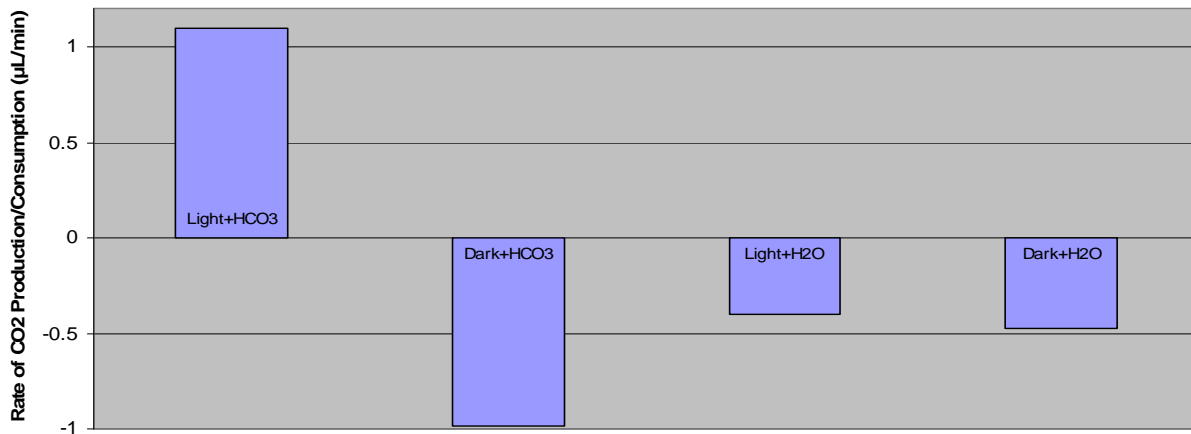


Photosynthesis and Respiration of Elodea

Summary: My group and I measured photosynthesis and respiration rates of the single celled protist algae Elodea. We did this by using a Gilson Respirometer and samples of Elodea plant placed in H₂O and NaHCO₃ solutions—both of which were operated under lighted and darkened external conditions—to measure the consumption of CO₂ during photosynthesis and the production of CO₂ during respiration. Our results produced the following rates (negative values reflect O₂ consumption): dark+H₂O - 0.48μL/min, light+H₂O -0.4μL/min, light+HCO₃ and dark+HCO₃ -0.98μL/min. The value for light+H₂O is inconsistent, as O₂ production during photosynthesis should occur whenever there are available sources of sunlight and CO₂ (Raven *et al.*, 2008). However, the other three values appear to be reasonably accurate, and also support the general knowledge that the amounts of O₂ and CO₂ available to a plant are known to have unique effects on the rates of respiration and photosynthesis (Simpson *et al.*, 1980).

Methods & Results: My group and I obtained two Gilson Respirometer flasks to prepare two Elodea samples under specific conditions: lighted environment in NaCO₃ solution and shuttered environment in NaCO₃ solution. (Some groups within the class were assigned the same experiment with the same conditions, while others were assigned a different set of conditions: lighted environment in H₂O and shuttered environment in H₂O. Class data was then combined at the end of the lab period to provide more experimental data when drawing conclusions.) We pipetted enough 6M KOH solution into the center well of both flasks until each was a little more than half full. Next, we folded two small pieces of filter paper into a fan shape and placed one into each of the center wells. About 3mL of NaHCO₃ was then added to main portion of both flasks, along with large amounts of Elodea leaves. The “dark” flask was wrapped entirely in aluminum foil to keep out all sources of light.

Each group attached its flasks to the Gilson Respirometer where they equilibrated in 22°C water for 10 minutes. After starting the machine, monometer readings were performed by the class every five minutes for one hour total. Individual group values were then pooled together into a spreadsheet and rates were averaged. The following bar graph represents overall class data (positive values represent O₂ production, while negative values represent O₂ consumption):



The values seem to be mostly accurate, except for the *consumption* of O₂ at a rate of 0.4μL/min when Elodea is in water and exposed to light (production should have occurred instead). This is attributable to experimental error. The fastest rate of production was 1.1μL/min in light and HCO₃, while the fastest rate of consumption was 0.98μL/min in darkness and HCO₃. Finally, in darkness and water, Elodea consumed O₂ at a 0.48μL/min. This is due to there being less CO₂ available in the environment.

References:

Raven, P. & Johnson, G. & Losos, J. & Mason, K. & Singer, S., 2008. *Biology*, 8th ed., McGraw-Hill.
Simpson, P.S. & Eaton, J.W. & Hardwick, K., 1980. The Influence of Environmental Factors on Apparent Photosynthesis and Respiration of the Submersed Macrophyte Elodea Canadensis, *Plant, Cell & Environment*, 3(6), pp. 415-423.