

Chemistry 1506: Allied Health Chemistry 2

Section 12: Specific Catabolic Pathways

Molecular Destruction

Outline

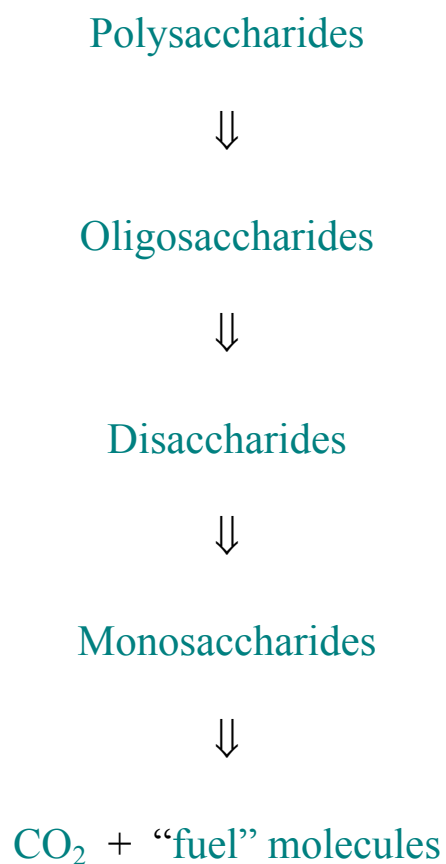
SECTION	12.1 GENERAL FLOW OF CATABOLIC PATHWAYS.....	2
SECTION	12.2 GLYCOLYSIS.....	6
SECTION	12.3 TRIGLYCERIDE METABOLISM.....	7

Section 12.1 General Flow of Catabolic Pathways

- Overall Process
 - Start with complex mixtures of food molecules
 - Used to generate energy (as “fuel” molecules)
 - ATP
 - NADH and FADH₂
 - Acetyl CoA
 - Ultimate products are CO₂, H₂O, Urea (C(O)(NH₂)₂), etc.
 - Intermediate Breakdown products may be used in Anabolic pathways

➤ Carbohydrate Catabolism

- 1st stages can start in the **digestive tract**
- Final stage is called **glycolysis** and finishes within the **mitochondrion**



➤ Lipid Catabolism

- Starts in **digestive system** and ends inside **mitochondria**
- **Lipases** break the **ester linkages** in the triglycerides

Triglycerides



Glycerol + Fatty Acids



CO₂ + “fuel” molecules

➤ Protein Catabolism

- Starts in **digestive system** and ends inside **mitochondria**

Proteins



Peptides



Amino Acids



CO_2 + “fuel” molecules + Urea

Section 12.2 Glycolysis

- Monosaccharides \Rightarrow Energy
 - 1st stage adds energy to monosaccharide substrate
 - Activation by 2 ATP
 - This is typical of Catabolic reactions

- 2nd stage is oxidation which produces “fuel” molecules
 - ATP
 - NADH
 - FADH₂
 - Acetyl CoA

- Overall process shown on pages 668/669
 - It is very complex
 - Path differs under aerobic and anaerobic conditions
 - Lactic Acid byproduct
 - Net yield of Glucose is 36 ATP Molecules (i.e., 6/C)

Section 12.3 Triglyceride Metabolism

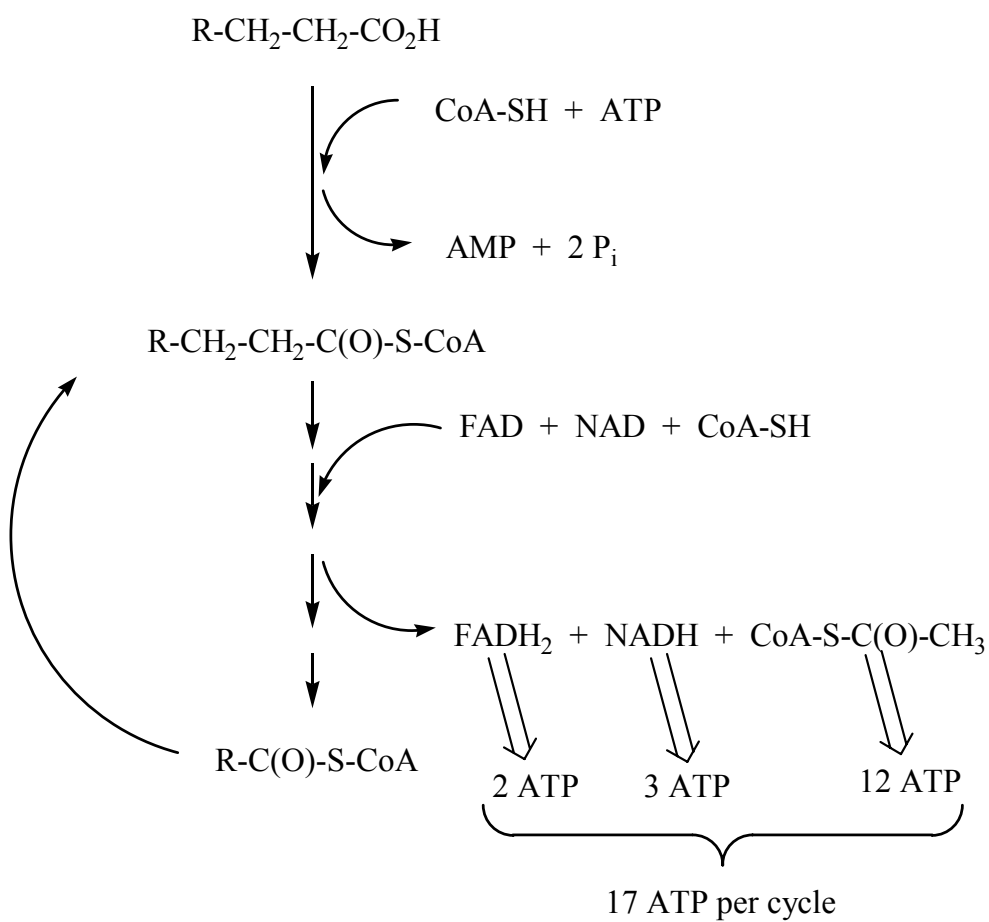
➤ Glycerol Metabolism

- Produces 20 ATP (i.e., 6.7/C)
- 1st step is ATP activation (i.e., phosphorylation)

➤ Fatty Acid Metabolism

- Typically produces 100-200 ATP
- Depends on Chain length and degree of unsaturation
- Steric Acid (C18, $\text{CH}_3\text{-(CH}_2\text{)}_{16}\text{-CO}_2\text{H}$)
 - Gives 146 ATP (8.1/C)
 - Higher ATP yield per carbon than carbohydrates because the molecule starts out less oxidized

- Reaction Pathway
- Cyclic Process
- C2 fragments removed each cycle
- Removed as Acetyl CoA



➤ For Steric Acid

➤ C18, $\text{CH}_3\text{-(CH}_2\text{)}_{16}\text{-CO}_2\text{H}$

ATP Activation \Rightarrow -2 ATP

8 x one FADH_2 per cycle \Rightarrow 8 x 2 ATP

8 x one NADH per cycle \Rightarrow 8 x 3 ATP

9 Acetyl CoA \Rightarrow 9 x 12 ATP

Total ATP Production 146 ATP

Index of Topics and Vocabulary

Acetyl CoA.....	2, 6, 8, 9	Glucose.....	6
activation.....	7	Glycerol.....	4
Activation by 2 ATP.....	6	Glycerol Metabolism.....	7
aerobic.....	6	Glycolysis.....	6
Amino Acids.....	5	H ₂ O.....	2
Anabolic pathways.....	2	Intermediate Breakdown products.....	2
anaerobic.....	6	Lactic Acid.....	6
ATP.....	2, 6, 7, 9	Lipases.....	4
ATP Activation.....	9	Lipid Catabolism.....	4
ATP yield per carbon.....	7	mitochondria.....	4, 5
C(O)(NH ₂) ₂	2	mitochondrion.....	3
C2 fragments.....	8	monosaccharide substrate.....	6
Carbohydrate Catabolism.....	3	Monosaccharides.....	3, 6
Catabolic reactions.....	6	NADH.....	2, 6, 9
CH ₃ -(CH ₂) ₁₆ -CO ₂ H.....	9	Oligosaccharides.....	3
Chain length.....	7	oxidation.....	6
CO ₂	2, 3, 4, 5	oxidized.....	7
complex.....	6	Peptides.....	5
complex mixtures of food molecules.....	2	phosphorylation.....	7
Cyclic Process.....	8	Polysaccharides.....	3
digestive system.....	4, 5	Protein Catabolism.....	5
digestive tract.....	3	Proteins.....	5
Disaccharides.....	3	Reaction Pathway.....	8
Energy.....	6	Steric Acid.....	9
ester linkages.....	4	Total ATP Production.....	9
FADH ₂	2, 6	Triglyceride Metabolism.....	7
Fatty Acid Metabolism.....	7	Triglycerides.....	4
Fatty Acids.....	4	Ultimate products.....	2
fuel molecule.....	6	unsaturation.....	7
fuel molecules.....	2, 3, 4, 5	Urea.....	2, 5
General Flow of Catabolic Pathways.....	2		