Biology 206
Laboratory 3
Cellular Respiration and Photosynthesis

Cellular respiration is the process through which cells convert the energy obtained from food molecules into a form the cell can use, ATP. The process, which occurs in both prokaryotic and eukaryotic cells, is described by the formula:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_20$$

Photosynthesis allows plants and certain algae to use the sun's energy and inorganic materials obtained from the environment to synthesize organic molecules, such as sugars. The following formula describes this process:

$$6CO_2 + 6H_20 \rightarrow C_6H_{12}O_6 + 6O_2$$

In this lab, you will setup test samples for both cellular respiration and photosynthesis. By measuring the CO_2 of each test sample, you will monitor the effect of temperature on the rate of cellular respiration and the effect of light on the rate of photosynthesis.

The class will divide into 4 groups. Each group will perform a part of the overall experiment. You will need to collect the raw data from the other three groups to complete your lab report.

Before you begin, be sure that your Xplorer is correctly set to measure the CO_2 level in your bottle every 30 sec. You will have to attach the CO_2 sensor to Xplorer while you are adjusting the sample rate.

Experiment 1: Cellular Respiration

Sample Bottles 1 and 2 will contain dried beans. Upon rehydration, these beans will begin to undergo cellular respiration. One bottle will be kept at room temperature. The other bottle will be placed at 4°C (in the refrigerator).

Day One:

1. Into Bottles 1 and 2, place about ¼ cup dried beans
2. Insert rubber stopper with CO_2 sensor, wait 90 sec, and connect Xplorer unit
3. Turn on Xplorer and begin to collect measurements for 10 min (take a reading every 30 sec). The Xplorer will retain the data once it has been setup for the correct sampling rate.
4. Disconnect Xplorer and remove the CO_2 sensor from the bottle.
5. Add 4 mL of H_20 to moisten the beans and replace the stopper with its CO_2 sensor.
6. Place Bottle 1 in a dark cabinet, and place Bottle 2 at 4°C until the next class meeting.
7. Record the baseline data from Xplorer in your lab notebook. The CO_2 in the bottle is measured by Xplorer in ppm which means "parts per million."

Day Two:

1. Remove bottles from storage, being sure not to dislodge the CO_2 sensor, and attach Xplorer.
2. Turn on Xplorer and collect measurements for 10 min, as you did on Day One
3. Record the data from Xplorer.
4. Obtain data for the other 3 sample bottles from your classmates.

Experiment 2: Photosynthesis

Sample Bottles 3 and 4 will contain live *Elodea*. These plants will undergo photosynthesis when sunlight is available. One bottle will be kept on the windowsill, the other will be placed in a dark cabinet.

Day One:

1. Into each Bottle (3 and 4), place approximately equally sized sprigs of *Elodea,* along with some of the water (no more than ~8 mL)
2. Insert rubber stopper with CO_2 sensor, wait 90 sec, and connect Xplorer unit
3. Turn on Xplorer and begin to collect measurements for 10 min (take a reading every 30 sec). The Xplorer will retain the data once it has been setup for the correct sampling rate.
4. Disconnect Xplorer but leave the stopper and CO_2 sensor in the bottle.
5. Place Bottle 3 on the windowsill, and place Bottle 4 in a dark cabinet until the next class meeting.
6. Record the baseline data from Xplorer in your lab notebook. The CO_2 in the bottle is measured by Xplorer in ppm which means "parts per million."

Day Two:

5. Remove bottles from storage, being sure not to dislodge the CO_2 sensor, and attach Xplorer.
6. Turn on Xplorer and collect measurements for 10 min, as you did on Day One
7. Record the data from Xplorer.
8. Obtain data for the other 3 sample bottles from your classmates.

Using Excel, prepare graphs for each experiment showing the levels of CO_2 over time. Compare the data for the baseline and the experimental conditions on the same graph. What did you hypothesize would happen to the rate of cellular respiration of the beans kept at 4°C? Do your data support this hypothesis? What about the *Elodea* kept in the dark cabinet? Do the data support your hypothesis?