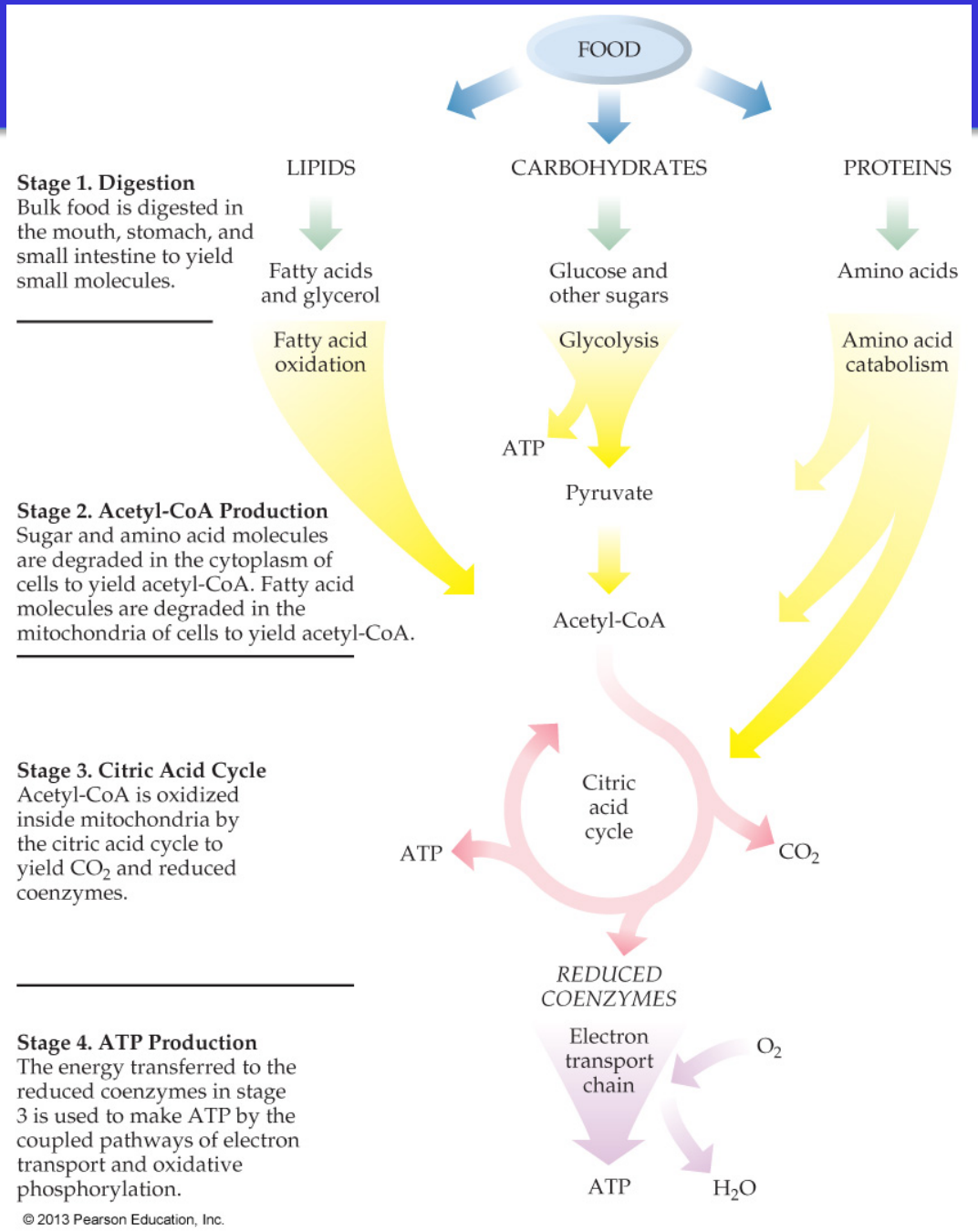
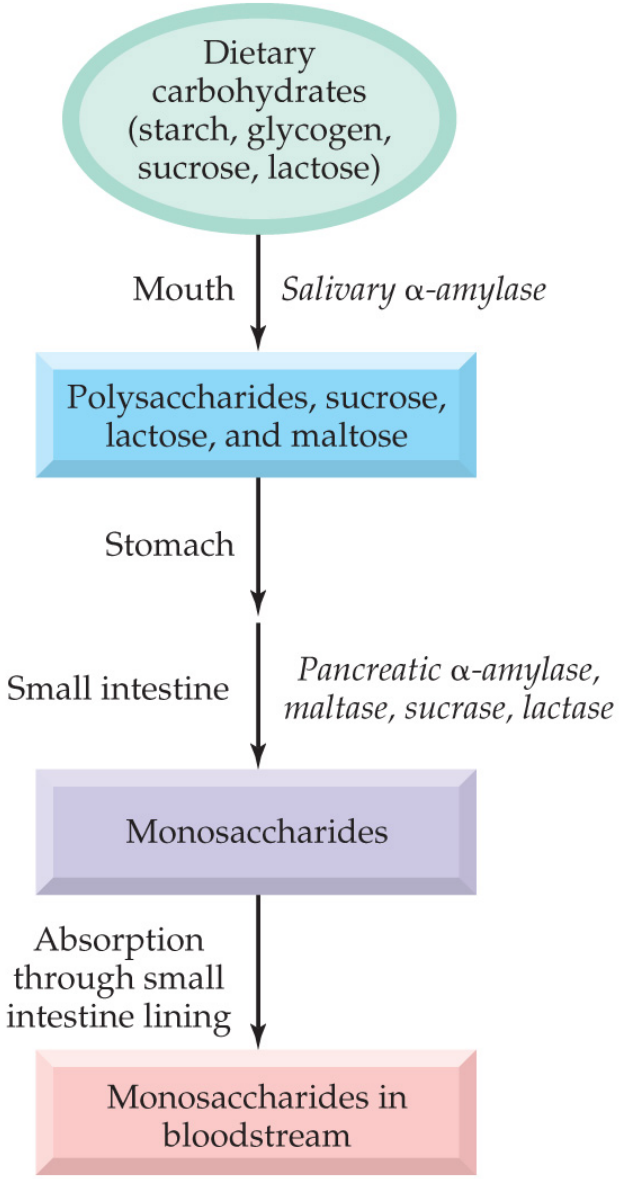
Chem 30B

Ch22: Carbohydrate Metabolism

Catabolism Overview

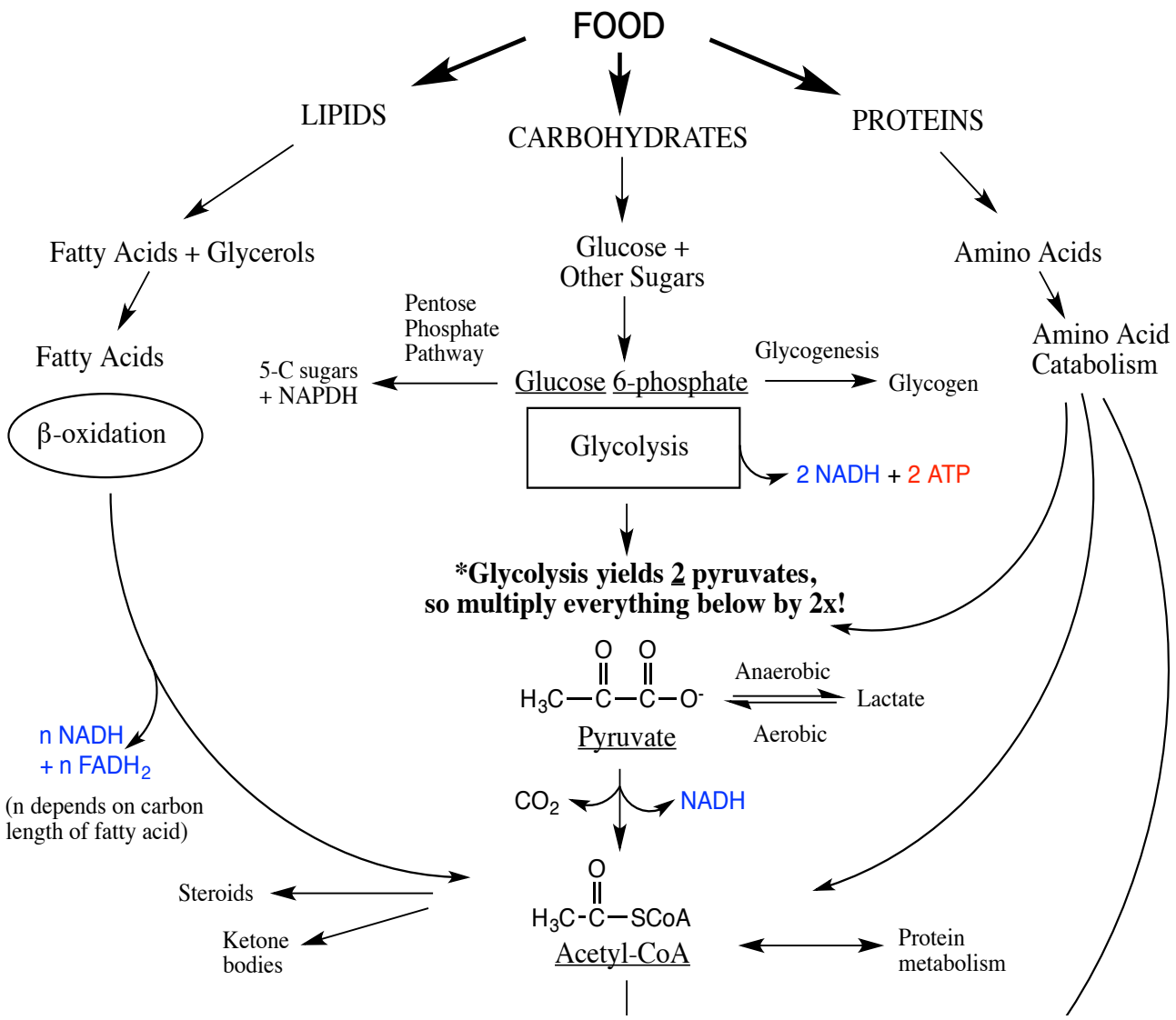


Digestion of Carbohydrates

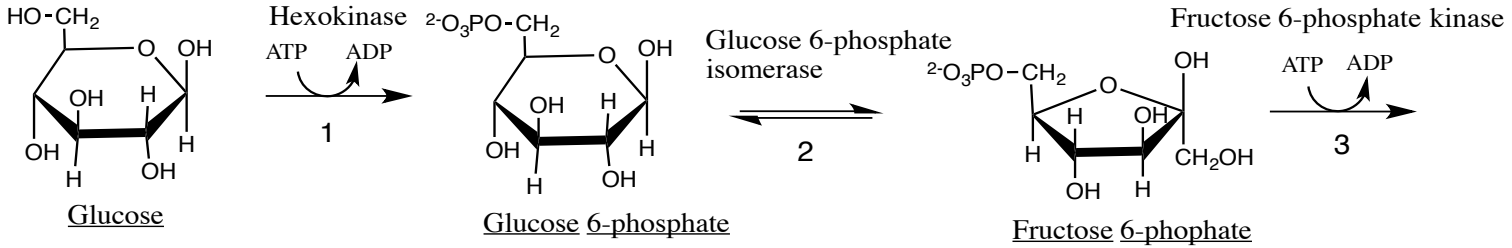


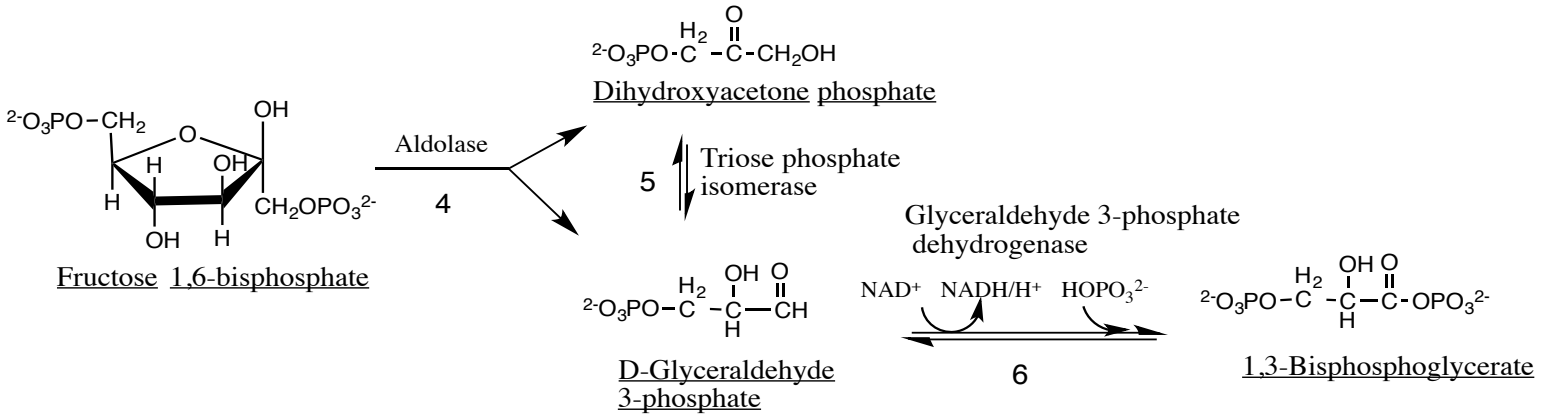
Villi of Small Intestine

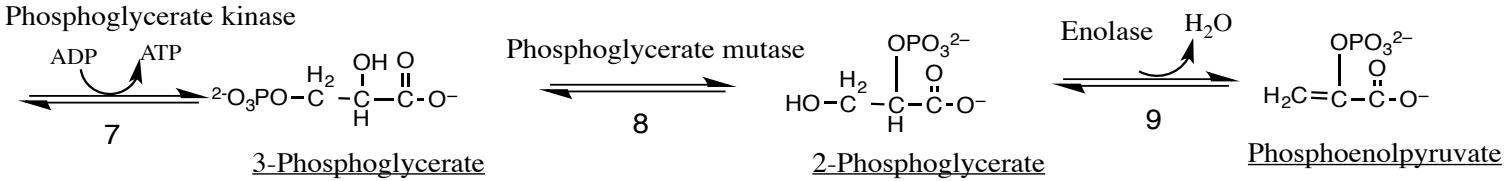
[Handout] Catabolism Flow Chart

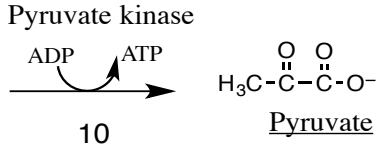


[Handout] Glycolysis

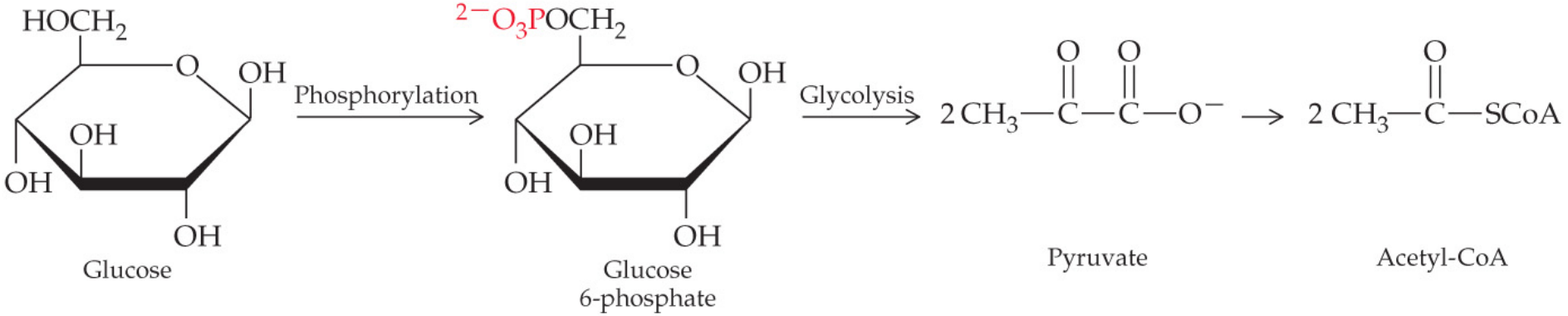








Glucose to Acetyl-CoA



[Handout] ATP Accounting for Glucose Catabolism

1. Glycolysis:

glucose + 2 NAD^+ + 2 $HOPO_3^{2-}$ + 2 ADP → **2 pyruvate** + 2 NADH + 2 ATP + 2 H_2O + 2 H^+

2. Pyruvate Oxidation:

2 pyruvate + 2 NAD^+ + 2 HSCoA → **2 Acetyl-CoA** + 2 CO_2 + 2 NADH + 2 H^+

3. Citric Acid Cycle:

2 Acetyl-CoA + 6 NAD^+ + 2 FAD + 2 ADP + 2 $HOPO_3^{2-}$ + 4 H_2O → 2 HSCoA + 6 NADH + 6 H^+ + 2 $FADH_2$ + 2 ATP + 4 CO_2

4. Electron Transport/Oxidative Phosphorylation:

Electrons from all the NADH and $FADH_2$ made in the previous steps are used to reduce O_2 to water:

O_2 + 4e- + 4 H^+ → 2 H_2O

The released energy is used to make ATP:

3 ATP made/1 NADH

2 ATP made/1 $FADH_2$

(More accurate: 2.5 ATP/NADH, 1.5 ATP/ $FADH_2$)

B. Total ATP Count for Catabolism of a Glucose Molecule

- Glycolysis: 2 ATP + 6 ATP (from 2 NADH) = 8 ATP
- Pyruvate oxidation: 6 ATP (from 2 NADH) = 6 ATP
- Citric Acid Cycle: 2 ATP + 18 ATP (from 6 NADH) + 4 ATP (from 2 $FADH_2$) = 24 ATP

TOTAL: 38 ATP