# Chapter 7- Cellular Respiration

#### Learning Objectives:

* Energy and Metabolism *(BIO I: IV-1. Explain how chemical processes impact the cellular processes of life. V-5. Describe the process of energy transfer from its source (the sun) through biological systems. BIO II: IV-1. Explain how energy moves through an ecosystem. V-2. Describe the relationship between life forms and their environment and ecosystems.)*
* Enzymes *(BIO I: IV-2. Describe the enzymatic basis of the mechanisms that living organisms use to harvest energy.*
* ATP: Adenosine Triphosphate *(BIO I: IV-1. Explain how chemical processes impact the cellular processes of life.)*

**Project 1:**

The ATP producing reactions of cellular respiration and fermentation are critical in providing an accessible source of energy for cellular function.

* Oxidative phosphorylation generates the majority of ATP in aerobic cellular respiration. Review the function of the electron transport chain (ETC) and chemiosmosis, then investigate the effect of dinitrophenol (DNP) on oxidative phosphorylation. Explain how DNP decreases ATP production through oxidative phosphorylation and how, though now banned, this molecule functioned as an effective weight-loss drug.
* Fermentation provides ATP when oxygen levels are too low for aerobic cellular respiration. Review the reactions of glycolysis, then investigate how tremetol can impact the metabolic pathways associated with lactic acid fermentation. Explain the symptoms associated with exposure to tremetol and why exercise can worsen symptoms associated with this metabolic poison.

**Project 2:**

Review the enzymes that catalyze each reaction of glycolysis. Note the reactions with enzymes that have names that include “kinase”. What do all these reactions have in common? Which reaction in the citric acid cycle would you predict is catalyzed by succinate thiokinase (also known as succinyl Co-A synthetase or succinyl Co-A ligase)? Explain the basic function of kinase enzymes.

**Project 3:**

Review section 7.1, *Energy in Living Systems*, with a focus on *Electrons and Energy* then answer the following questions. (1) Explain the relationship between oxidation/reduction and potential energy. (2) Explain the role of electron carriers in cellular respiration. (3) Identify which molecules are oxidized and which are reduced in the overall reaction for aerobic cellular respiration.

C6H12O6 + 6 O2 🡪 6 CO2 + 6 H2O

(4) Methanogens are prokaryotes from Domain Archaea that conduct anaerobic cellular respiration. Identify which molecules are oxidized and which are reduced in the overall reaction for methanogenesis.

CO2 + 4 H2 🡪 CH4 + 2 H2O