Carbohydrates

Metabolism: Gluconeogenesis

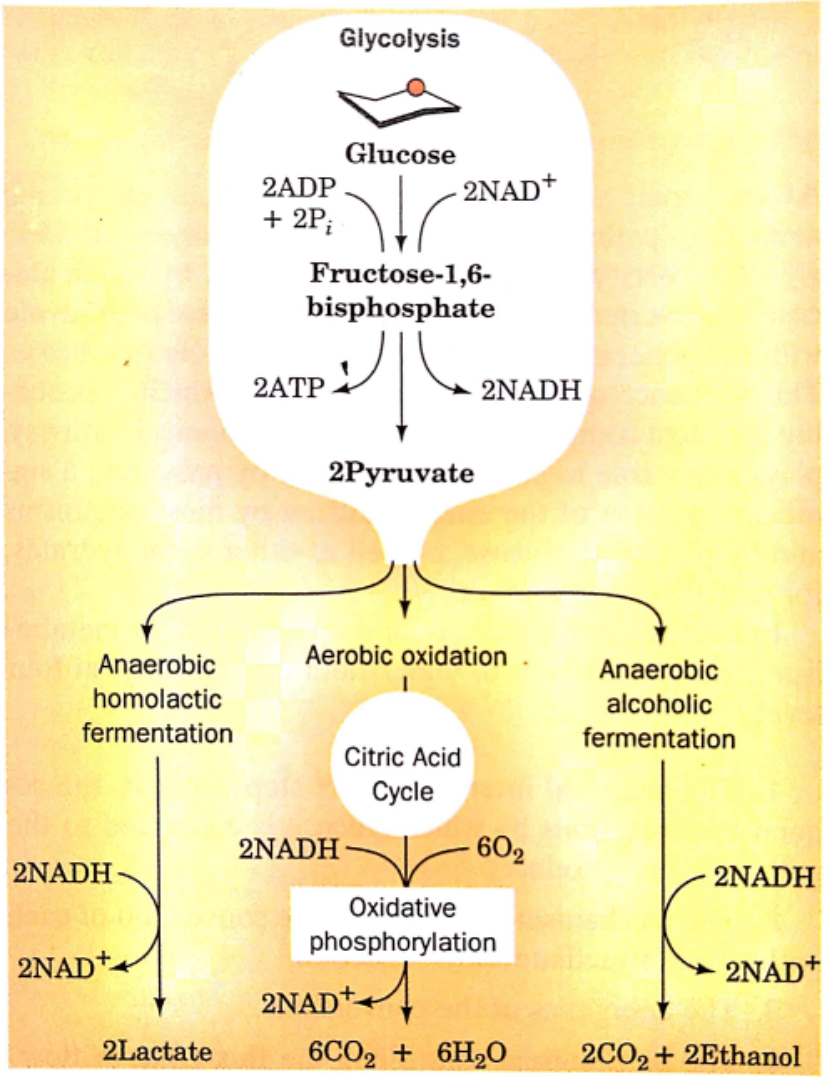


FIGURE 17-1 Glycolysis. Glycolysis converts glucose to pyruvate while generating two ATPs. Under anaerobic conditions, alcoholic fermentation of pyruvate occurs in yeast, whereas homolactic fermentation occurs in muscle. Under aerobic conditions, pyruvate is oxidized to H_2O and CO_2 via the citric acid cycle (Chapter 21) and oxidative phosphorylation (Chapter 22).

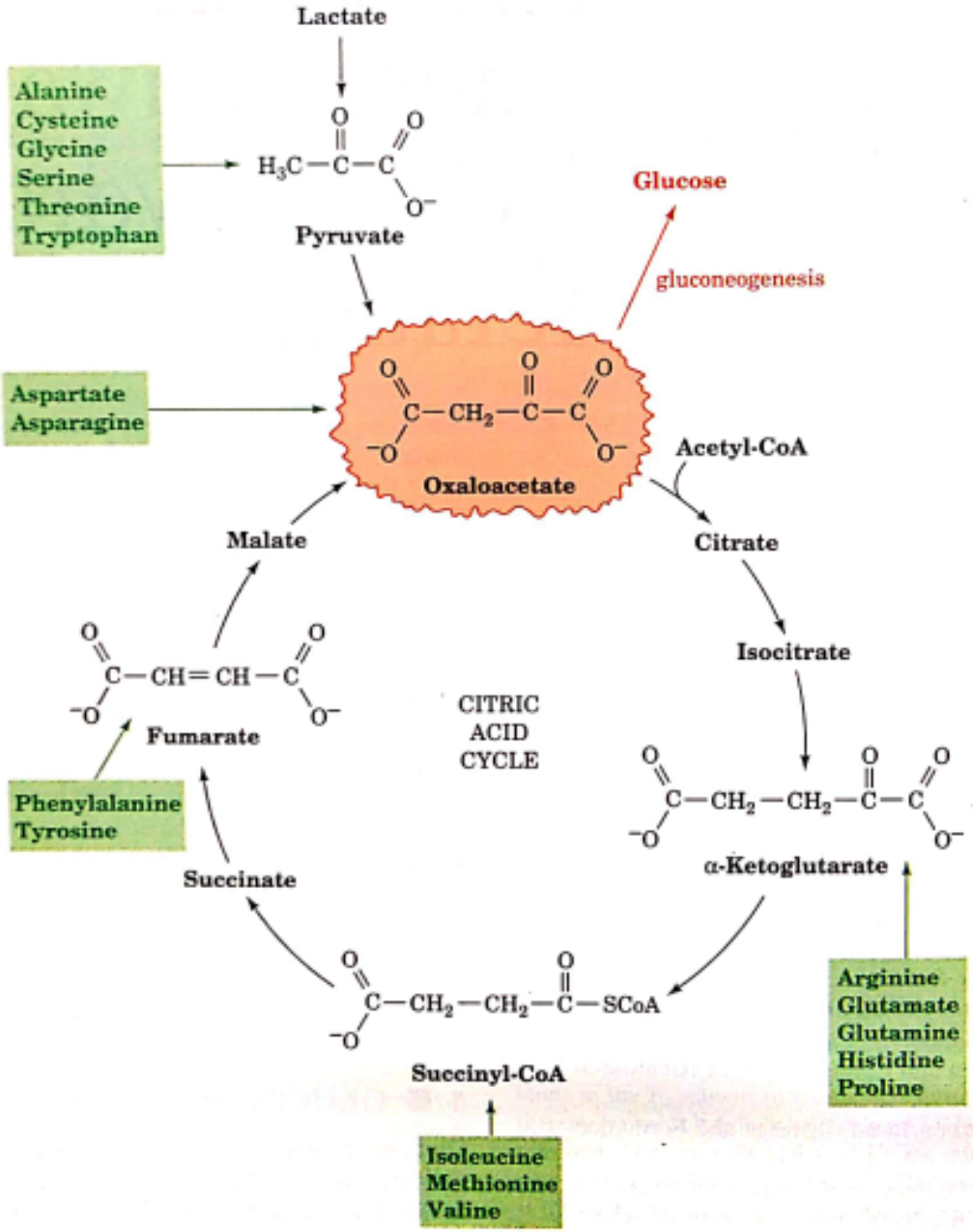


FIGURE 23-1 Pathways converting lactate, pyruvate, and citric acid cycle intermediates to oxaloacetate. The carbon skeletons of all amino acids but leucine and lysine may be, at least in part, converted to oxaloacetate and thus to glucose by these reactions.

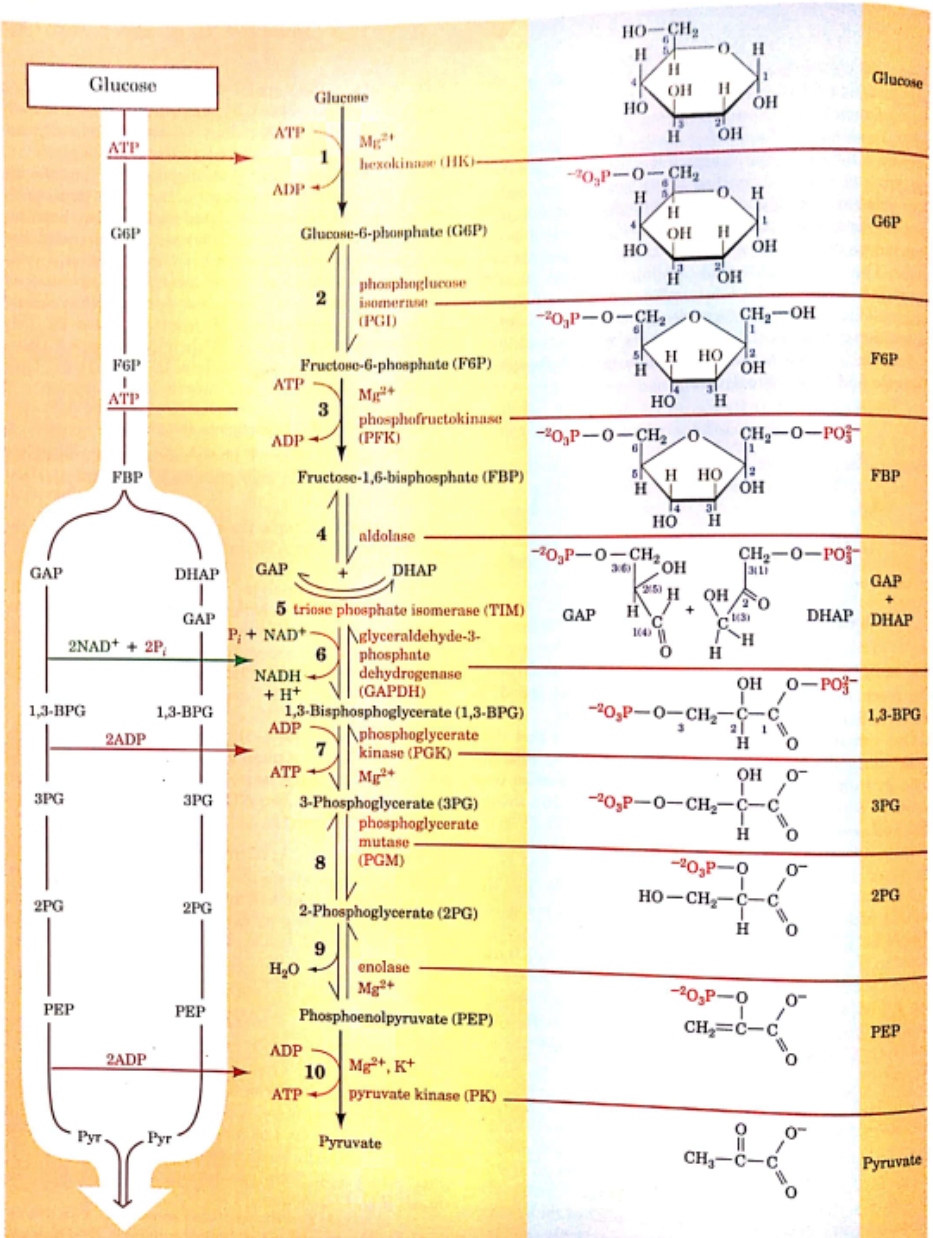
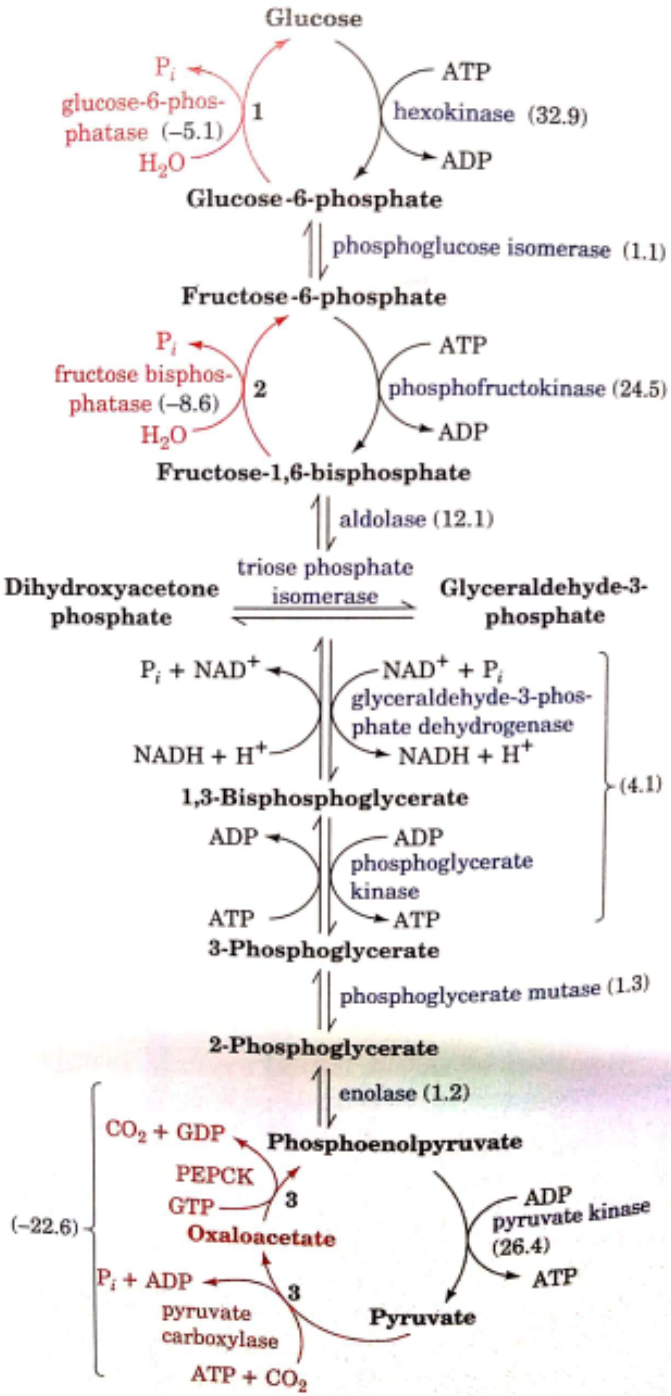


FIGURE 17-3 Degradation of glucose via the glycolytic pathway. Glycolysis may be considered to occur in two stages. Stage I (Reactions **1–5**): Glucose is phosphorylated and cleaved to form two molecules of the triose glyceraldehyde-3-phosphate. This requires the expenditure of two ATPs in an "energy investment" (Reactions **1** and **3**). Stage II (Reactions **6–10**): The two molecules of glyceraldehyde-3-phosphate are converted to pyruvate with the concomitant generation of four ATPs (Reactions **7** and **10**). See the Animated Figures



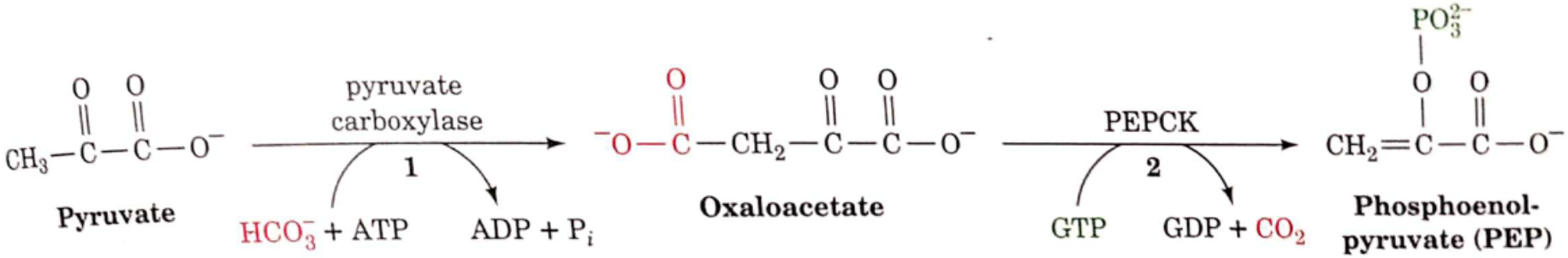
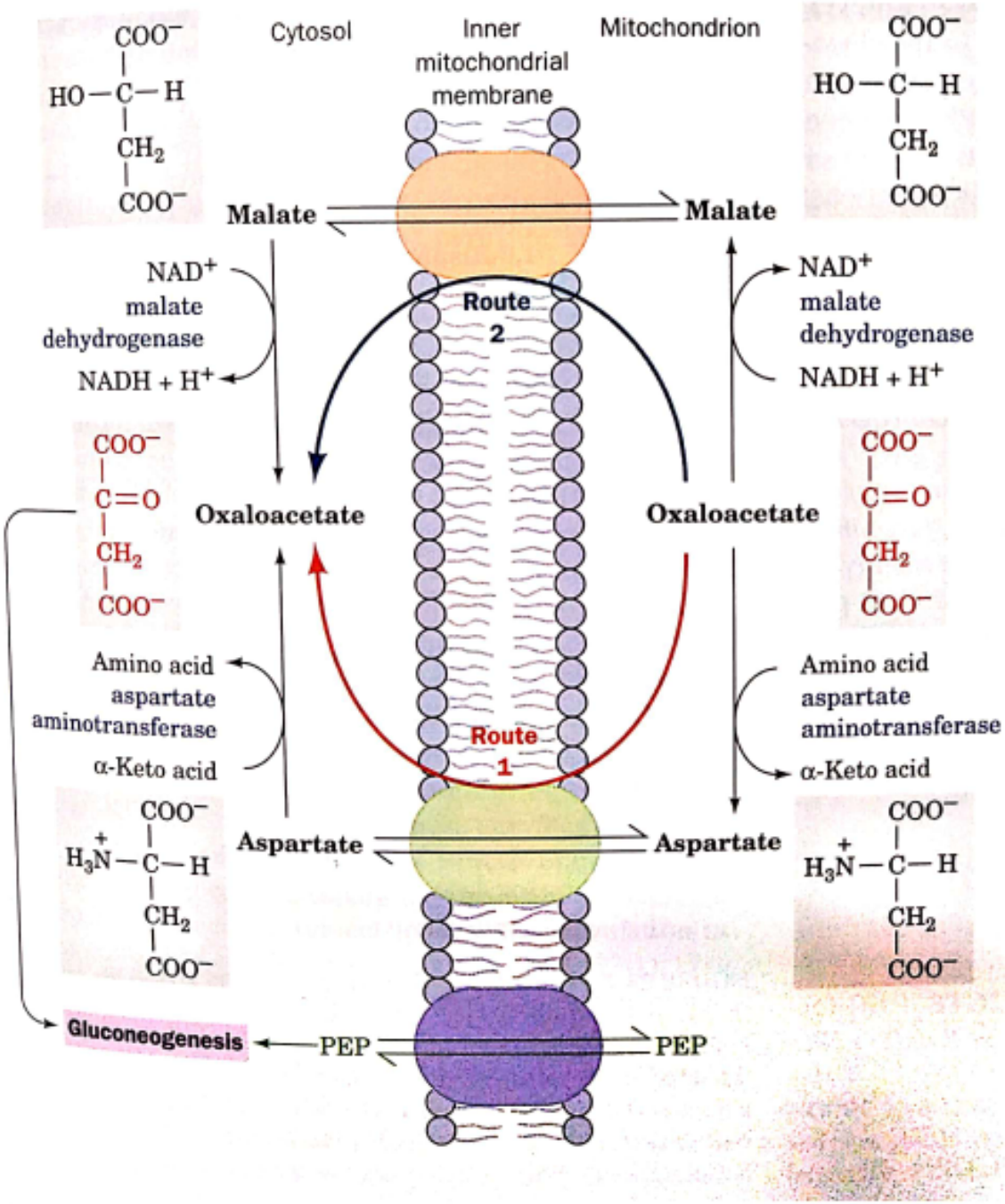


FIGURE 23-2 Conversion of pyruvate to oxaloacetate and then to phosphoenolpyruvate. The enzymes involved are **(1)** pyruvate carboxylase and **(2)** PEP carboxykinase (PEPCK).



Glycolysis:

$$\text{Glucose} + 2NAD^+ + 2ADP + 2P_i \rightarrow 2\text{pyruvate} + 2NADH + 4H^+ + 2ATP + 2H_2O$$

Gluconeogenesis:

$$2\text{Pyruvate} + 2NADH + 4H^+ + \mathbf{4ATP} + \mathbf{2GTP} + 6H_2O \rightarrow \text{glucose} + 2NAD^+ + 4ADP + 2GDP + 6P_i$$

Overall:

$$2ATP + 2GTP + 4H_2O \rightarrow 2ADP + 2GDP + 4P_i$$