# Chapter 8- Photosynthesis

#### Learning Objectives:

* Overview of Photosynthesis (*BIO I: IV-5. Summarize the overall organization of the chemical pathways involved in photosynthesis and how these pathways accomplish the conversion of light energy into chemical bond energy. 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.)*
* The Light-Dependent Reactions of Photosynthesis *(BIO I: IV-4. Describe the principles of energy transformations through membrane embedded electron transport chains. IV-5. Summarize the overall organization of the chemical pathways involved in photosynthesis and how these pathways accomplish the conversion of light energy into chemical bond energy.)*
* Using Light Energy to Make Organic Molecules *(BIO I: IV-2. Describe the enzymatic basis of the mechanisms that living organisms use to harvest energy. IV-5. Summarize the overall organization of the chemical pathways involved in photosynthesis and how these pathways accomplish the conversion of light energy into chemical bond energy.)*

**Project 1:**

Carbon dioxide enters the leaves through stomata and is accompanied by water loss. Plants must balance obtaining adequate carbon dioxide for the Calvin Cycle with maintaining water content in tissues. Most plants conduct C3 photosynthesis where a three-carbon compound (3- phosphoglycerate) is the first stable product of carbon fixation.

-Investigate how C4 and CAM plants are able to use spatial and temporal separation of carbon dioxide intake from the reactions of the Calvin Cycle to conserve water and optimize efficiency of carbon fixation.

-How might increasing concentrations of carbon dioxide in the atmosphere impact photosynthesis? Would the impact differ for C3, C4 and CAM plants?

**Project 2:**

Draw a diagram of a chloroplast. Label the inner membrane, outer membrane, a thylakoid disk, granum, and the stroma. Identify the location of the light-dependent reactions and the Calvin cycle. Consider the following:

- If the pH of the stroma were decreased, what might be the most immediate impact on photosynthesis? Explain your answer.

- Compare ATP production through oxidative phosphorylation in Aerobic Cellular Respiration to photosynthesis. What region of the mitochondria would be analogous the lumen of the thylakoids. Explain your answer.

-How does the structure of a chlorophyll (a or b) molecule facilitate its positioning in the thylakoid membrane? Be sure to include an explanation of hydrophobic/ hydrophilic properties and membrane structure in your answer.

**Project 3:**

Ribulose 1,5-bisphosphate carboxylase/oxygenase (RuBisCO) is an enzyme that catalyzes the reaction between carbon dioxide and ribulose bisphosphate in the Calvin cycle. This reaction is the carboxylase function. RuBisCo also has oxygenase activity or the ability to bind oxygen (O2). This reaction is part of a process called photorespiration. Investigate photorespiration and answer the following questions.

* How does photorespiration result is plants releasing carbon dioxides?
* Why is this typically considered a wasteful process for plants?
* How might this process have a beneficial function in plants?