108C Discussion Problems – Week 2

Answer each question descriptively with complete sentences where appropriate.

1a. RUBISCO can have both carboxylase and oxygenase activity. How does RUBISCO oxygenase activity arise? What are the products of RUBISCO oxygenase activity?

1b. For each carbon fixation event catalyzed by RUBISCO, there is an ATP and NADPH cost associated with the Calvin cycle reactions. How many molecules of ATP and NADPH are necessary to fix 3 molecules of CO_2 and regenerate 3 molecules of ribulose 1,5-bisphosphate? If RUBISCO catalyzes 2 oxygenase reactions, how many molecules of ATP and NADPH are necessary to regenerate 2 molecules of ribulose 1,5-bisphopshate? How many molecules of CO_2 are lost/gained during this process? Remember to account for <u>all</u> products of RUBISCO oxygenase activity.

2a. C4 plants are able to prevent RUBISCO oxygenase activity by spatially separating areas of gas exchange and areas of carbon fixation. What is the 4-carbon compound used to transport CO_2 equivalents from the mesophyll cells to the bundle sheath cells in these plants? Once in the stroma of the bundle sheath cell, this compound is converted to pyruvate by the malic enzyme. What are the other two products of this reaction?

2b. Do the bundle sheath cells have photosystem II? Why or why not? How do bundle sheath cells generate ATP? How do bundle sheath cell generate NADPH?