10.1.3

Photosynthesis summarized

Before we introduce the complexity of photosynthesis, let's try a "big picture" summary approach. The ultimate goal of photosynthesis is to store converted light energy (sun) into stable chemical energy (chemical bonds). Light "sun" energy will be initially captured by light absorbing pigments (chlorophyll) in the form of excited electrons. Those excited electrons possess lots of absorbed energy which needs to be captured. The capturing will occur by sending the electrons through an "electron transport chain" where protein complexes will use that energy to split water, resulting in free H^+ and O atoms. The H^+ ions will then be pumped "uphill" into a small space (thylakoid space). This is very similar to what happened in the mitochondria during aerobic respiration, but now this electron transport chain is found in another organelle called the chloroplast.

Not all the energy will be used to pump H^+ ions, some of the energized electrons will be placed on H^+ ions and then stuck to a molecule of $NADP^+$ to form NADPH (NAPDH functions exactly the same as NADH). Thus, the hydrogen atoms that are split from water will have a dual role, some will be used to directly bind excited electrons and then bind to $NADP^+$ and others will be used to run the ATP synthase enzyme and make ATP. Thus, light energy (excited electrons) will successfully be converted to chemical energy in the covalent bonds of NADPH and as potential energy in phosphate bonds of ATP. This process will be called the light **dependent** reaction.

The problem is that both forms of the chemical energy bonds (ATP and NADPH) are very unstable so we must convert those bonds to more stable forms (carbohydrates). To make a carbohydrate we will need three things, carbon (CO_2), water, and the newly trapped energy (ATP and NADPH) which we will do in the light **independent** reactions. Seems simple right? Well, let's take a deeper dive below!