

8.3 Reactions of Photosynthesis

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- Photosynthesis takes place in the chloroplasts of photosynthetic eukaryotes.
 - The chloroplast is made up of stacked membranes called thylakoids
 - Each stack of thylakoids is known as a granum
 - Proteins in thylakoid membranes are arranged into groups called photosystems which collect light
- Photosynth. takes place as 2 separate but dependant reactions known as the light dependant (occurring in the thylakoids) and the light-independent aka a Calvin cycle (occurring in the stroma - the stuff surrounding the thylakoids in the chloroplast)
- In order for these reactions to take place, electron carriers are needed. These transport high-energy electrons from chlorophyll to other molecules.
 - This process is known as electron transport
- NADP⁺ is an example - it carries 2 high-energy electrons along w/ a Hydrogen ion (H^+) to become NADPH. This traps some of the sun's energy for processing.
 - The energy stored in NADPH can also be used to create other molecules, for the cell (like carbs)

Light dependant Rxns

- require light to take place

* The reaction uses light energy \checkmark to create NADPH & ATP molecules, while releasing O_2 gas.
- complex process is shown on pg 211

- 1) - pigments absorb light \rightarrow energized electrons are sent out
- 2) - old electrons are replaced by H_2O electrons $\rightarrow 2H^+$ ions, 2 e's $\neq 0$
- 3) - high energy e's from 1) pass through electron transport chain moving H^+ ions into inner thylakoid space
- 4) pigments re-energize electrons to make NADPH
- 5) - more ions are pumped across membrane creating a negatively charged outside & positively charged inside.
- 6) The difference between inside & outside gives energy to make ATP molecules
- 7) ATP synthase enzyme moves H^+ ions across membrane & generates the ATP

video "light D"

Calvin cycle (light-independent Rxns)

The ATP & NADPH carriers are not good for long term energy storage, so the Calvin cycle turns the energy into high-energy sugar molecules

see pg 212

- 1) - 6 CO_2 molecules from air react w/ 6 [5 carbon molecules] ^{RuBP} to make 12 [3-carbon] ^{PGA} molecules
- 2) - the 12 [3-carbon] molecules are converted to higher energy from ATP & NADPH \rightarrow 12 PGAL

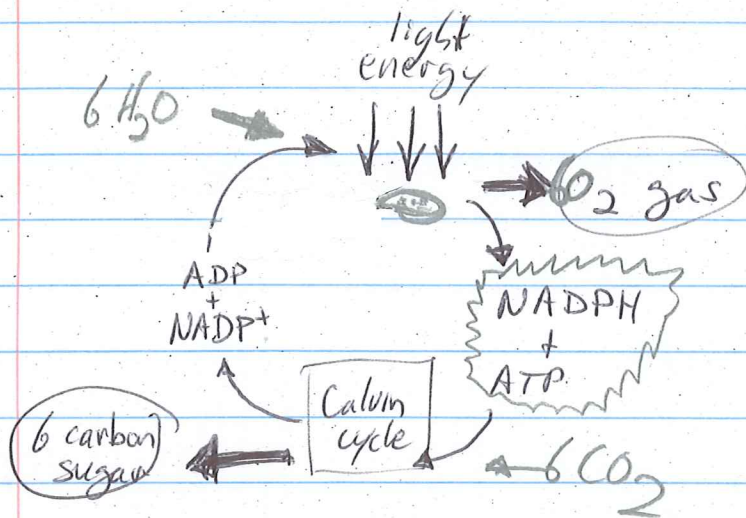
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3) - 2 of the 12 [3 carbon molecules] are removed and made into ^{6 carbon} sugars, lipids, amino acids, or proteins.

4) - the remaining 10 are converted back to 5-carbon molecules to start over again.

* in summary → $6\text{CO}_2 \rightarrow 1$ [6-carbon sugar] or other molecules.

video
"Calvin C."



Light dependant = \$\$\$ (ATP, NADPH)
Cash on Hand

Light Independent = Money in bank (sugar)
(Invested)