Aim: What is the role of photosynthesis in the carbon cycle?

Do Now: What is the role of NAD & FADH in cell respiration?

Homework
Read pp 202- 207
P.207 # 1,3,4, 6

Vocabulary: Photosynthesis, pigment, chlorophyll, chloroplast, thylakoid
Calvin cycle,,Carbon fixation

801/804

Aim: What is photosynthesis?

Do Now: What are the male & female parts of the flower?

Photosynthesis- Three Stages

Stage 1- Plants need to capture light energy

Stage 2- Light energy is converted into chemical energy

Stage 3- Formation of organic compounds using stored chemical energy

sugar a has carbon

$$\text{Sunlight} + H_2O + CO_2 \text{ ----------> } C_6H_{12}O_6 + H_2O + O_2$$

glucose

<http://www.fw.vt.edu/dendro/forestbiology/photosynthesis.swf>

Stage 1: Capturing Light Energy

Chloroplasts- specialized plant cell organelles adapted to convert light energy into chemical energy

I. Structure

-2 membranes, inner & outer; oth allow light to pass through
-Stroma- space inside the inner membrane
- Thylakoids- flat, disc-like sacs stacked in the stroma
- molecules that absorb light

II.Function

- light is emitted from the sun in different wavelengths, we perceive this as different colors
- Pigments are substances that absorb certain wavelengths
-3 are important in P:
- Chlorophyll a & b absorb blue & red light
- Carotenoids - absorb blue & green, reflect yellow & orange

LE3 1/8/10

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- molecules that absorb light, this is where photo. takes place

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ROY G BIV

Stage II: Converting Light energy to chemical energy

Electron Carriers transfer the excited electrons to two ET Chains:

1st Chain- uses the energy to make ATP

2nd Chain uses the energy to make NADPH

The ETC in Photosynthesis:

1. Light excites pigments, electrons leave the pigments, Electrons from water replace the electrons lost by chlorophyll. H_2O breaks down to produce H^+ ions & O_2 gas. O_2 is released into atmosphere.

2. A protein in the thylakoid membrane uses the energy in the excited electrons to pump H^+ into the thylakoid

3. H^+ ions move through ATP Synthase to make ATP. (ATP is used in later stages of photosynthesis)

4. Light excites electrons in amother chlorophyll molecule, E^- then move on to the 2nd chain. Electrons from 1st chain replace these excited electrons

5. The excited electrons combine w/ H^+ ions & $NADP^+$ to form NADPH.
Like ATP, NADPH provides energy for the final stage of photosynthesis

Stage III Photosynthesis produces Sugar

Final Stage:

ATP & NADPH are used to produce sugar molecules drom CO_2,.
These reactions do not require light!

The most common process in autotrophs to produce sugars is the Calvin Cycle

Calvin Cycle

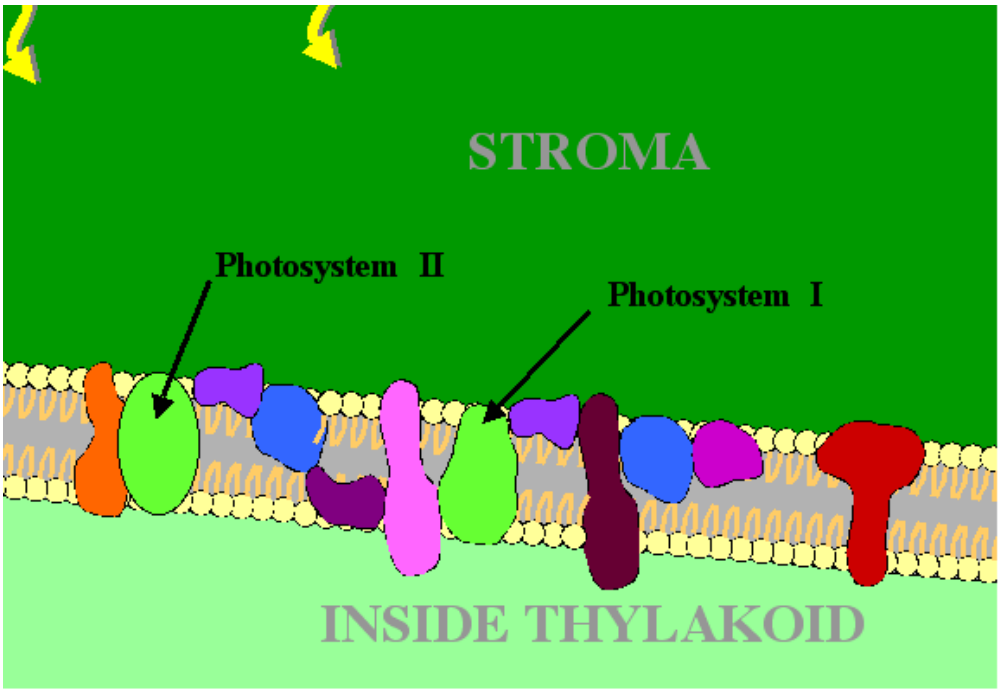
1. Three molecules of CO_2 combine with three molecules of another compound in a series of steps.

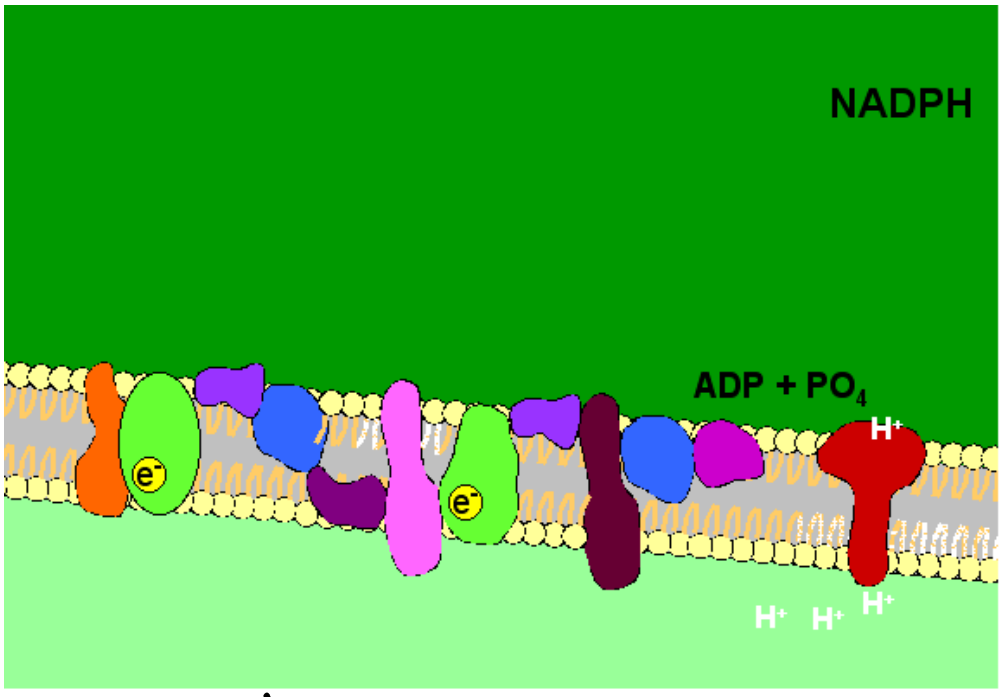
2. Proteins use energy from ATP & NADPH to combine the CO_2 w/ other molecules

3. The Calvin Cycle produces molecules of a 3- carbon sugar that can be used to produce other carbon compounds, like GLUCOSE

What factors can affect Photosynthesis?

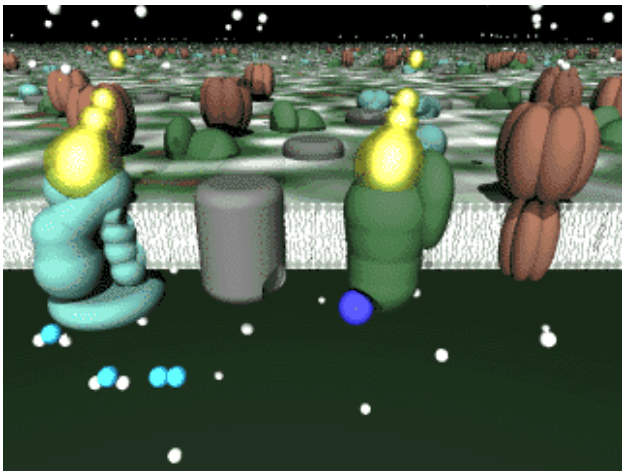
FACTOR	EFFECT
1. The amount of light:	1. As the amount of light increases, rate of P increases
2. Amount of CO_2	2. As amount of CO_2 increases, rate of P increases
3. Temperature	3. P can occur most quickly within a certain range of temperatures. Temps too high/low can make the proteins involved in P stop working


STROMA
Photosystem II
Photosystem I
INSIDE THYLAKOID



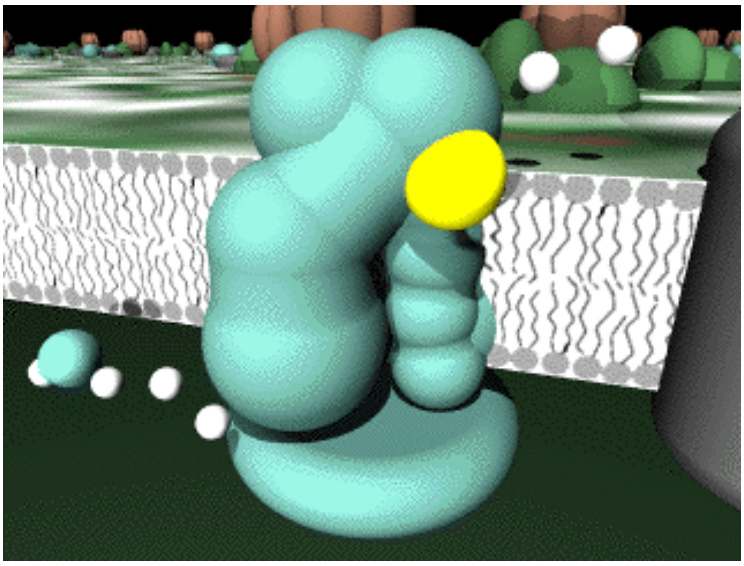
Rubisco - 5 carbon sugar in Calvin cycle
- grabs CO_2
- (Carbon Fixation)
- with ATP, becomes GLUCOSE

Photosynthesis in Action

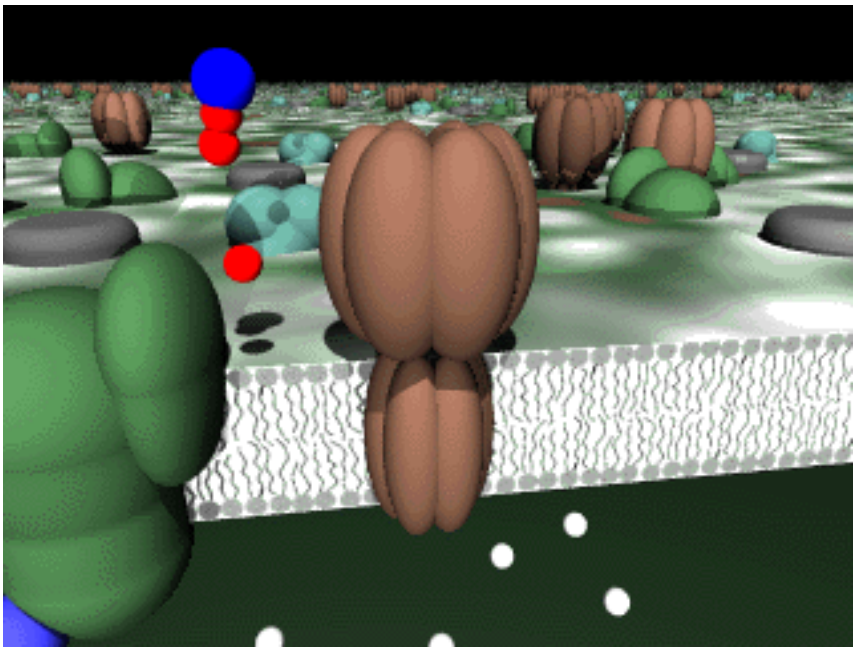


Light hitting photosystem II (blue-green in color) and photosystem I (dark green color). Also shown are cytochrom b6/f (gray color) , and ATP-synthase (brown color).

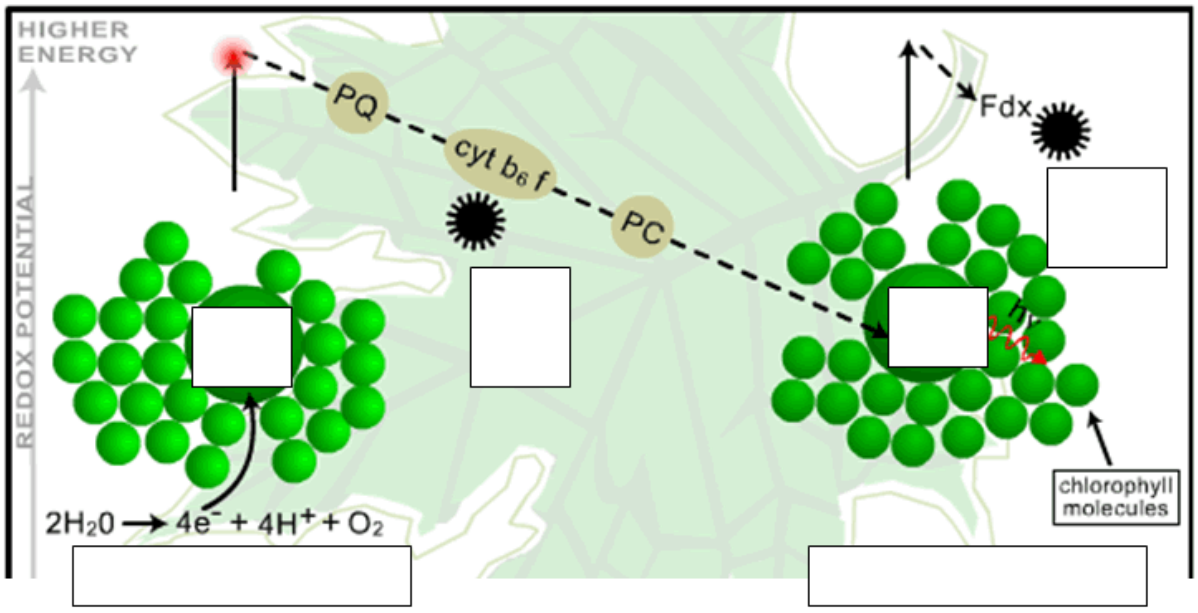
Photosystem II



PSII absorbing light and consuming water (1 blue-green oxygen and 2 white hydrogens) to replace the electron holes produced by the photooxydation of chlorophyll a.
The electrons are incorporated into chlorophyll and oxygen (blue-green) is produced as a waste product.
Hydrogen ions are retained to increase the concentration of hydrogen ions inside the thylakoid.
An electron carrier (yellow) is shown to move on to cytochrome b6/f and carry with it two more hydrogen ions to be added to the growing number of hydrogens in the thylakoid space.



Consumption of ADP (1 blue plus 2 red phosphates) and a phosphate (1 red) to produce ATP (1 bue and 3 reds).
This synthesis is driven by the proton-motive force, depicted as white spheres leaving through the ATP-synthase.


HIGHER ENERGY
REDOX POTENTIAL
PQ
cyt b_6 f
PC
Fdx
hν
chlorophyll molecules
$2H_20 \rightarrow 4e^- + 4H^+ + O_2$