I. METABOLISM: CAST OF CHARACTERS

food (carbohydrate, fat, or protein)

**pyruvate** = 3 carbon energy substrate

**acetyl group** = 2 carbon energy substrate

**coenzyme A** = acetyl group transporter

**acetyl CoA** = a coenzyme A that has picked up an acetyl group

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**NAD**⁺ (nicotinamide adenine dinucleotide) = electron transporters (coenzymes)

**FAD**⁺ (flavin adenine dinucleotide) = **NADH** and **FADH** when transporting

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**ADP** (adenosine diphosphate)

**ADP + P**₁ + energy = **ATP**

**ATP** (adenosine triphosphate)
II. CARBOHYDRATE CATABOLISM

1. Glucose catabolism = GLYCOLYSIS

NET RESULT OF GLYCOLYSIS =

After glycolysis, one of two pathways will be followed. Which pathway is chosen depends on the presence of ___________ and ___________.

Are BOTH __________ AND __________ present?

- NO
- YES
II. CARBOHYDRATE CATABOLISM (cont.)

2A. Anaerobic Catabolism of Pyruvate = Lactic Acid Pathway
   If EITHER oxygen OR mitochondria are NOT present

   ![Diagram: Pyruvate to Lactic Acid]

   NET RESULT OF LACTIC ACID PATHWAY =

2B. Aerobic Catabolism of Pyruvate
   If BOTH oxygen AND mitochondria are present...

   ![Diagram: Pyruvate + Coenzyme A]

   NET RESULT OF AEROBIC PYRUVATE CATABOLISM =

3. The Krebs Cycle (a.k.a. citric acid cycle)
   Coenzyme A drops the acetyl group off in the mitochondrial matrix where a
   cascade of enzymes go to work on it.

   ![Diagram: Krebs Cycle]

   NET RESULT OF THE KREBS CYCLE =
II. CARBOHYDRATE CATABOLISM (cont.)

4. Oxidative Phosphorylation

The NADH and FADH produced by the catabolism of pyruvic acid and the Krebs cycle carry their electrons to CYTOCHROMES in the mitochondrial cristae. This starts a complex process that releases energy that is used to phosphorylate ADP. The electrons are finally picked up by oxygen.

\[
\text{NET RESULT OF OXIDATIVE PHOSPHORYLATION}
\]

III. SUMMARY OF GLUCOSE CATABOLISM

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\begin{array}{c|c|c|c}
\text{glucose} & \text{pyruvate} & \text{acetyl group} & \text{Krebs cycle} \\
\text{during GLYCOLYSIS} & & & \\
\text{during PYRUVATE CATABOLISM} & & & \\
\text{during the KREBS CYCLE} & & & \\
\text{during OXIDATIVE PHOSPHORYLATION} & & & \\
\text{TOTAL} & & & \\
\end{array}
\]

Remember!

oxidative phosphorylation

for each NADH → 3 ATP produced
for each FADH → 2 ATP produced

\[
\text{grand total ATP} = \boxed{\text{for each glucose}}
\]
IV. FAT CATABOLISM

Fat = Triglyceride = Glycerol + 3 Fatty Acid chains

Step 1: Lipolysis =

Step 2: “Burn” glycerol

Step 3: “Burn” each Fatty Acid chain (beta-oxidation)

NET RESULT OF THE FAT CATABOLISM =

V. PROTEIN CATABOLISM

This is the least desirable method of producing energy to phosphorylate ADP. WHY?

Protein → Amino Acids → variable metabolic entrance points

The bottom line on protein catabolism is ________________________________.
VI. THE ROLE OF ANABOLISM

What happens when we have more nutrients than we currently need for energy?

Anabolic Processes:

Gluconeogenesis

Glycogenesis

Lipogenesis

Relationships of Metabolic Pathways For Carbohydrate, Fats, and Proteins