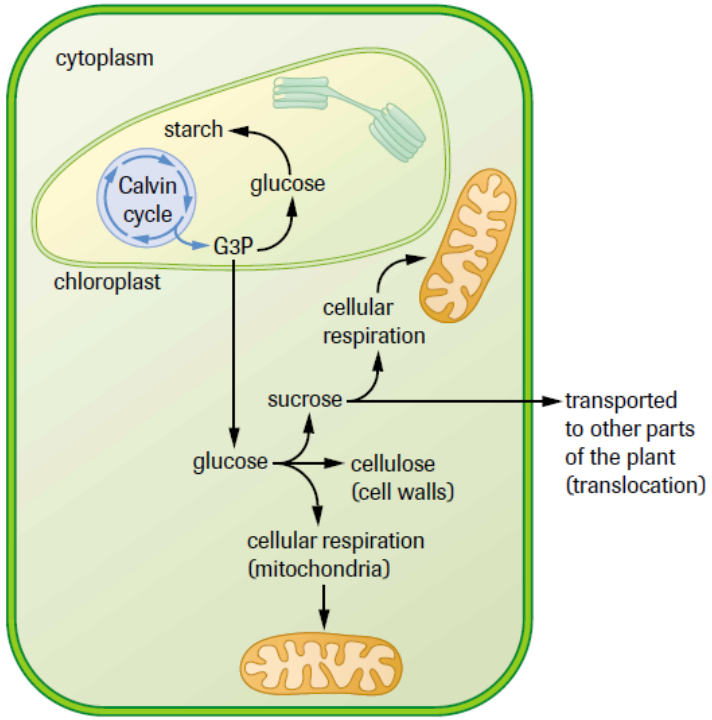
Section 4.2 Light Independent Reactions

SBI4UP

MRS. FRANKLIN

G3P: A Key Intermediate

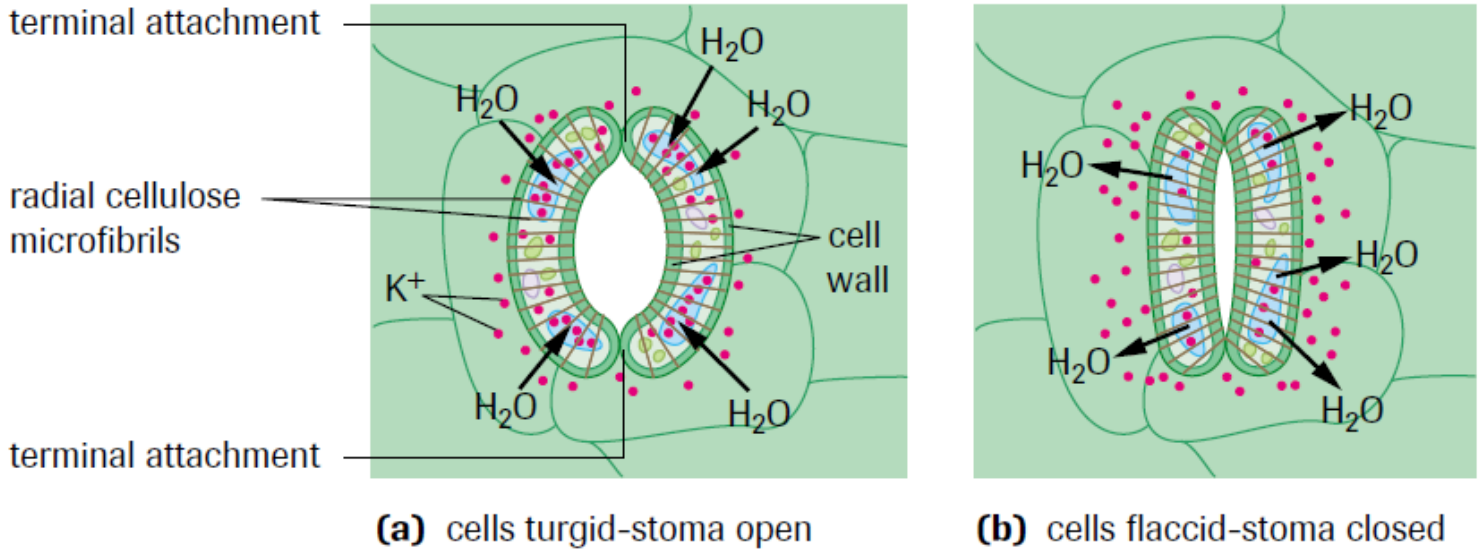
The ***G3P*** that leaves the Calvin Cycle can be synthesized into ***glucose*** in the cytoplasm or the chloroplast. If a large quantity of glucose is produced than immediately needed, glucose can be polymerized into amylose and amylopectin.



Sugar can be transported in the cell through sucrose. Some of the glucose may be stored as starch until it is needed.

Opening/Closing of the Stomata

In order for G3P to be produced, both light and CO_2 must be taken in order for the light dependent reactions to occur. During the daytime, the stomata tends to remain open to allow gases (CO_2 and O_2) to enter/leave the cell.



(a) cells turgid-stoma open

(b) cells flaccid-stoma closed

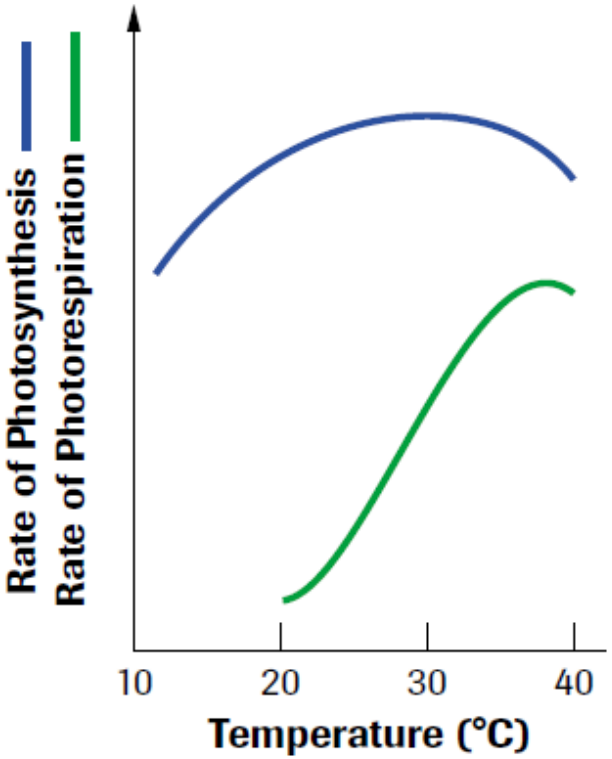
Changes in the size of the stomata are dependent on H_2O movement and K+ movement into the guard cells. If the water moves into the guard cell, it will swell and remain open.

Photorespiration – C_3 Plants

When the weather is hot/dry, the stomata of the plants tend to remain closed to prevent the loss of water. This is in turn decreases the amount of CO_2 in the air spaces and O_2 increases (since cellular respiration is still occurring).

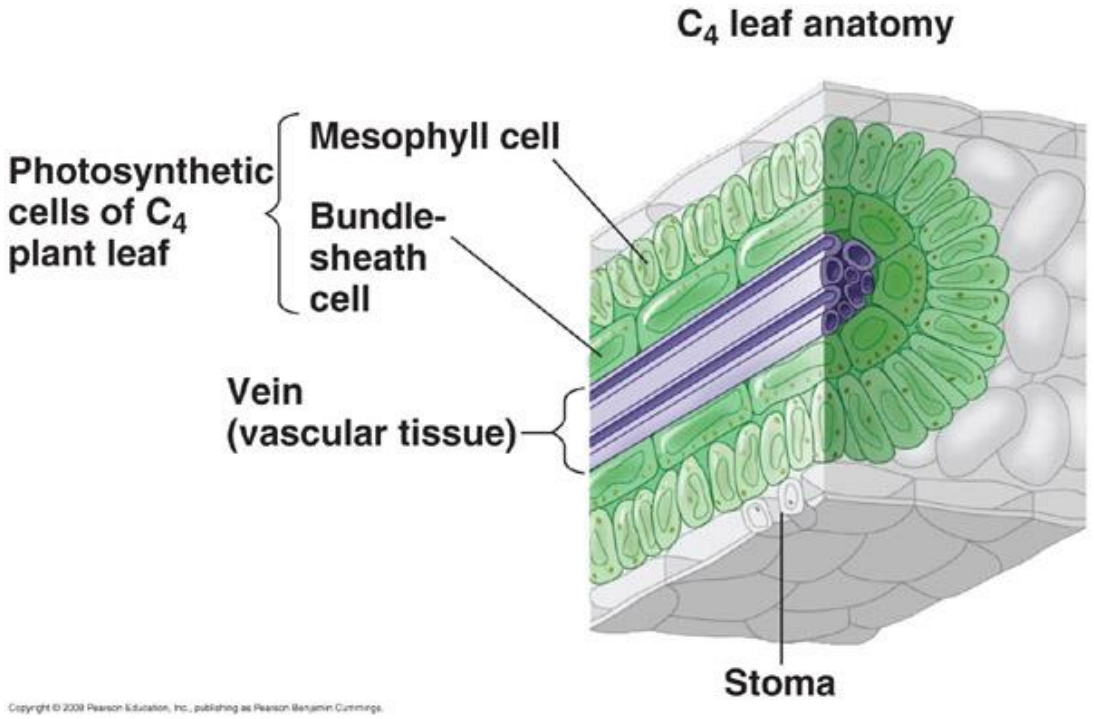
Photorespiration:

Rubisco is the enzyme uses for the caboxylation reaction between RuBP and CO_2



C_4 Plants

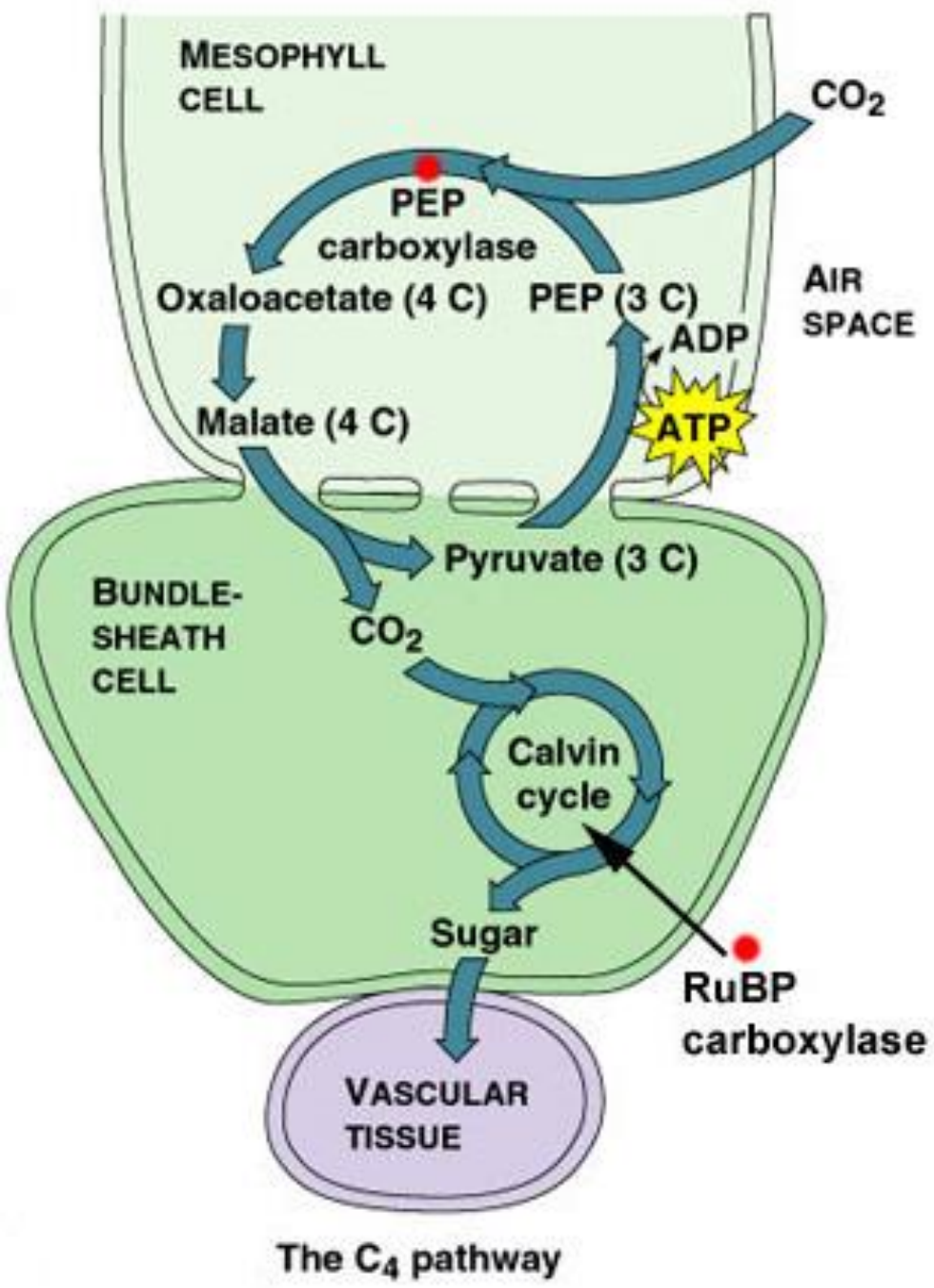
C_4 photosynthesis: carbon fixation that reduces the amount of photorespiration by pumping out CO_2 molecules from the mesophyll into the bundle-sheath cells.



It is known as the C_4 pathway because the CO_2 molecule is added to PEP (a 3 carbon molecule) to form a 4 carbon molecule known as oxaloacetate. This process occurs in the mesophyll cells.

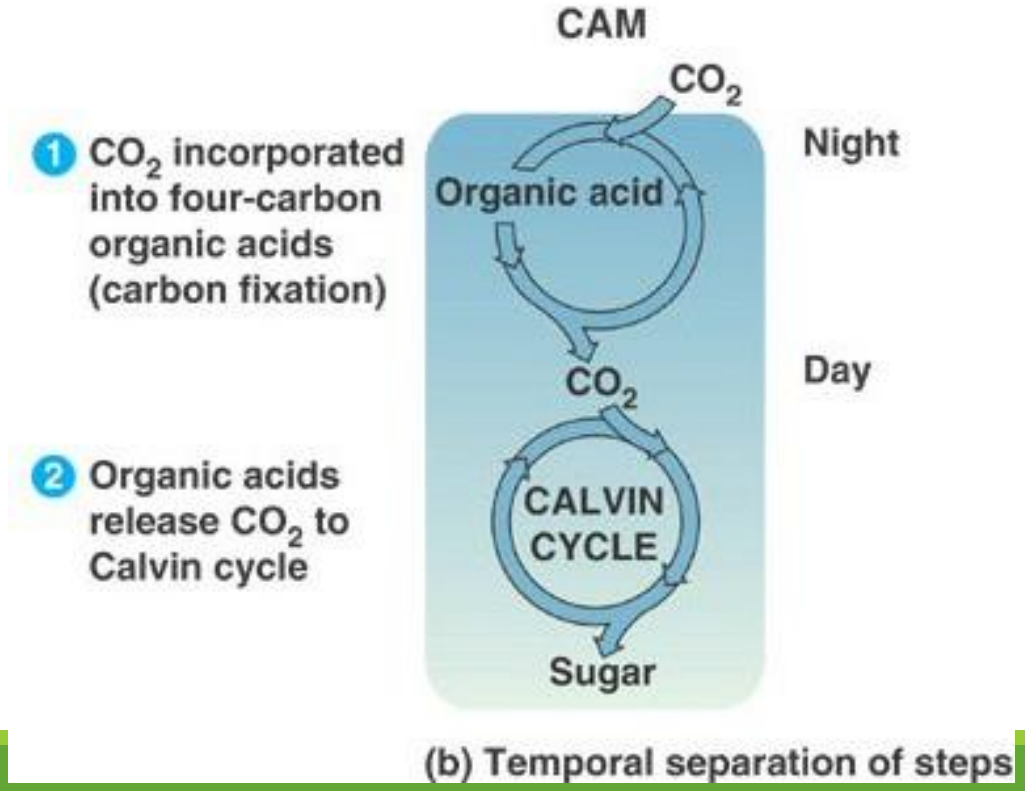
C_4 Plants

Malate enables CO_2 to enter the bundle of sheath whereby it will enter the C_3 Calvin Cycle and create G3P. The amount of CO_2 in the bundle of sheath is kept high and outcompetes the O_2 from binding to Rubisco.



CAM (crassulacean acid metabolism) Plants

CAM plants are water-storing plants that only open their stomata at night. When the CO_2 is taken up in the evening, it must be stored in vacuoles until the next morning when there is light available to continue photosynthesis.



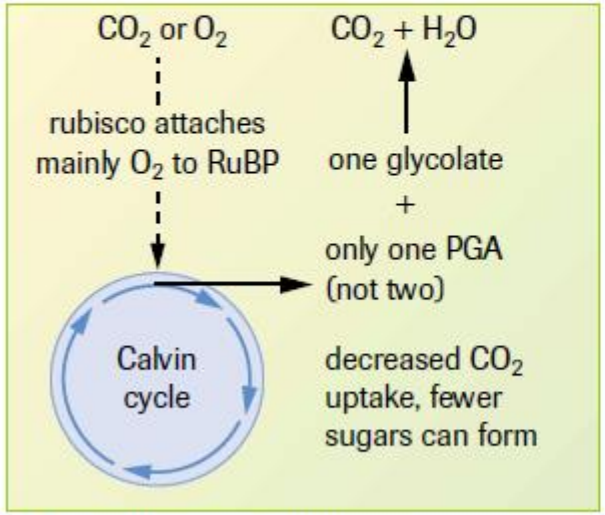
The organic acid is converted back into CO_2 during daytime so that is can enter the Calvin Cycle and produce G3P. Carbon fixation an the Calvin Cycle both occur in the same compartment of the cells as opposed to the C_4 plants.

Summary of Carbon Fixation

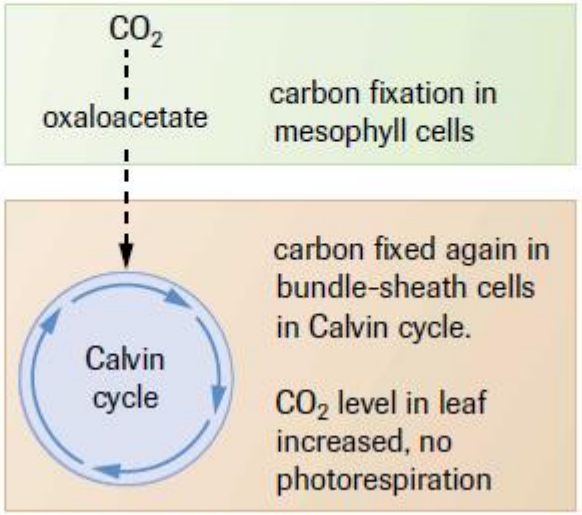
C_3 plants: cool, moist environments

C_4 plants: hot, dry environments

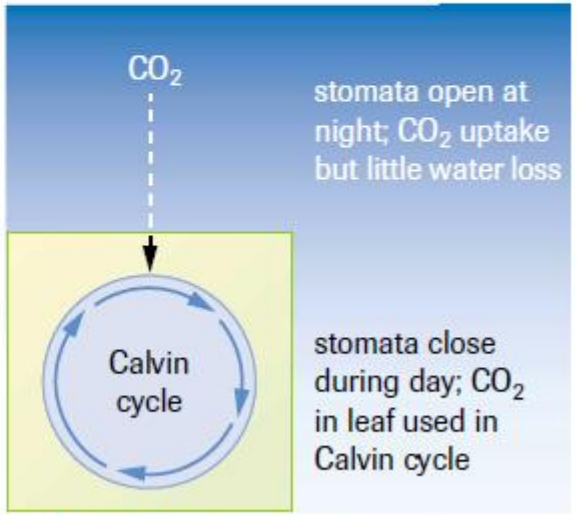
CAM plants: hot, dry, and desert environments



photorespiration predominates

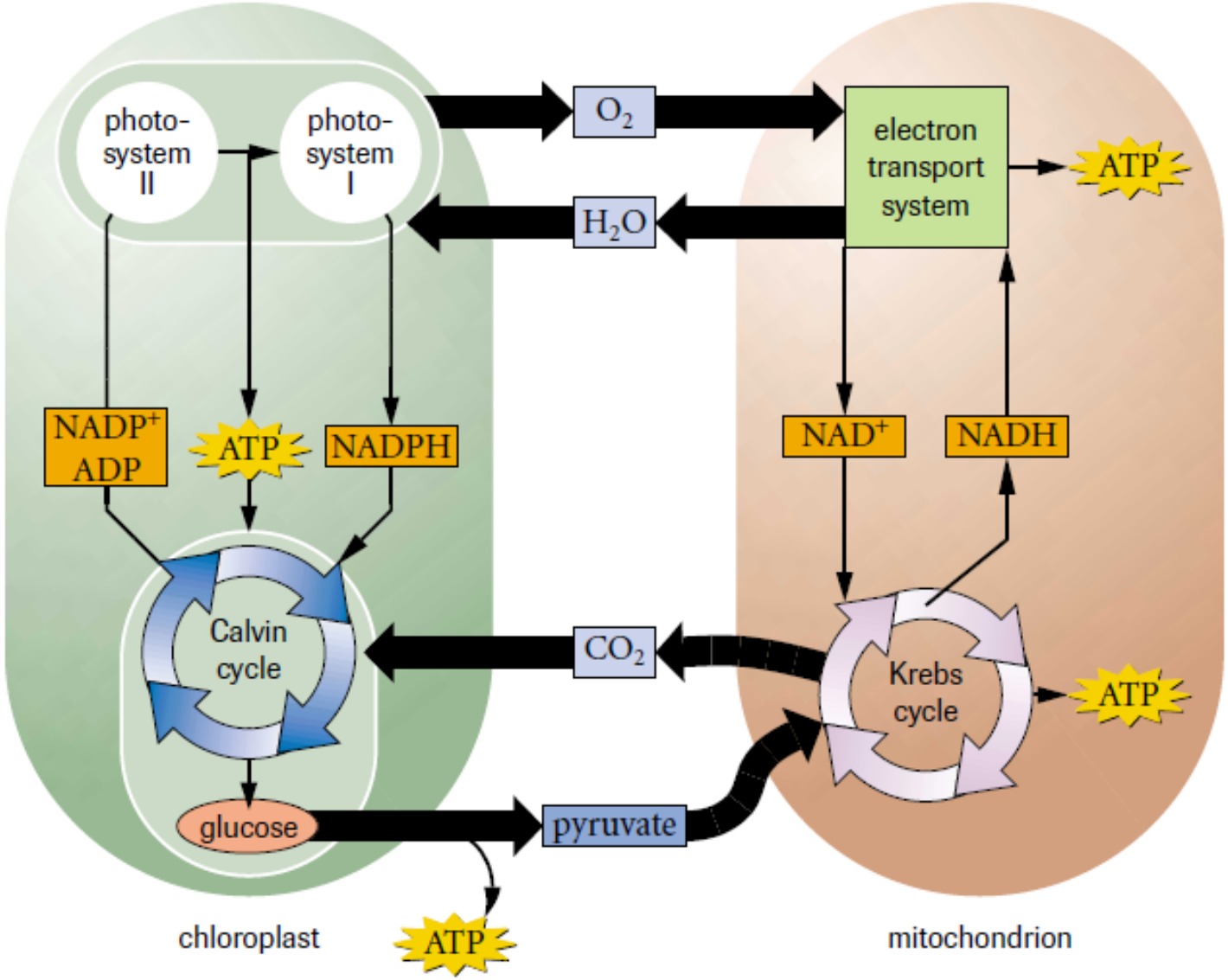


Calvin cycle predominates; no photorespiration

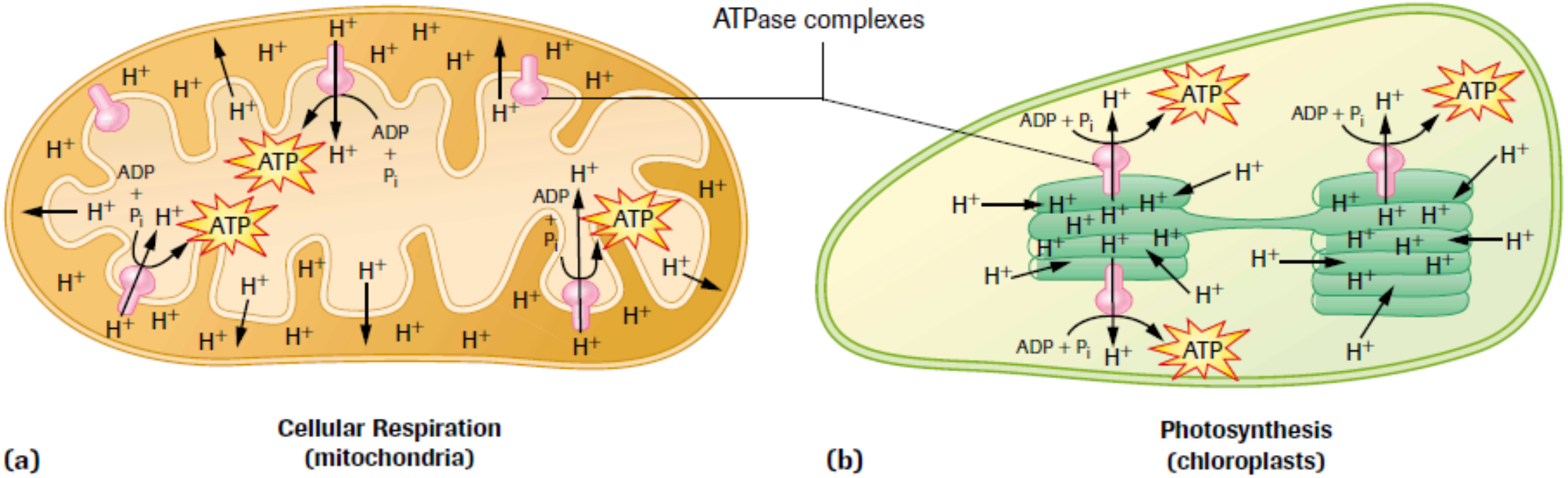


Calvin cycle predominates; no photorespiration

Comparing **Photosynthesis** and Cellular Respiration



Comparing **Chemiosmosis** and Cellular Respiration



Homework

Complete the worksheets given in class.