# Photosynthesis reflecting it, while absorbing other colors

Photosynthesis is the process by which plants, some bacteria, and some protistans, use the energy from sunlight to produce sugar, which cellular respiration converts into ATP, the “ fuel” used by all living things.

The site of photosynthesis is the chloroplast, which are disc-shaped organelles found in the mesophyll of the leaf in the palisade layer. They have outer and inner membranes with an inner membrane space between them. The stroma in the middle of the chloroplast contain membrane discs known as thylakoids, arranged in interconnected stacks called granum. The membrane of a thylakoid disc contains light-harvesting complexes that include chlorophyll, a pigment that gives plants their green color by reflecting it, while absorbing other colors such as violet and red for energy.

There are two stages to photosynthesis, with the first stage being the light reaction and second stage being the calvin cycle. In light-dependent reactions, light energy from the sun is used to split water (photolysis) which has been taken in by plants. Water, when broken, makes oxygen, hydrogen, and electrons. These excited electrons in photosystem II are used to create a proton gradient.

The ATP synthase in the thylakoids generates ATP using this proton gradient. When the electrons gets transported to photosystem I, they are used to reduce NADP+. Oxygen diffuses out of the plant as a waste product of photosynthesis.

This all happens in the thylakoid membrane of chloroplasts. Overall, the light reaction uses solar energy to produce ATP, NADPH, and O2. The light dependent reaction (Calvin Cycle) take place in the stroma.

Energy from the ATP and NADPH molecules generated by the light reactions drives a chemical pathway that uses the carbon in carbon dioxide to build a three-carbon sugar called glyceraldehyde-3-phosphate (G3P). Cells then use G3P to build a wide variety of other sugars (such as glucose) and organic molecules. Overall, the Calvin Cycle produces sugar ($C_6H_{12}O_6$ ) that can be used for things such as growth for the plant. Water is important to photosynthesis because it splits into oxygen and two hydrogen ions, and uses the electrons to replace the lost electrons of photosystem II in the light-dependent reaction.

Also, these hydrogen ions from water are used further as seen when hydrogen ions pass through ATP synthase so ATP can form to be used in the light-independent reaction. Since a reactant for photosynthesis is water ($H_2O$), this experiment displays how changing the amount of sugar in the water given to the seed affects the growth of a beet seed. The amount the beet seed grows displays how much glucose ($C_6H_{12}O_6$) the plant is producing. Glucose is converted into chemicals that are required for the growth of plant cells such as cellulose. Therefore, a rapidly increasing rate of growth ties in directly with photosynthesis, because if the beet seed has a fast growth rate, that means photosynthesis is occurring at a higher rate as well since more glucose (the molecule that makes plants grow) is being produced.