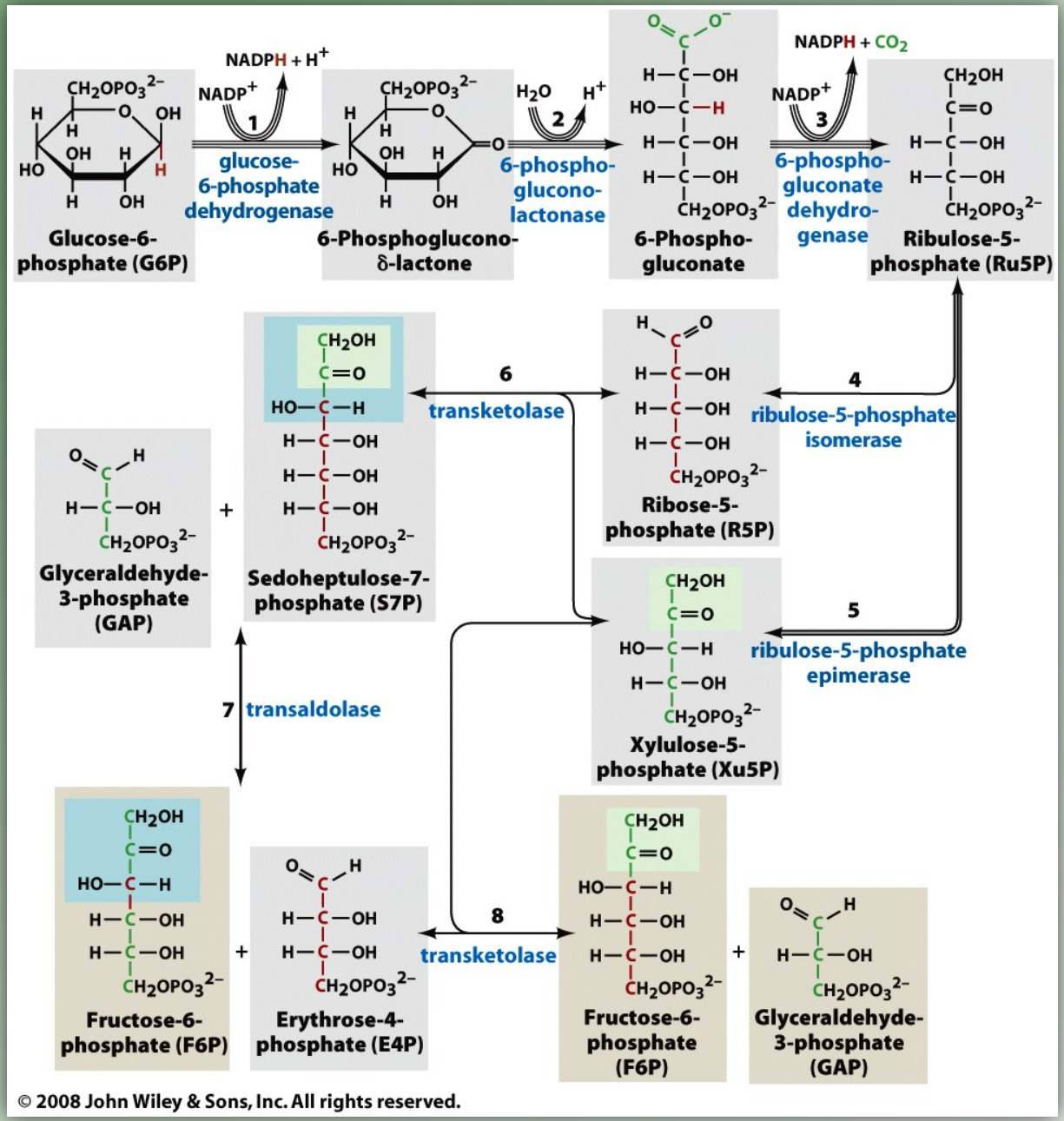
ribulose-5-phosphate isomerase and ribulose-5-phosphate epimerase



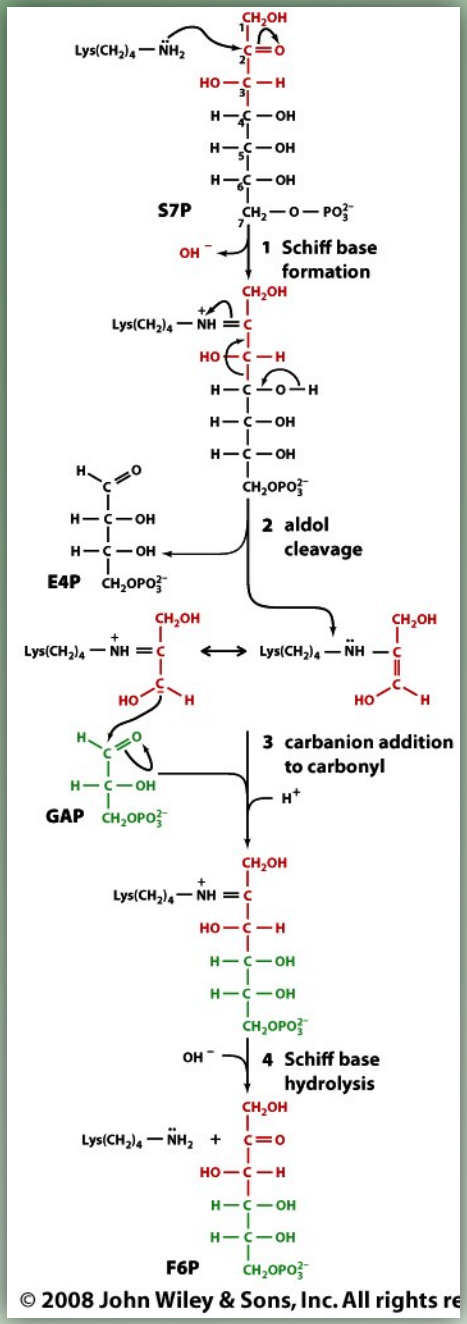
Transketolase reaction 1

(reaction of R5P and Xu5P to give G3P and S7P)

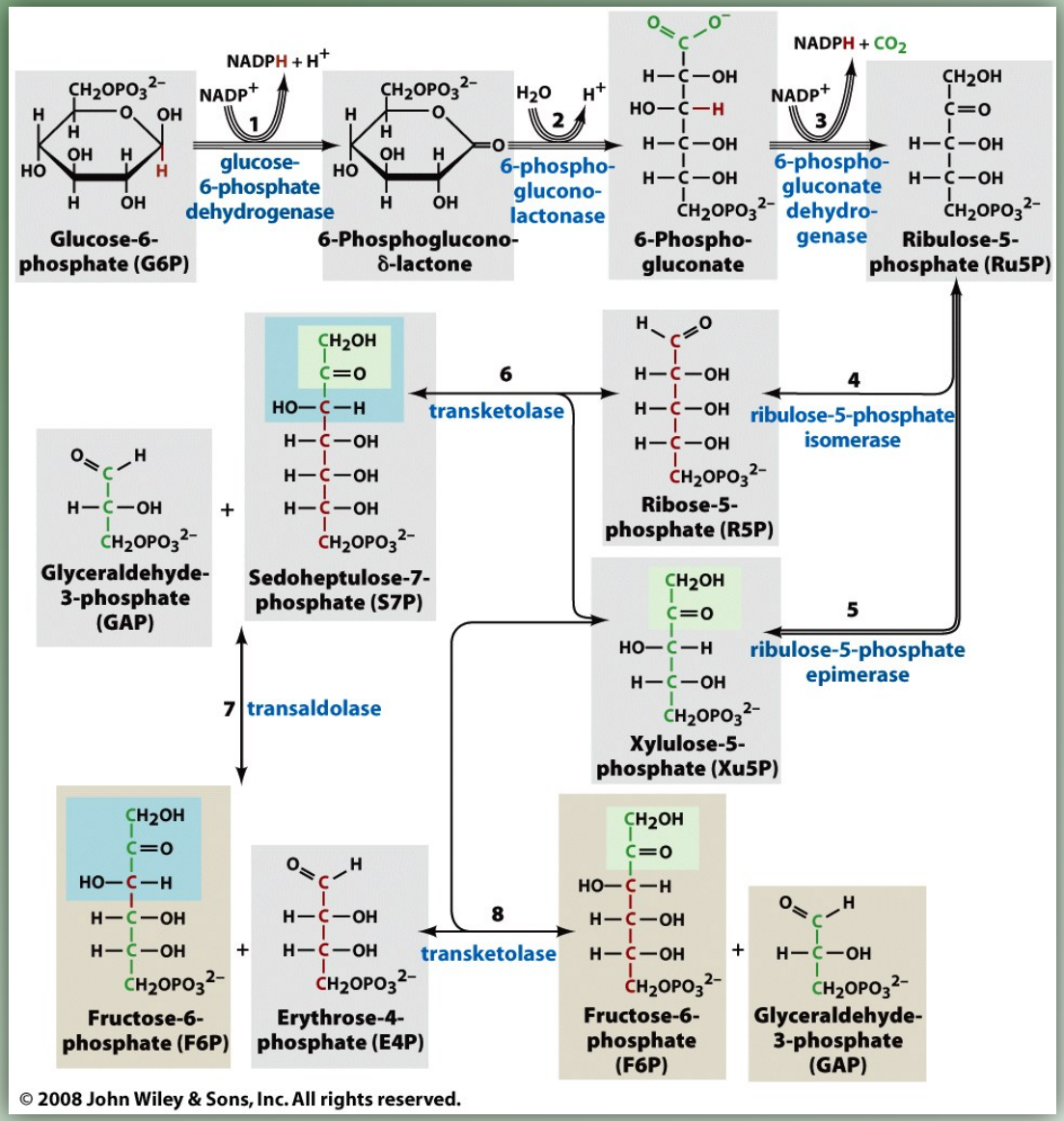
A TPP-requiring enzyme



Overview of the pentose phosphate pathway



The transaldolase reaction (reaction of G3P and S7P to give E4P and F6P)



Overview of the pentose phosphate pathway

Transketolase reaction 2 (reaction of E4P and Xu5P to give F6P and G3P)

A TPP-requiring enzyme

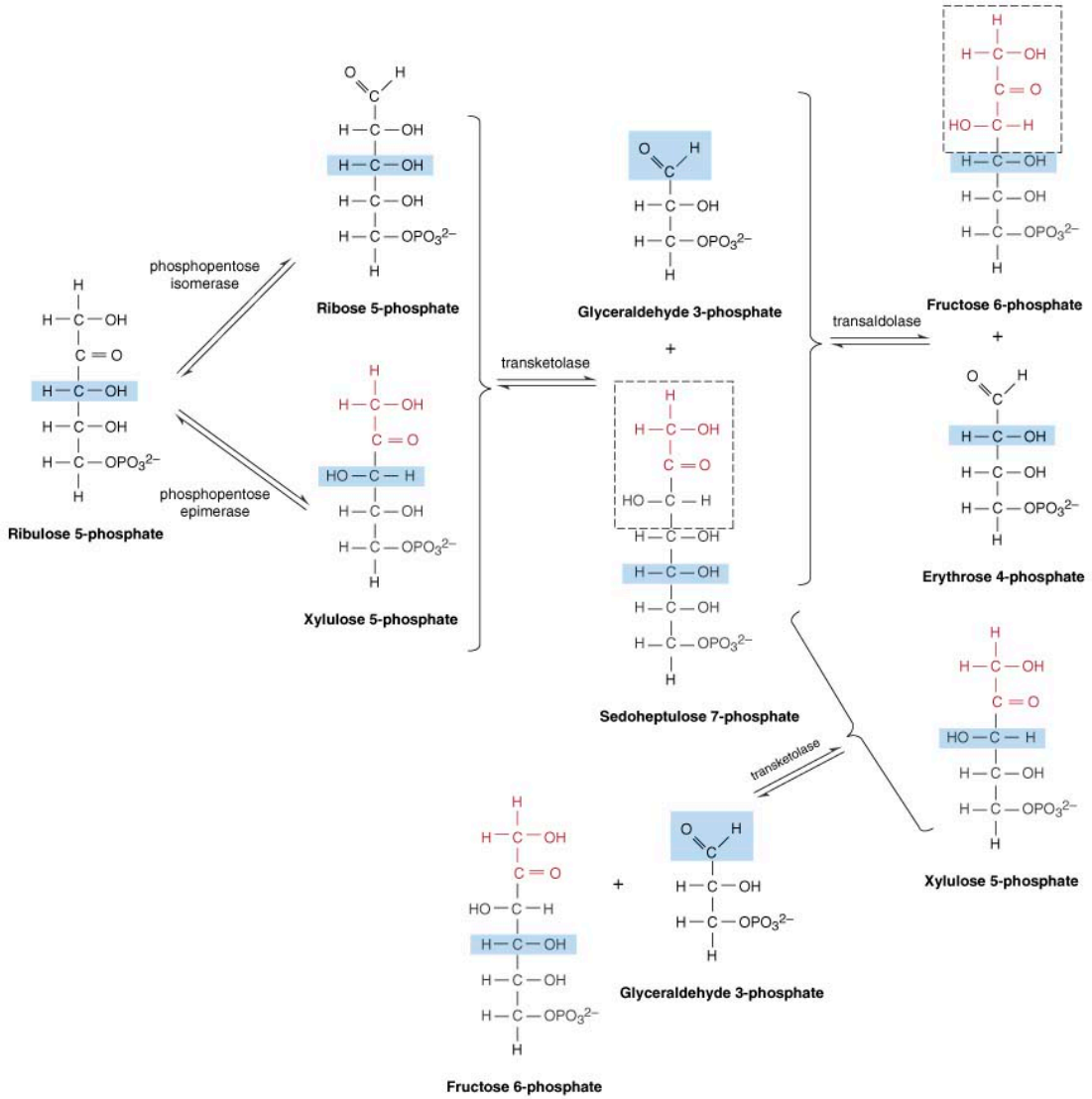
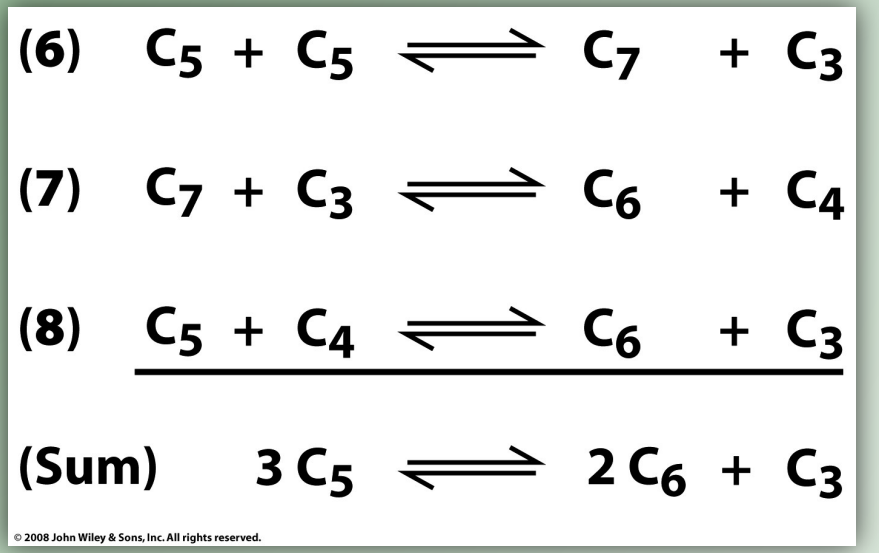
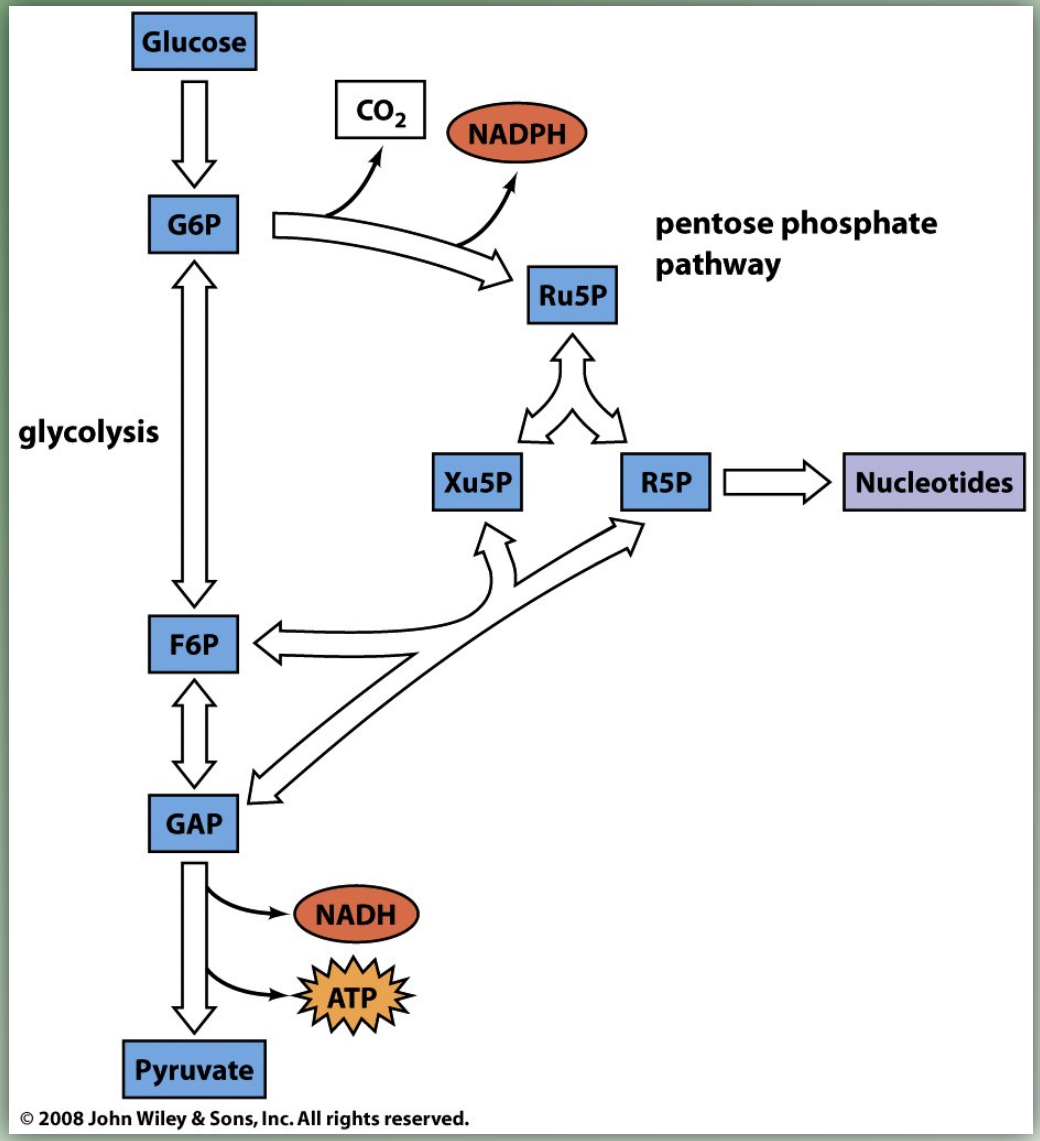


Figure 16.2. Nonoxidative reactions of the pentose phosphate pathway: Interconversions of pentose phosphates.

Summary of carbon skeleton rearrangements from reactions 6-8 in the PPP

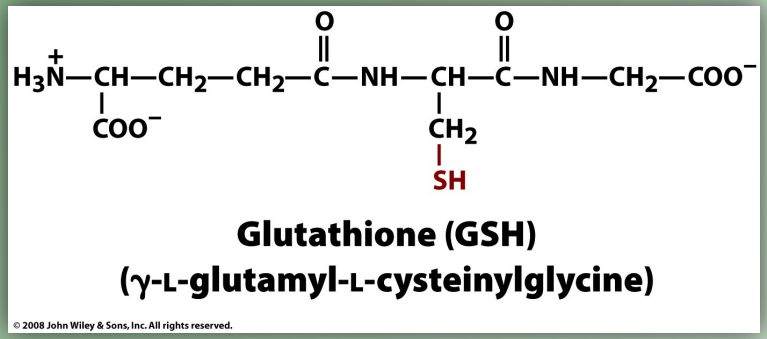


Three C_5 fragments are converted into two C_6 fragments (F6P) and one C_3 fragment (G3P). The F6P and G3P enter glycolysis for subsequent degradation.

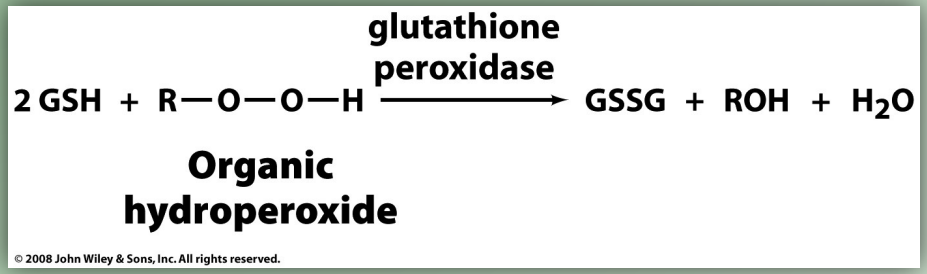


Relationship between glycolysis and the PPP

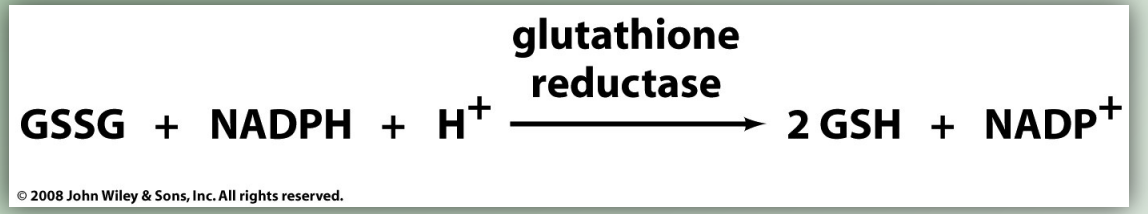
Erythrocyte biochemistry:



GSH is very abundant in erythrocytes.



GSH-mediated removal of ROS, which damage Hb and lipids and cause cell lysis



GSSG is converted back to GSH with NADPH.