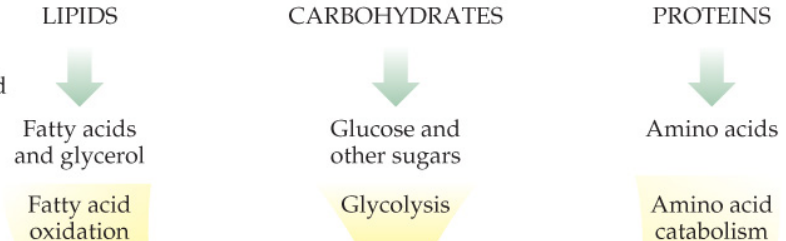


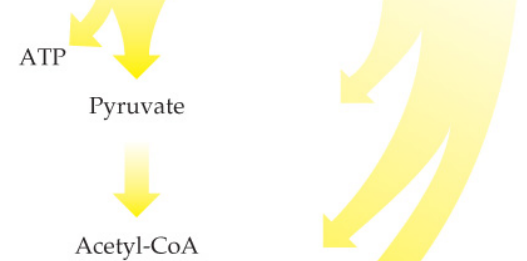
Ch22: Carbohydrate Metabolism

Catabolism Overview

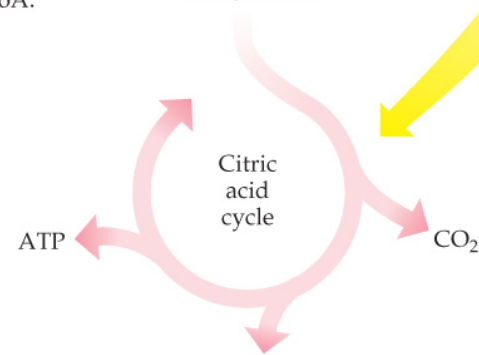
Stage 1. Digestion
Bulk food is digested in the mouth, stomach, and small intestine to yield small molecules.



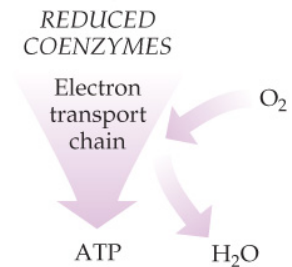
Stage 2. Acetyl-CoA Production
Sugar and amino acid molecules are degraded in the cytoplasm of cells to yield acetyl-CoA. Fatty acid molecules are degraded in the mitochondria of cells to yield acetyl-CoA.



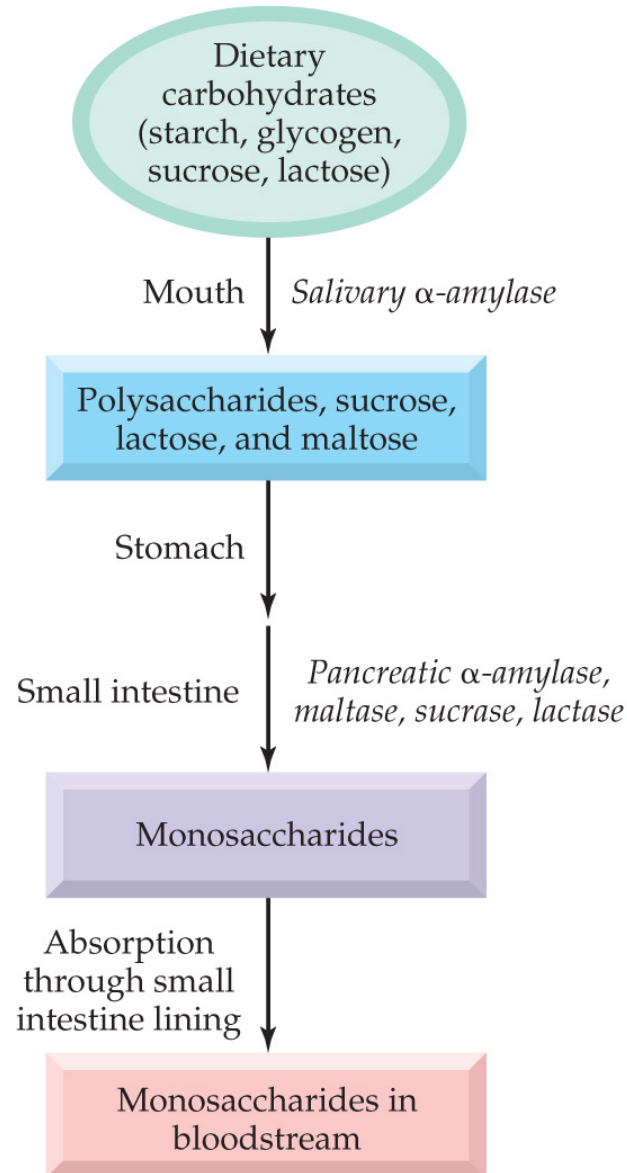
Stage 3. Citric Acid Cycle
Acetyl-CoA is oxidized inside mitochondria by the citric acid cycle to yield CO₂ and reduced coenzymes.



Stage 4. ATP Production
The energy transferred to the reduced coenzymes in stage 3 is used to make ATP by the coupled pathways of electron transport and oxidative phosphorylation.



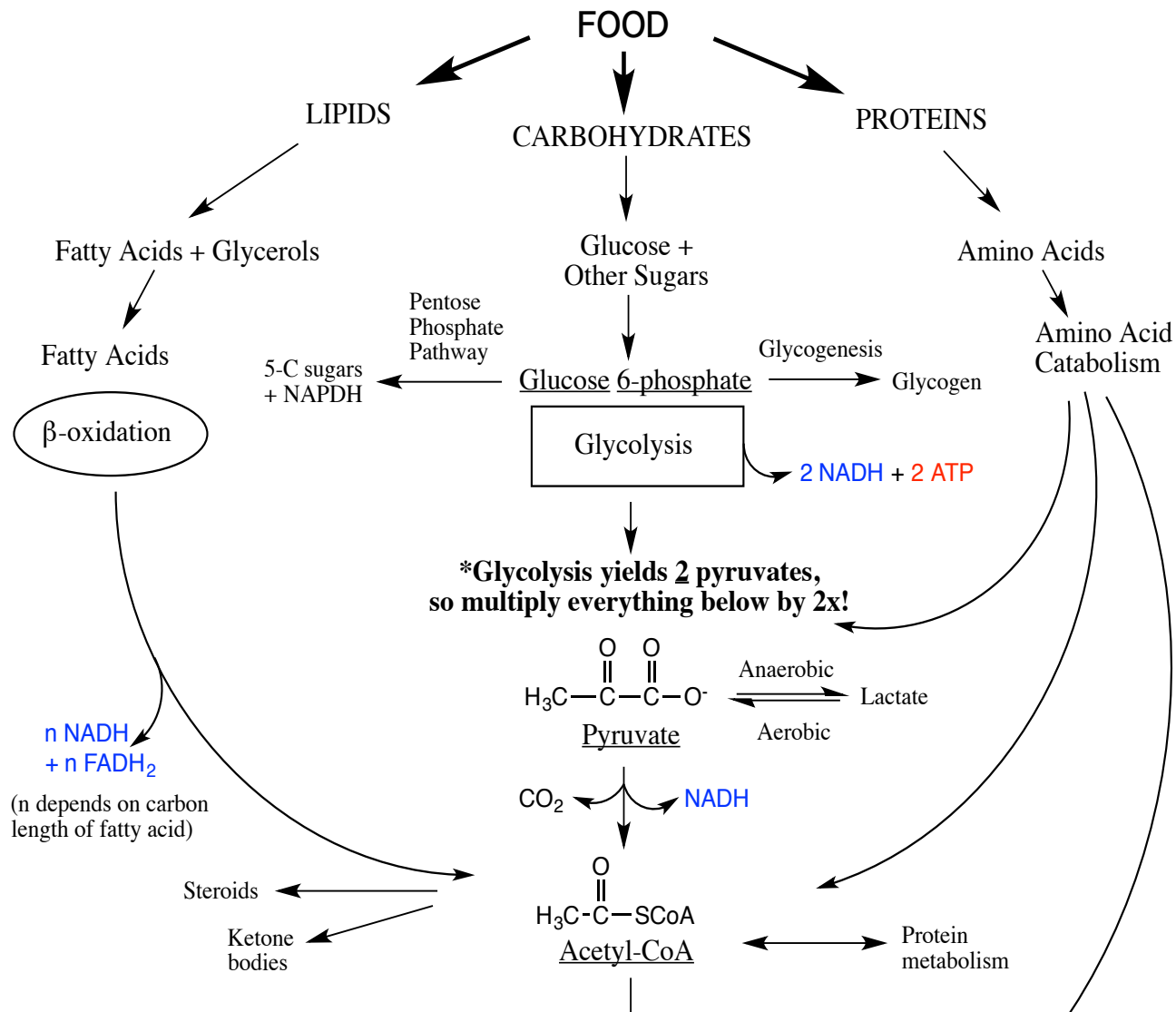
Digestion of Carbohydrates



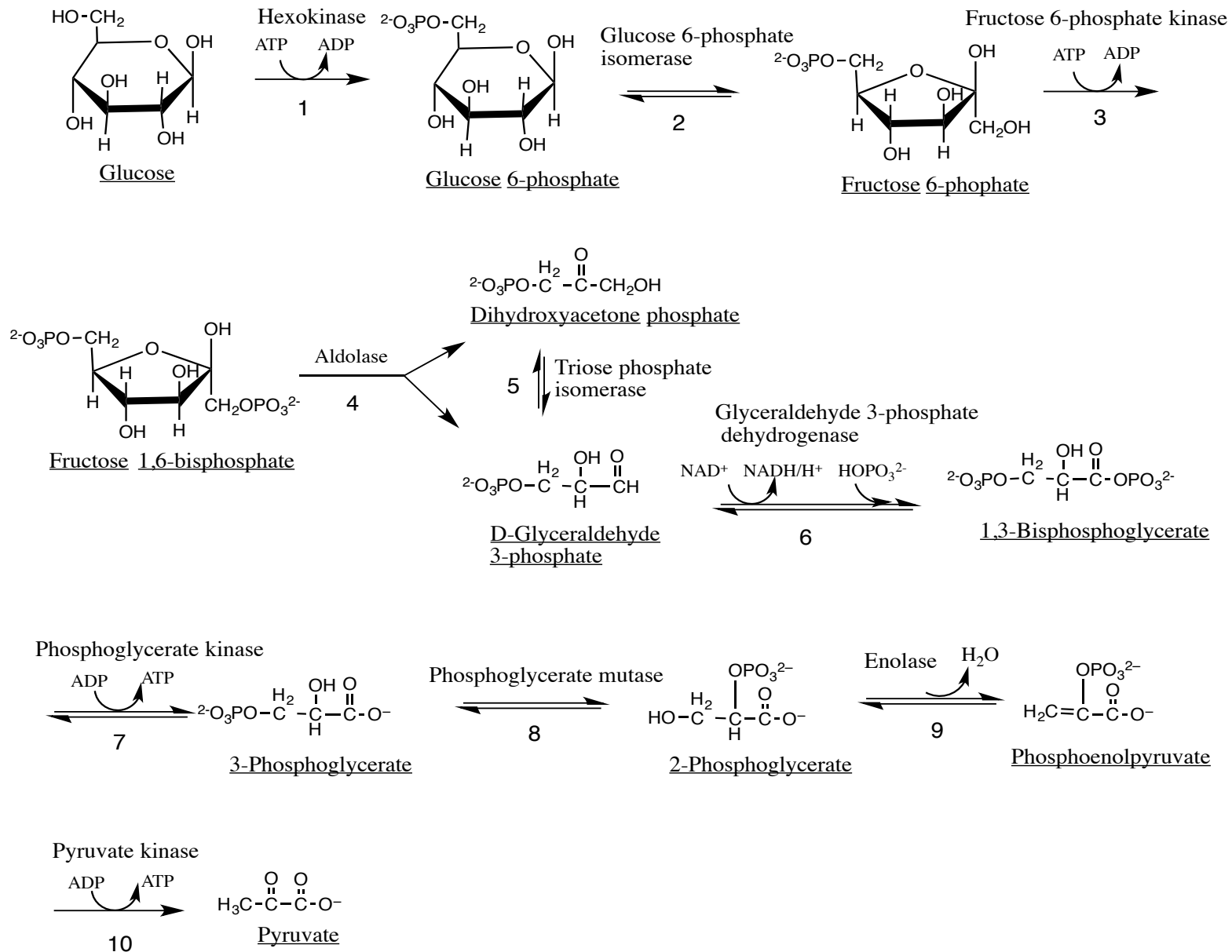
Villi of Small Intestine



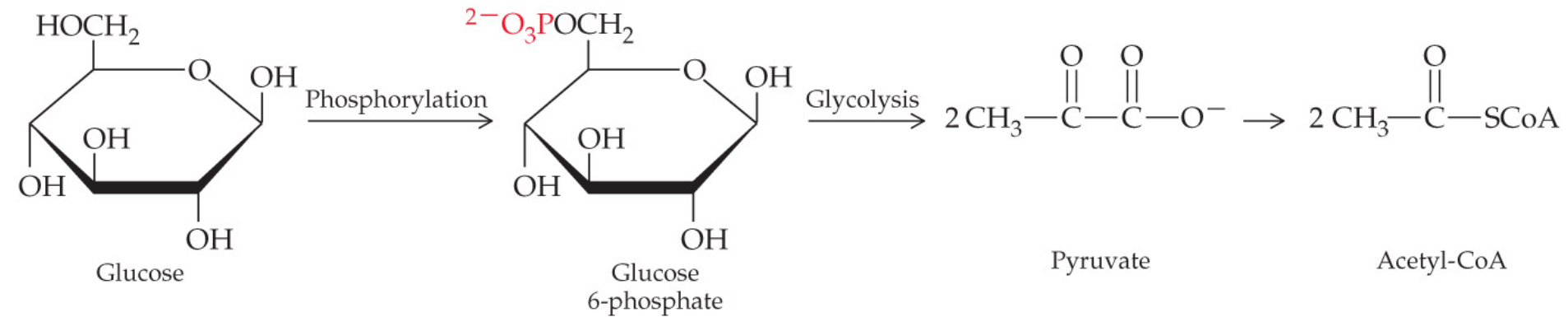
[Handout] Catabolism Flow Chart



[Handout] Glycolysis

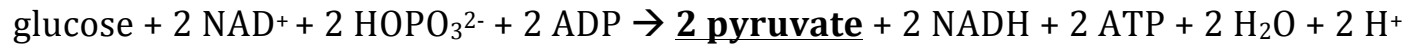


Glucose to Acetyl-CoA

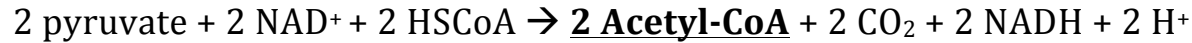


[Handout] ATP Accounting for Glucose Catabolism

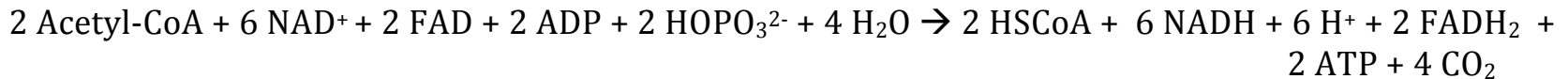
1. Glycolysis:



2. Pyruvate Oxidation:

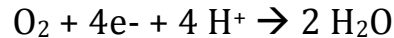


3. Citric Acid Cycle:



4. Electron Transport/Oxidative Phosphorylation:

Electrons from all the NADH and FADH₂ made in the previous steps are used to reduce O₂ to water:



The released energy is used to make ATP:

3 ATP made/1 NADH

2 ATP made/1 FADH₂

(More accurate: 2.5 ATP/NADH, 1.5 ATP/ FADH₂)

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 FADH₂) = 24 ATP

TOTAL: 38 ATP