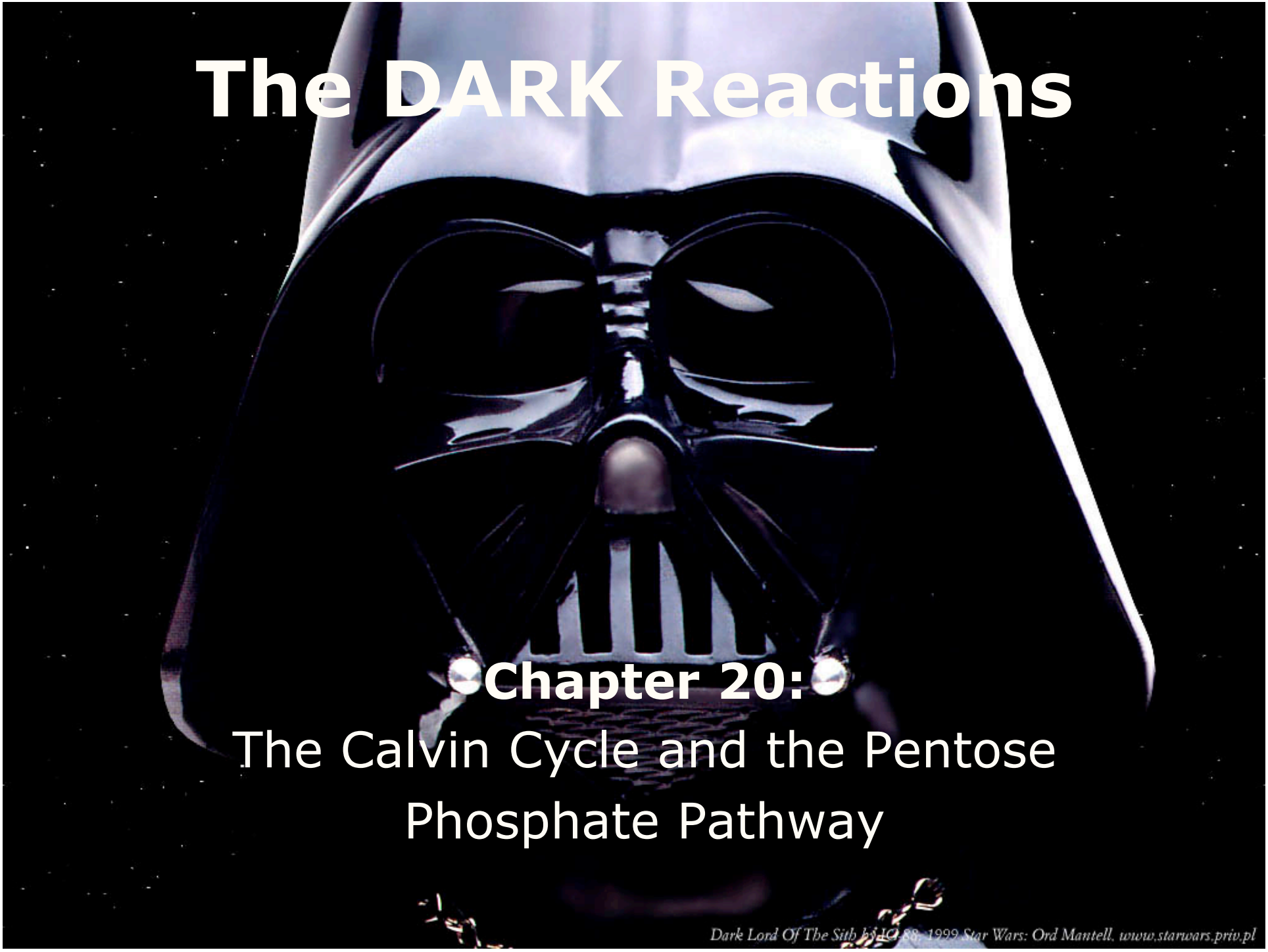
The DARK Reactions



Chapter 20:

The Calvin Cycle and the Pentose Phosphate Pathway

The Calvin Cycle:a CO2 Fixation!

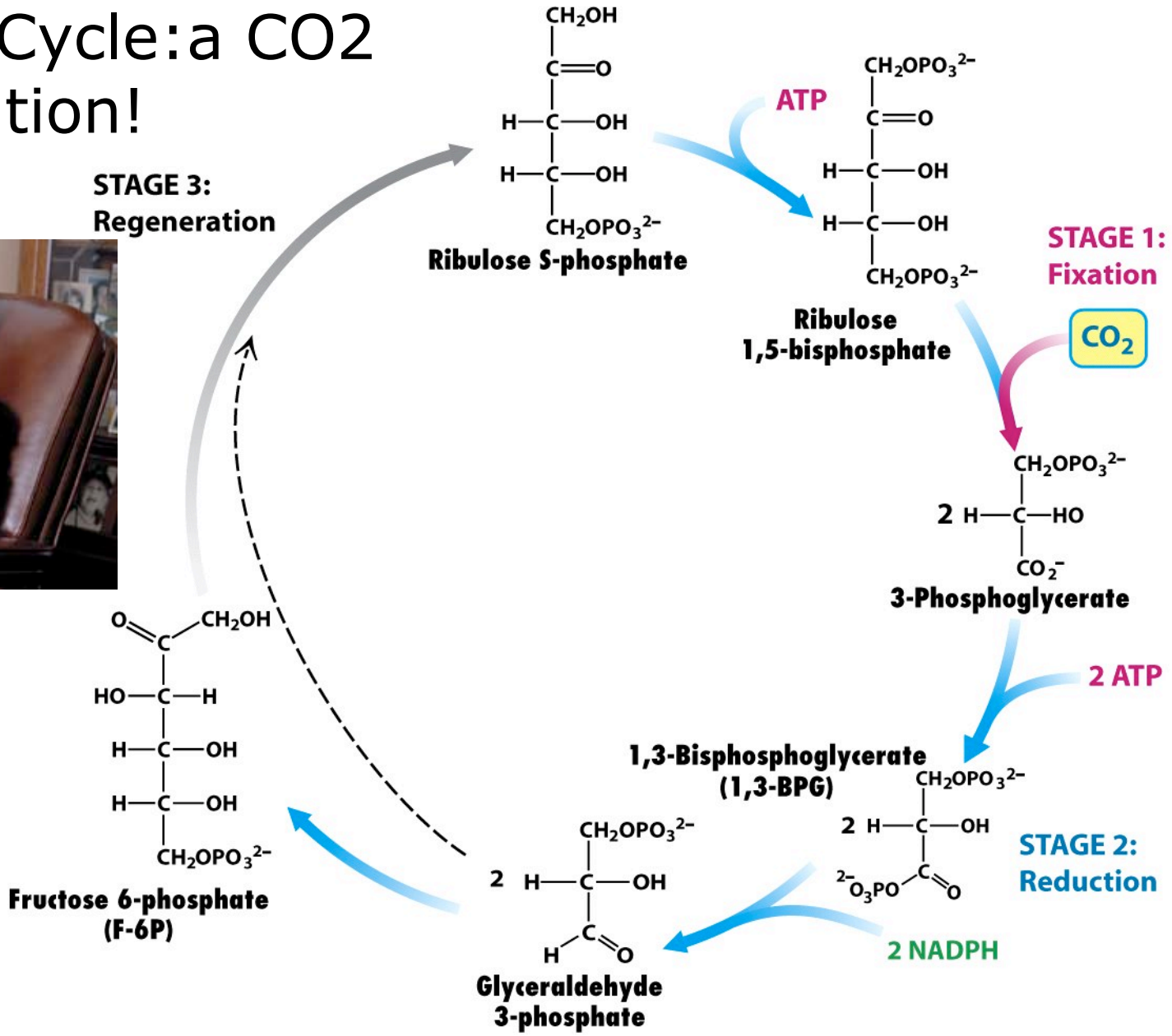


Figure 20-1
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RUBISCO!: not a cookie, but the most abundant protein on earth! (likely)

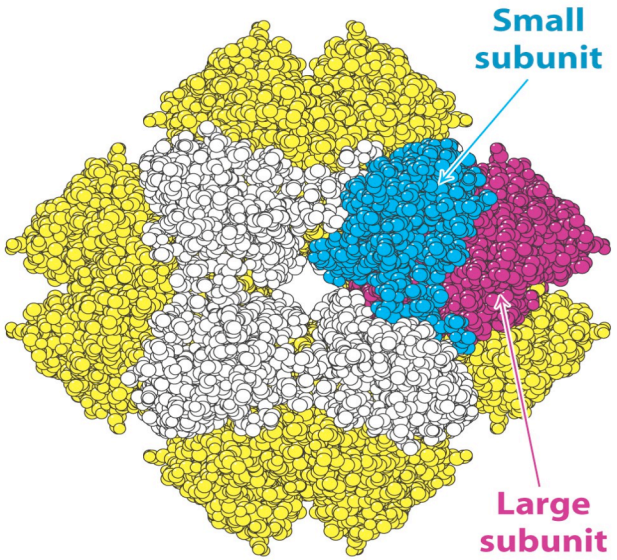

Figure 20-3
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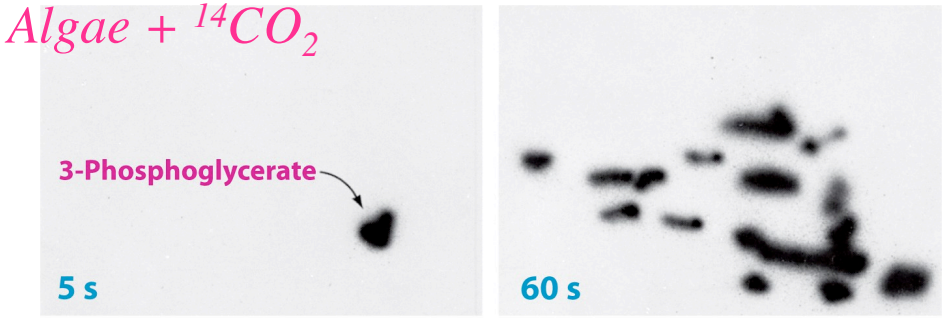

Figure 20-2
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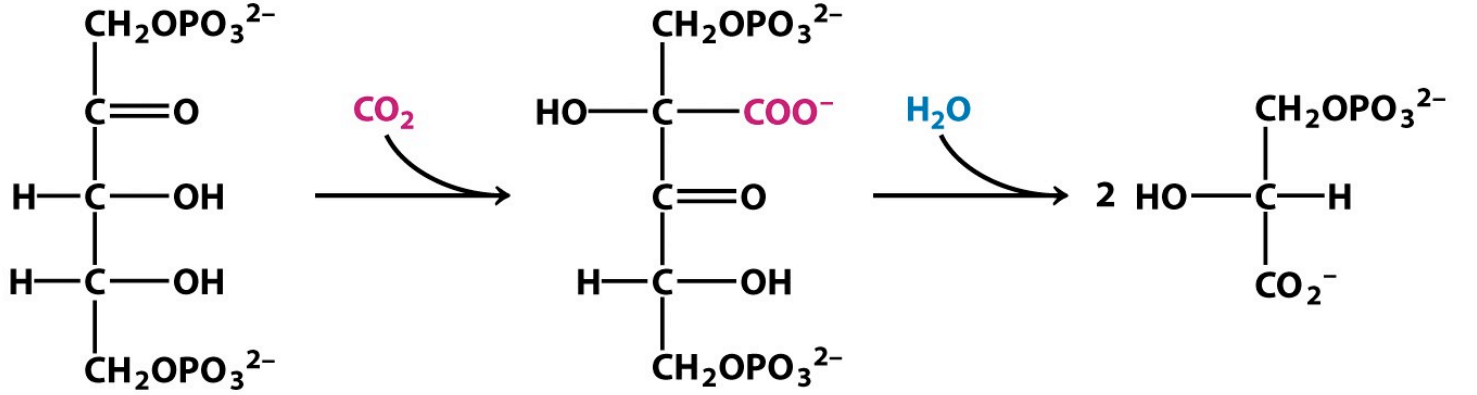

Ribulose 1,5-bisphosphate **Unstable intermediate** **3-Phosphoglycerate**

Unnumbered figure pg 567
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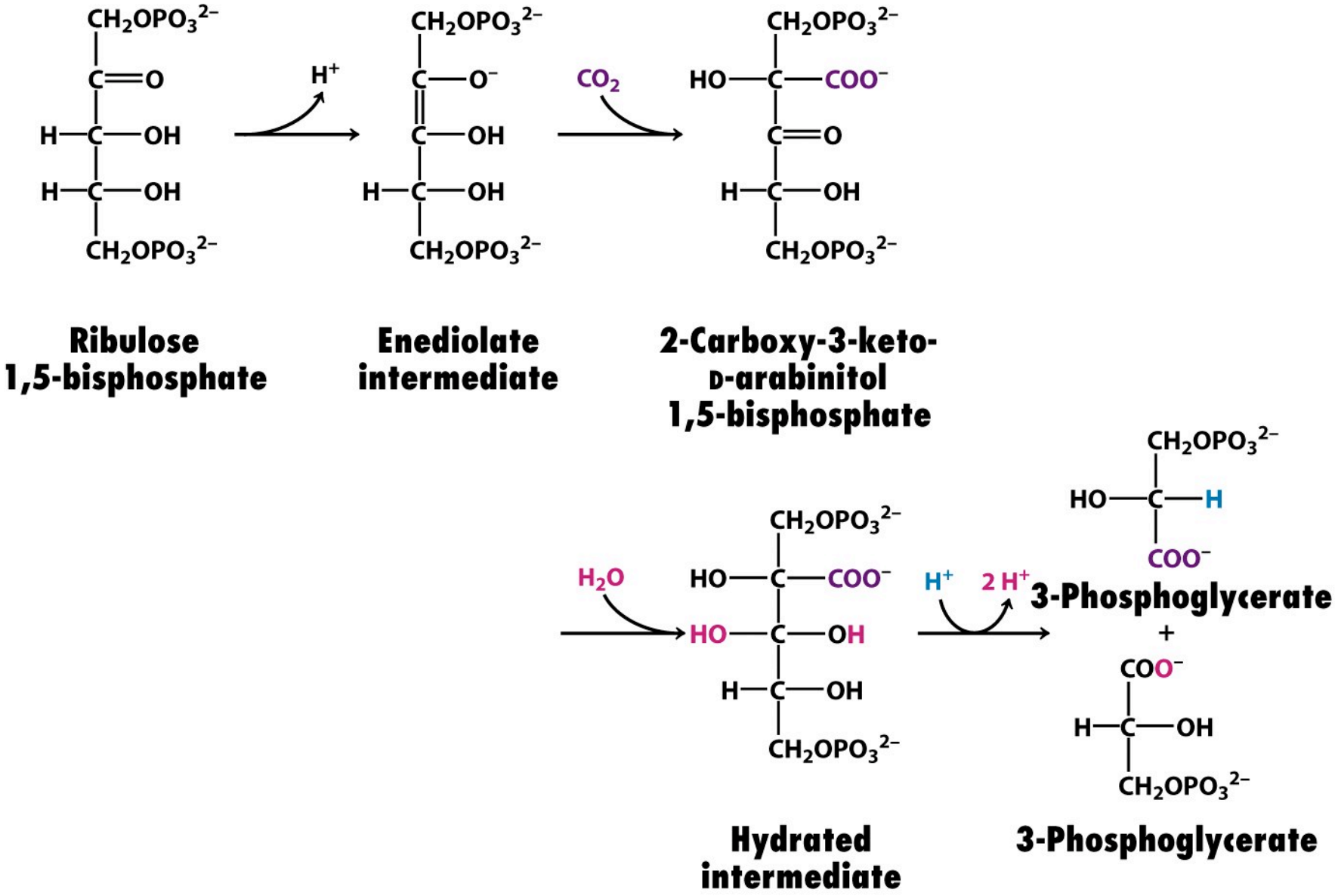

Figure 20-5
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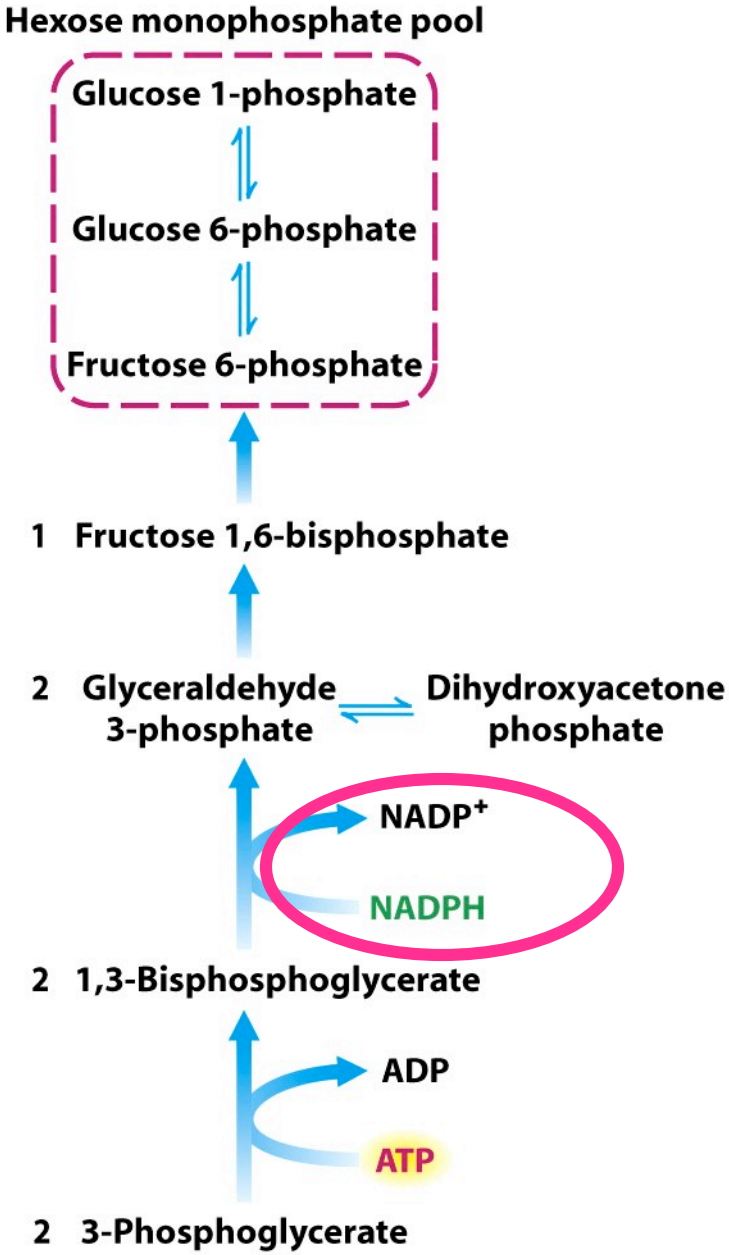

Figure 20-9
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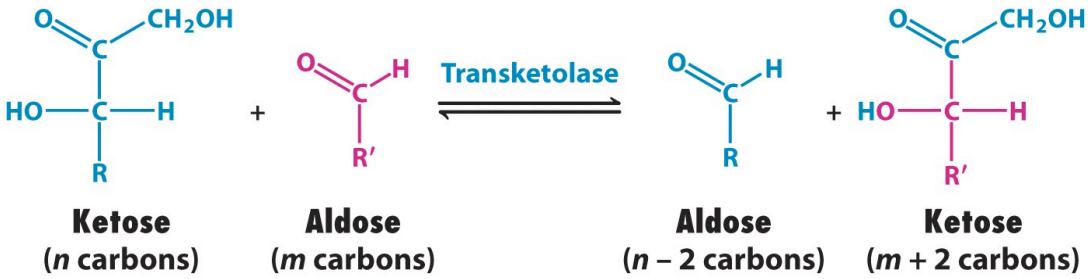
Additional Reactions to make new sugars and regenerate RuBP:

3+6 = 5????



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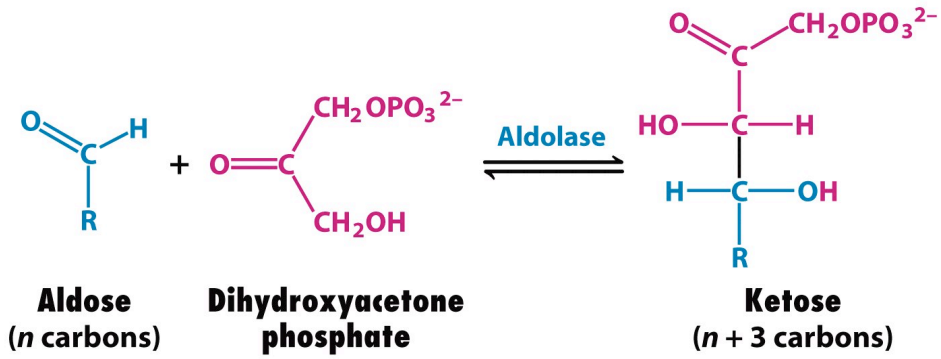

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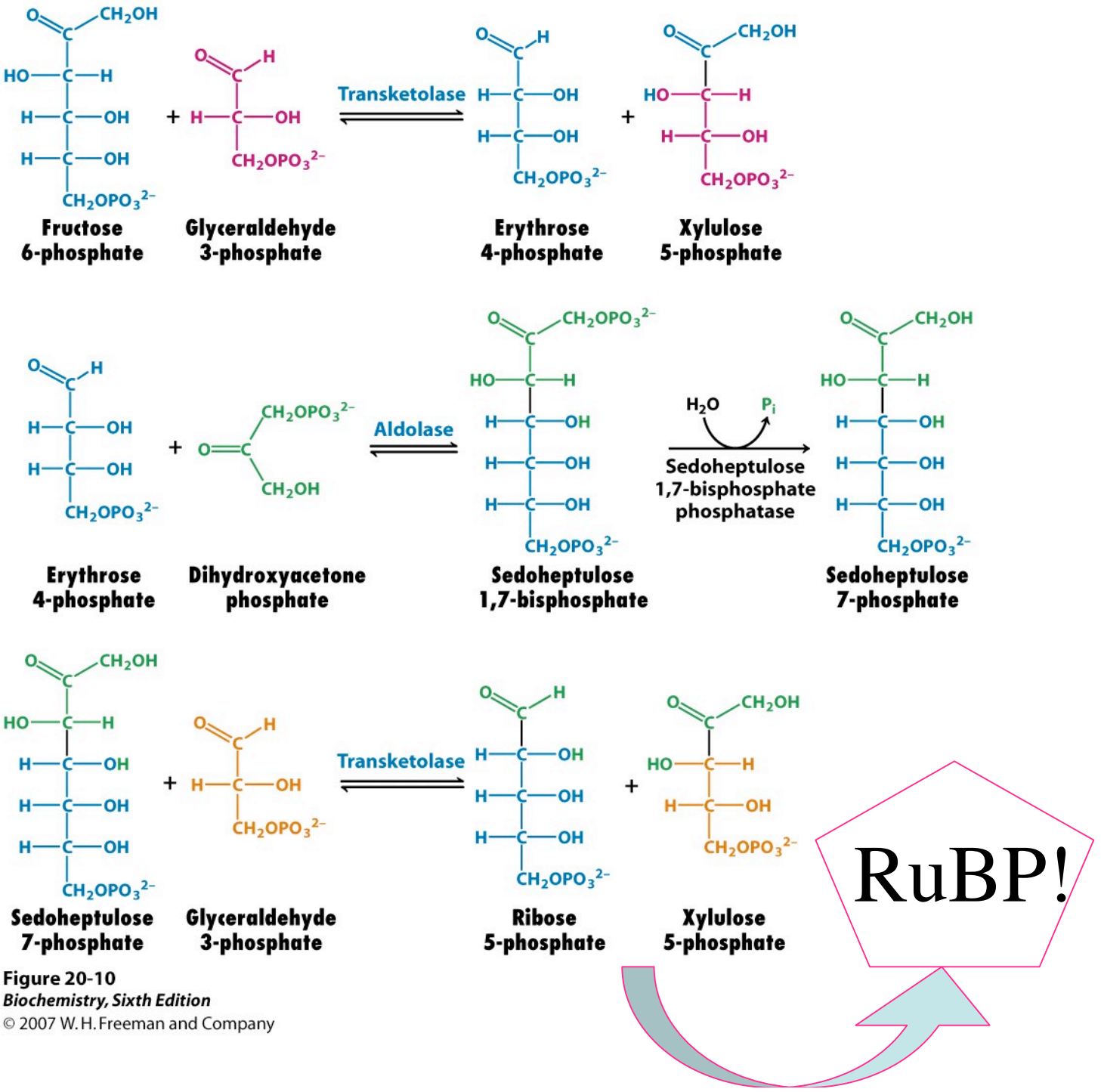

Figure 20-10
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Regeneration of RuBP

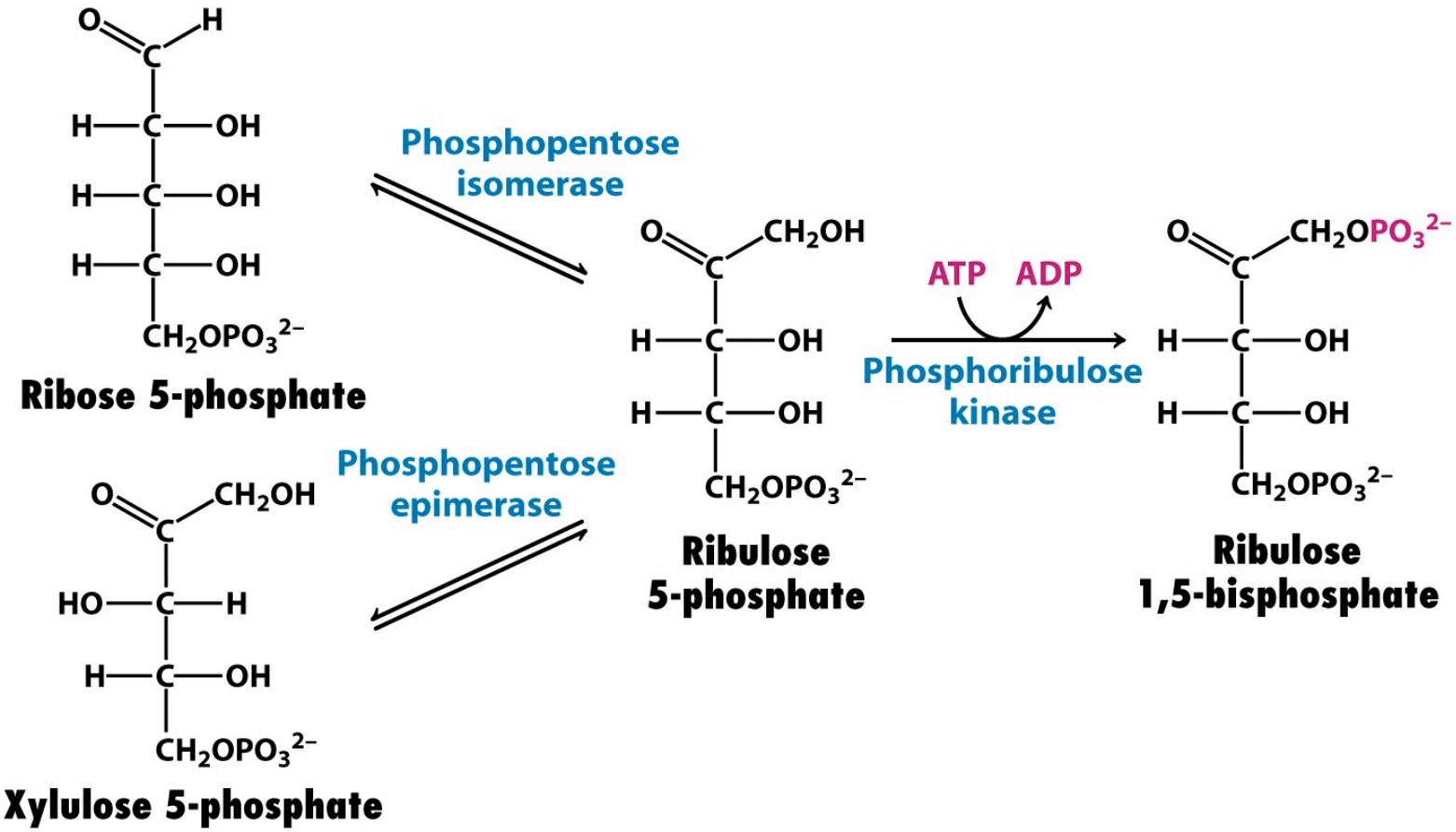

Figure 20-11
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The Whole Calvin Cycle

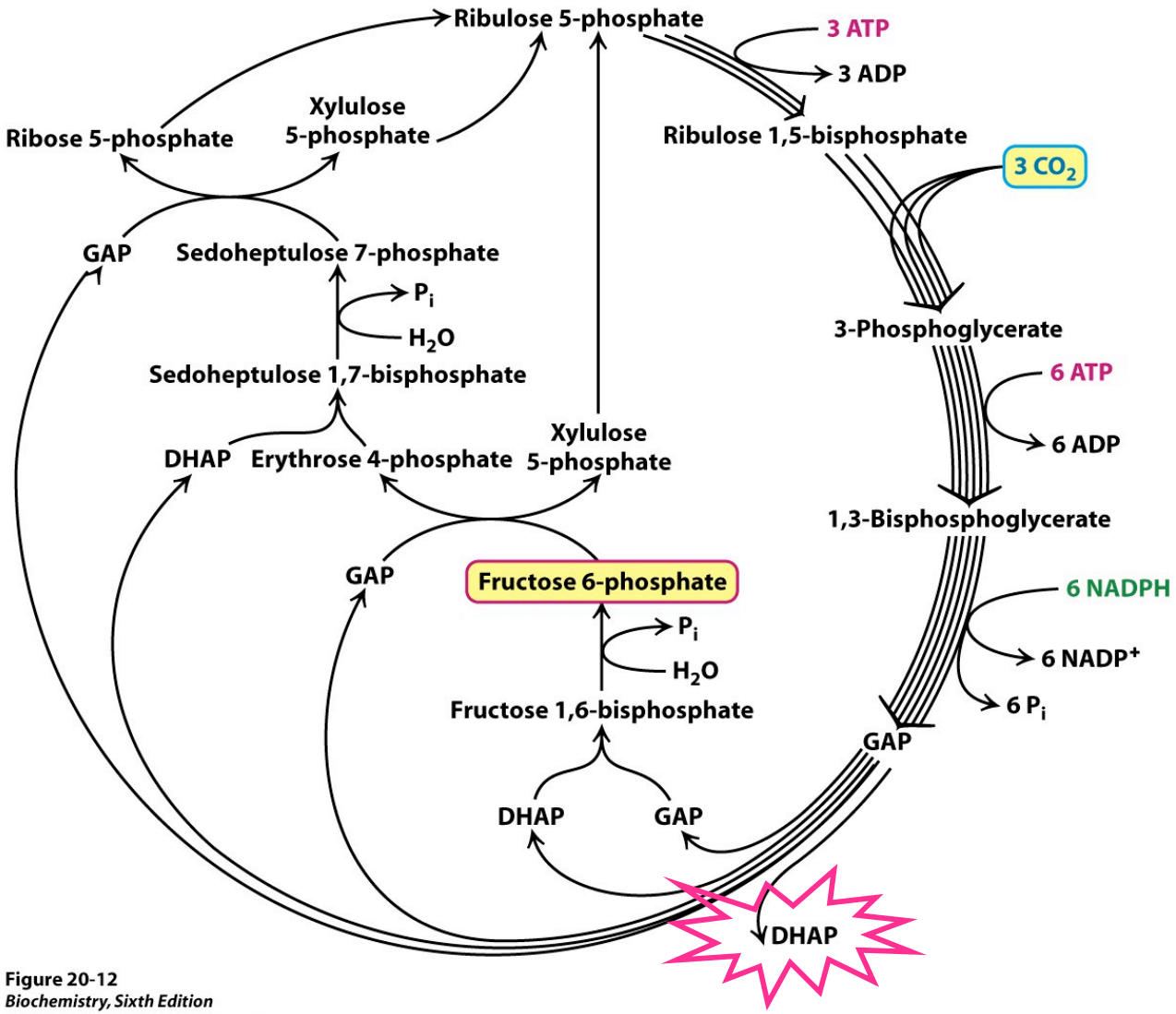

Figure 20-12
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$6\ CO_2 + 18ATP + 12\ NADPH + 12\ H_2O \rightarrow C_6H_{12}O_6 + 18ADP + 18P_i + 12\ NADP^+ + 6H^+$

The pentose phosphate pathway

TABLE 20.2 Pathways requiring NADPH

Synthesis
Fatty acid biosynthesis
Cholesterol biosynthesis
Neurotransmitter biosynthesis
Nucleotide biosynthesis
Detoxification
Reduction of oxidized glutathione
Cytochrome P450 monooxygenases

Table 20-2
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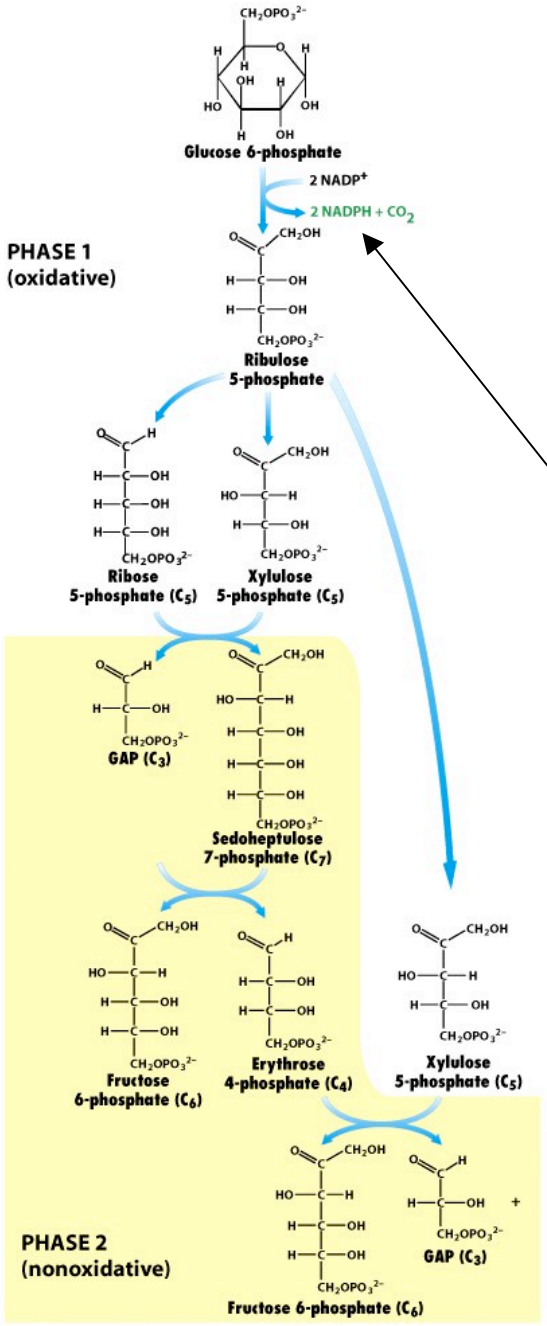

Figure 20-19
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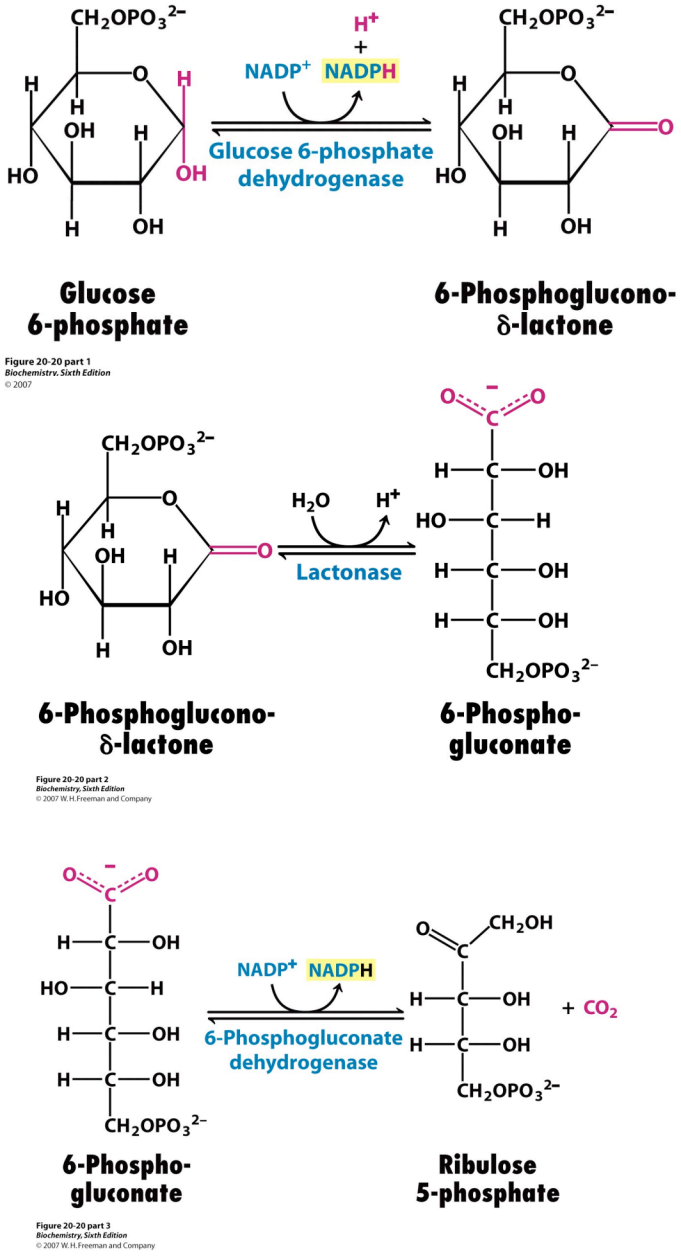

Pentose Phosphate Pathway

(*aka* Hexose monophosphate shunt etc.)

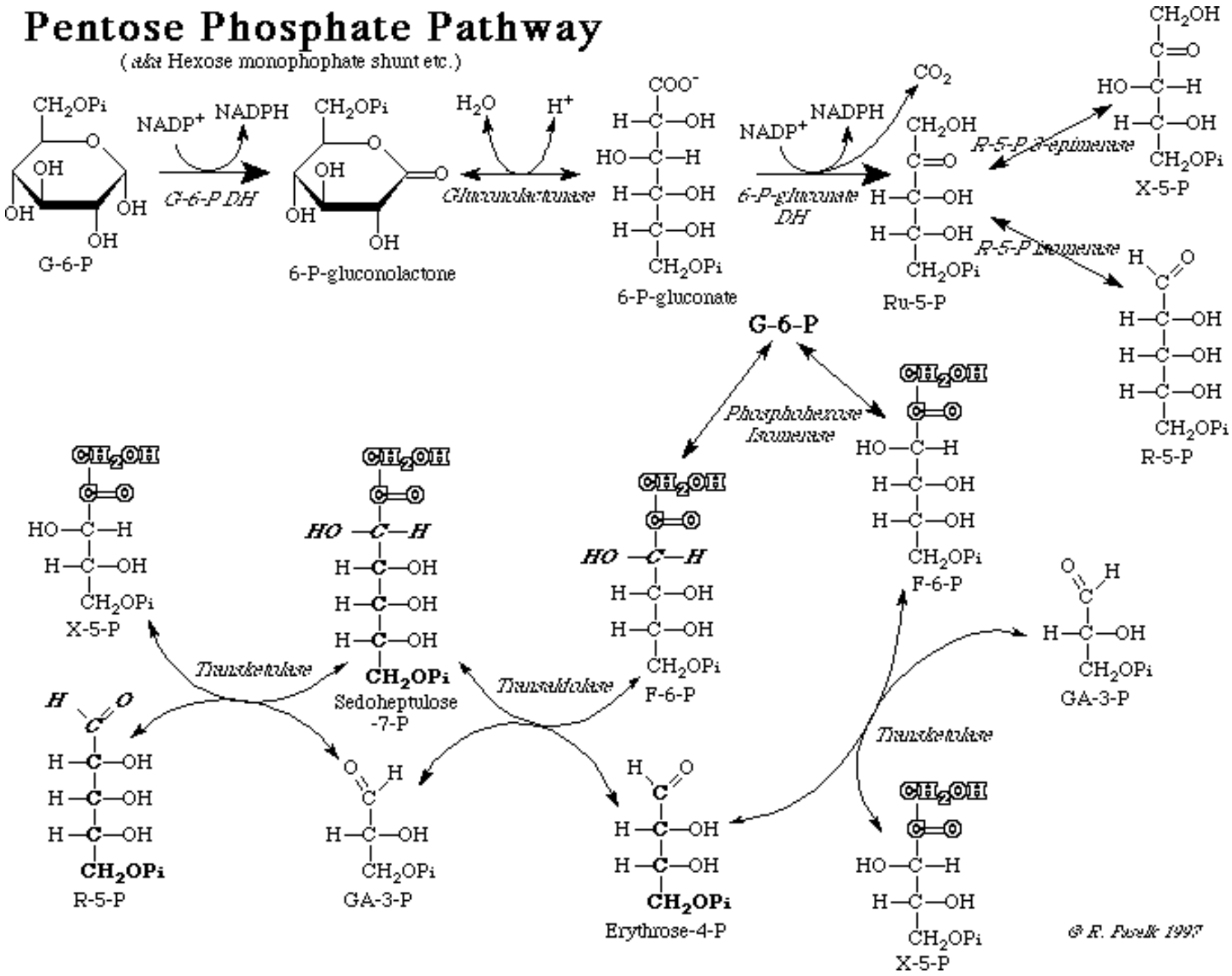

TABLE 20.3 Pentose phosphate pathway

Reaction	Enzyme
Oxidative phase	
Glucose 6-phosphate + $NADP^+$ $\longrightarrow$ 6-phosphoglucono-δ-lactone + NADPH + H^+	Glucose 6-phosphate dehydrogenase
6-Phosphoglucono-δ-lactone + H_2O $\longrightarrow$ 6-phosphogluconate + H^+	Lactonase
6-Phosphogluconate + $NADP^+$ $\longrightarrow$ ribulose 5-phosphate + CO_2 + NADPH + H^+	6-Phosphogluconate dehydrogenase
Nonoxidative Phase	
Ribulose 5-phosphate $\rightleftharpoons$ ribose 5-phosphate	Phosphopentose isomerase
Ribulose 5-phosphate $\rightleftharpoons$ xylulose 5-phosphate	Phosphopentose epimerase
Xylulose 5-phosphate + ribose 5-phosphate $\rightleftharpoons$ sedoheptulose 7-phosphate + glyceraldehyde 3-phosphate	Transketolase
Sedoheptulose 7-phosphate + glyceraldehyde 3-phosphate $\rightleftharpoons$ fructose 6-phosphate + erythrose 4-phosphate	Transaldolase
Xylulose 5-phosphate + erythrose 4-phosphate $\rightleftharpoons$ fructose 6-phosphate + glyceraldehyde 3-phosphate	Transketolase

Table 20-3
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The PPP adapts to cellular needs:

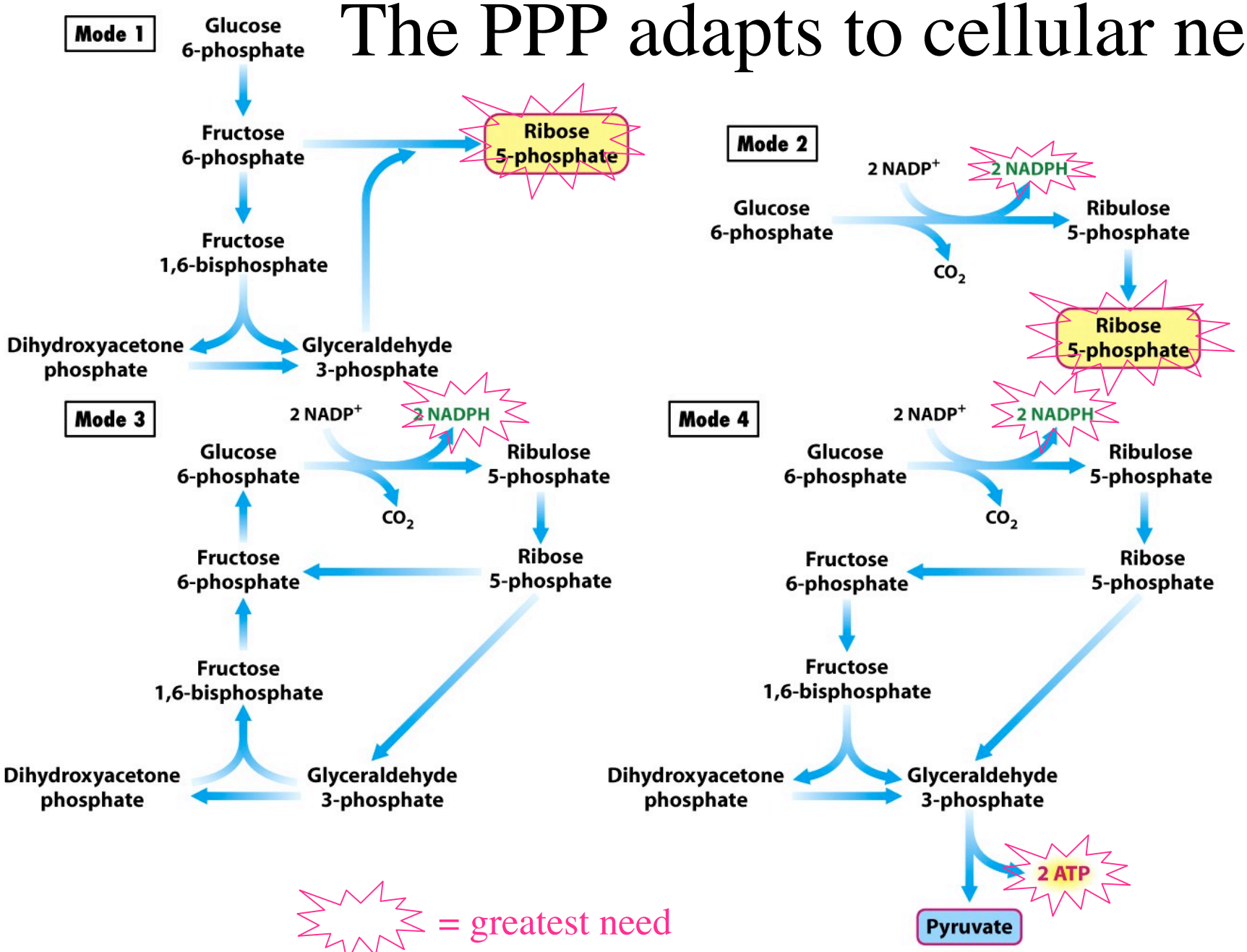

Figure 20-24
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