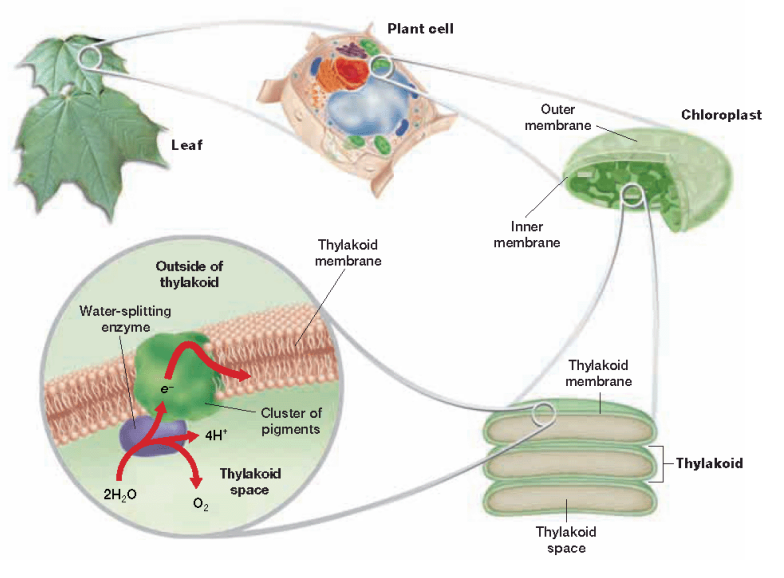
Photosynthesis…

the process by which light energy is converted to chemical energy then to organic compounds (What are organic compounds?)



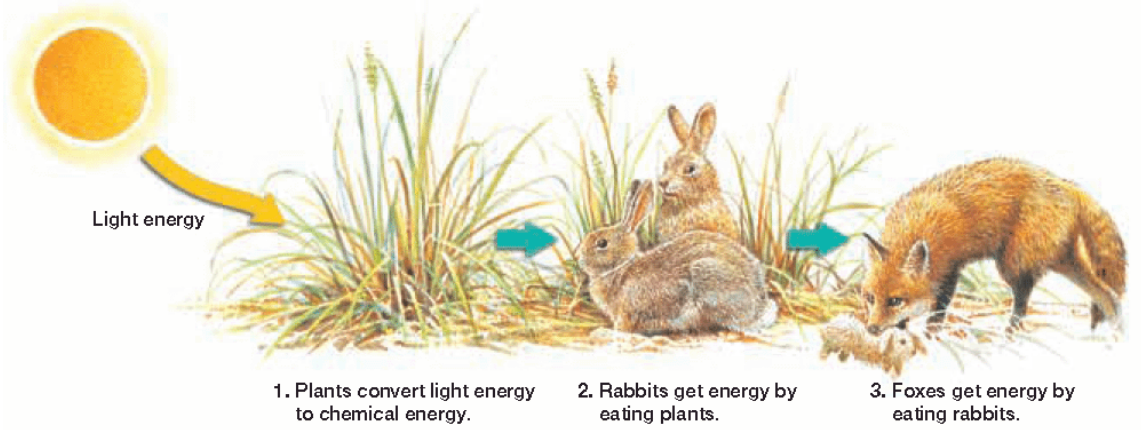
1. Organisms are autotrophs OR heterotrophs.

a) Autotrophs/producers-use sunlight & the process of photosynthesis OR inorganic compounds & the process of chemosynthesis to make food (organic compounds).

b) Heterotrophs/consumers- break down organic compounds (food) for energy through Cellular Respiration.

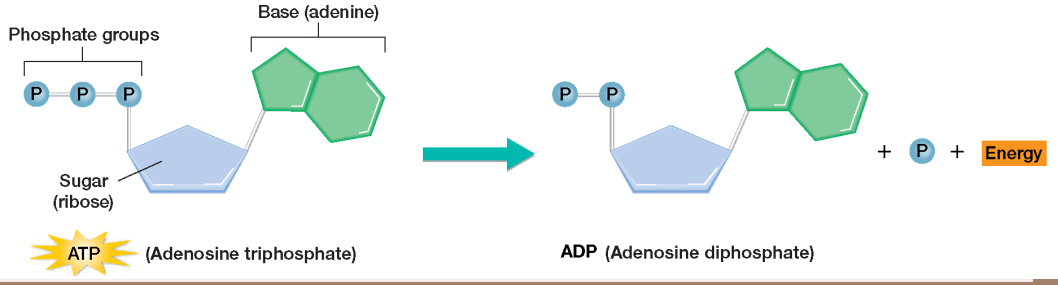
c) Almost all of the energy on Earth comes from the sun.

(If organisms didn't use the sun, what did they use for energy?) (What process is involved when using the sun?)

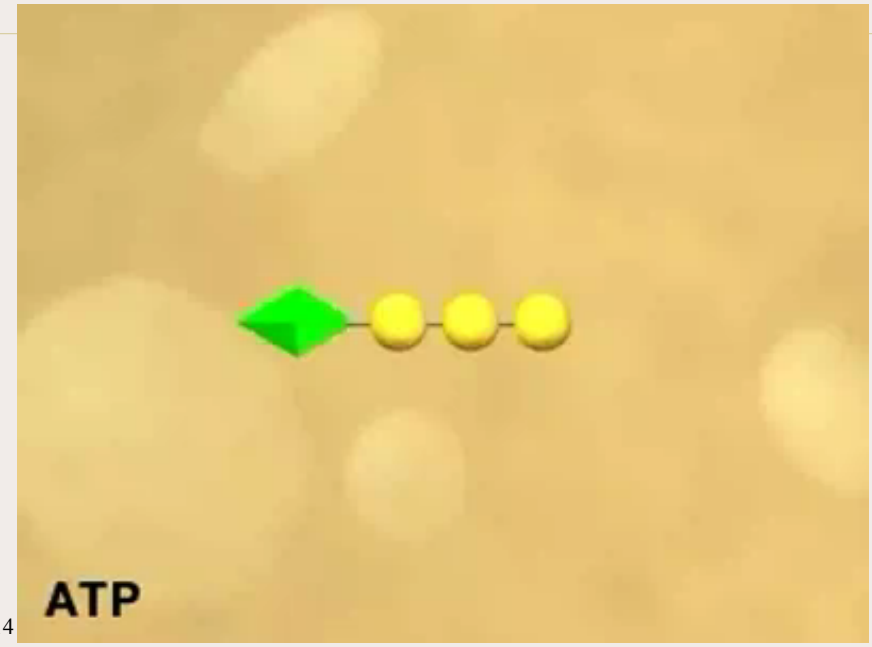


2. ATP - Adenosine Triphosphate

A. Stored molecules of chemical energy
B. When high energy P bond is broken, ATP releases energy.
C. Removal of P group produces ADP +P +energy
D. Addition of P group is phosphorylation



Comparing ATP with ADP



3. Photosynthesis - to make carbohydrates & O_2 from CO_2 and H_2O plus sunlight.

A. Balanced Equation:

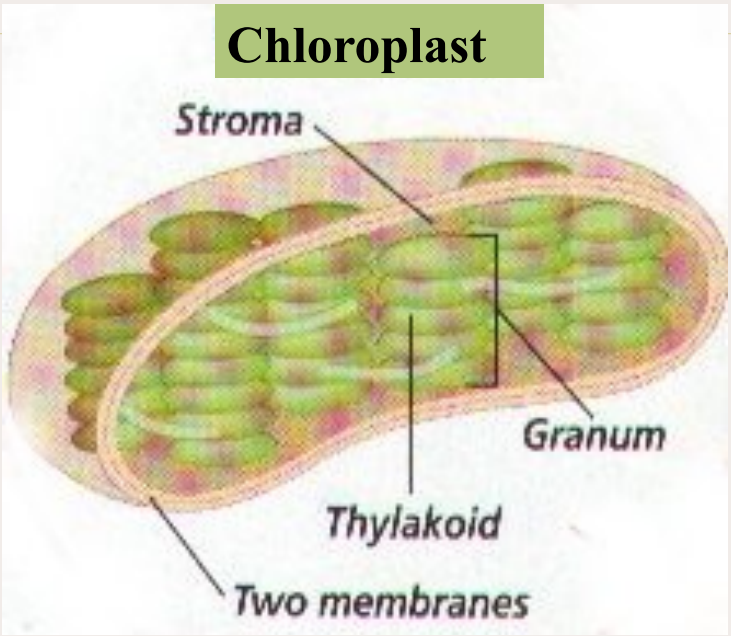
$$6CO_2 + 6H_2O \xrightarrow{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

carbon dioxide — Water — glucose — oxygen

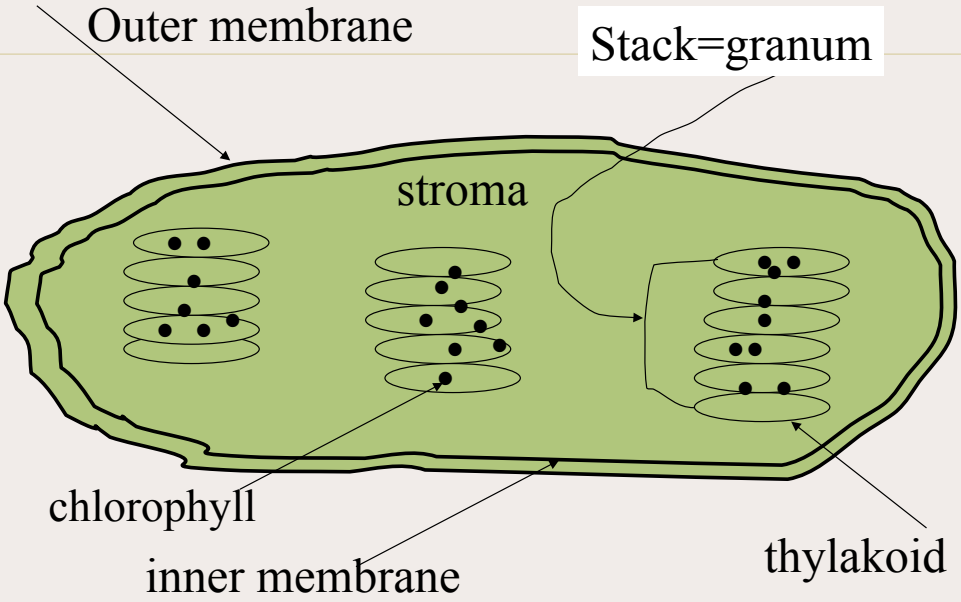
FYI. The water from transpiration is netted out (or it would appear as a product).

4. All photosynthesis reactions occur in the:

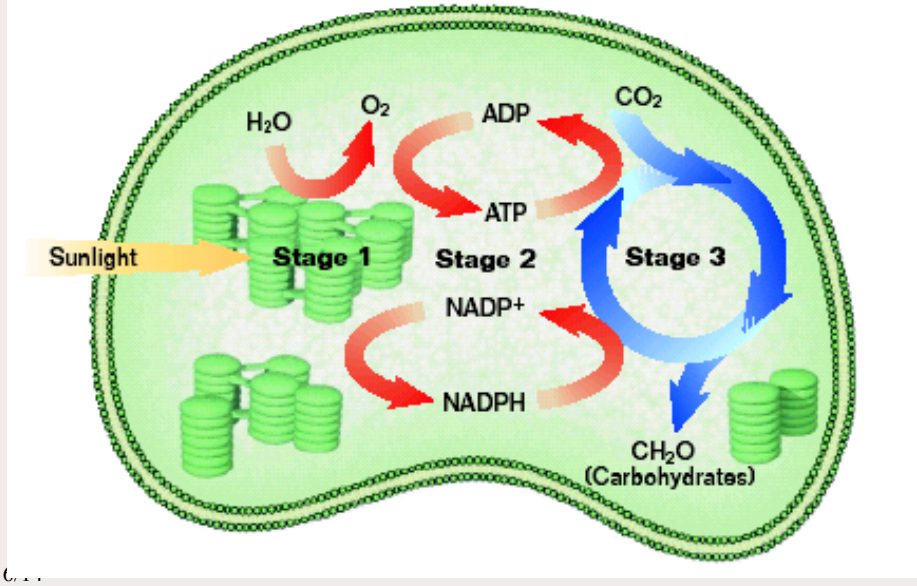
Chloroplast



STRUCTURE OF THE CHLOROPLAST



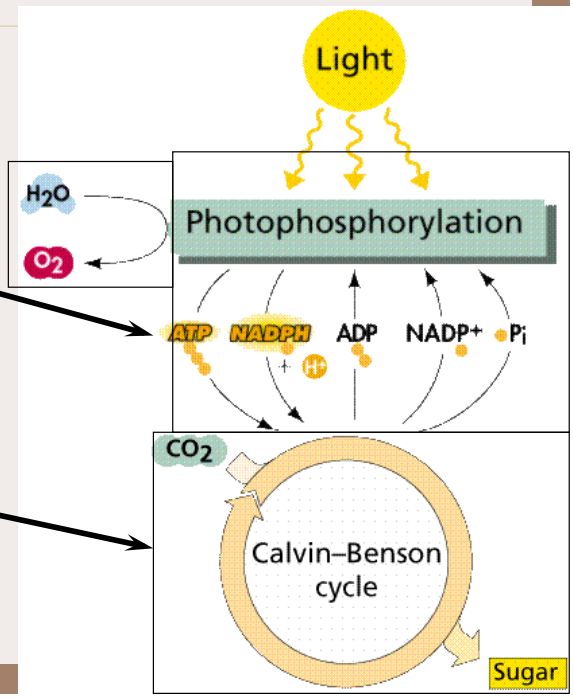
Stages of Photosynthesis



5. Photosynthesis happens in 2 parts:

a. Light reactions transform light to ATP

b. Dark Reactions transform ATP to sugars



6. Absorption of light energy

a) Chlorophyll - green pigment that reflects green and yellow light.

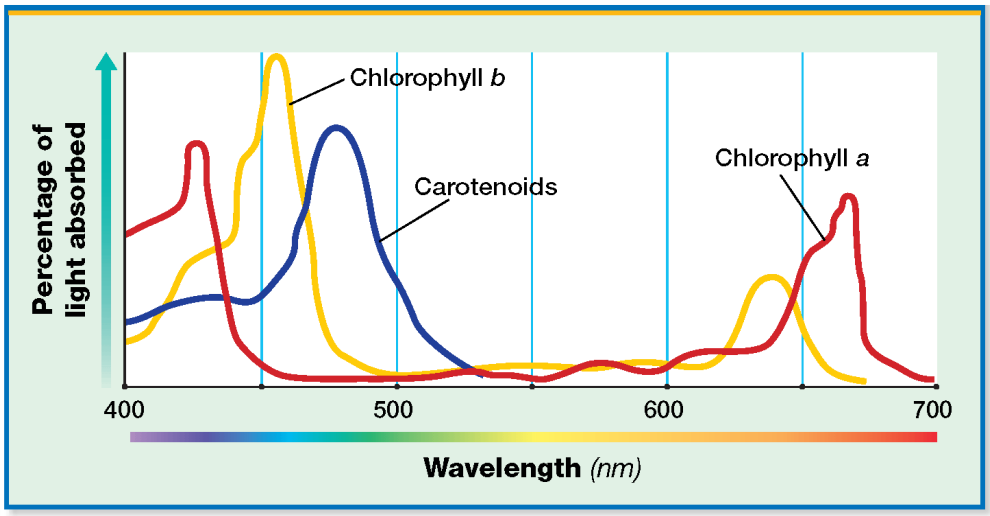
b) Carotenoids- reflect yellow & orange

c) An object is the color you see because it reflects that color light.

Primary pigment chlorophyll? YES!

NO, its carotenoids

Photosynthetic Pigments



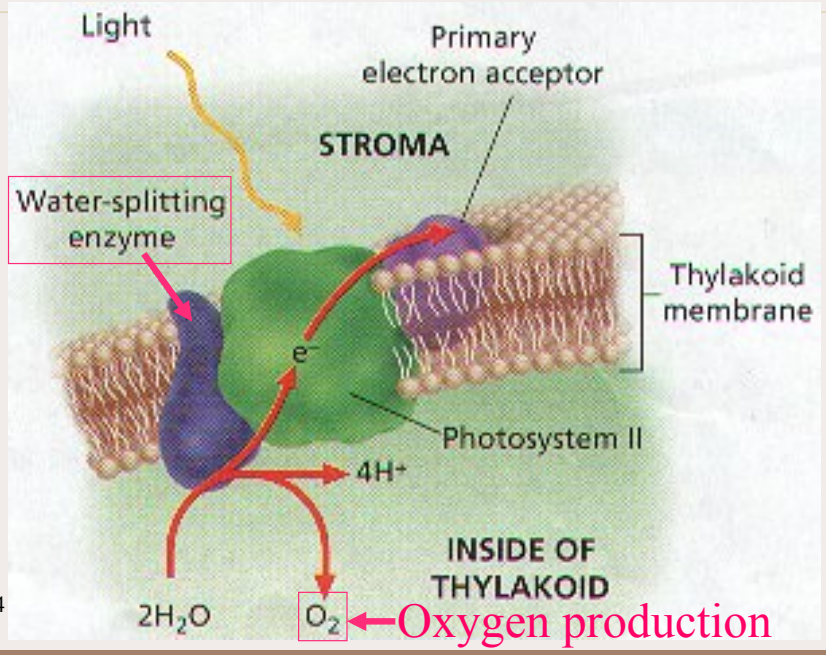
Visual Concept

7. Light Reactions- light energy to chemical energy – (that's the transformation)

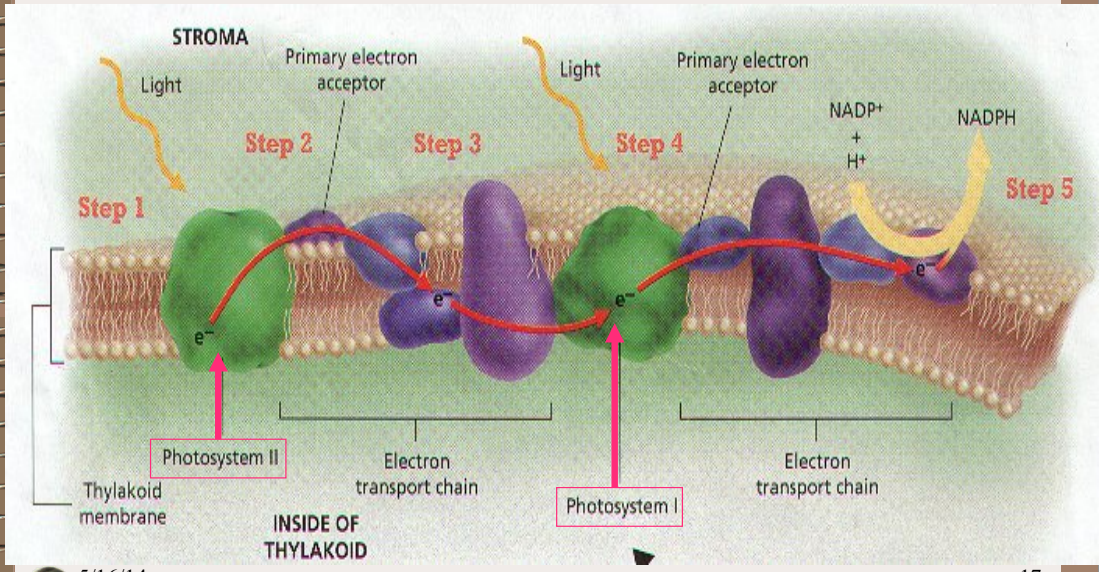
A. Pigments inside thylakoid absorb sunlight to make ATP* and NADPH* for use later in the dark reactions.

* indicates ENERGY

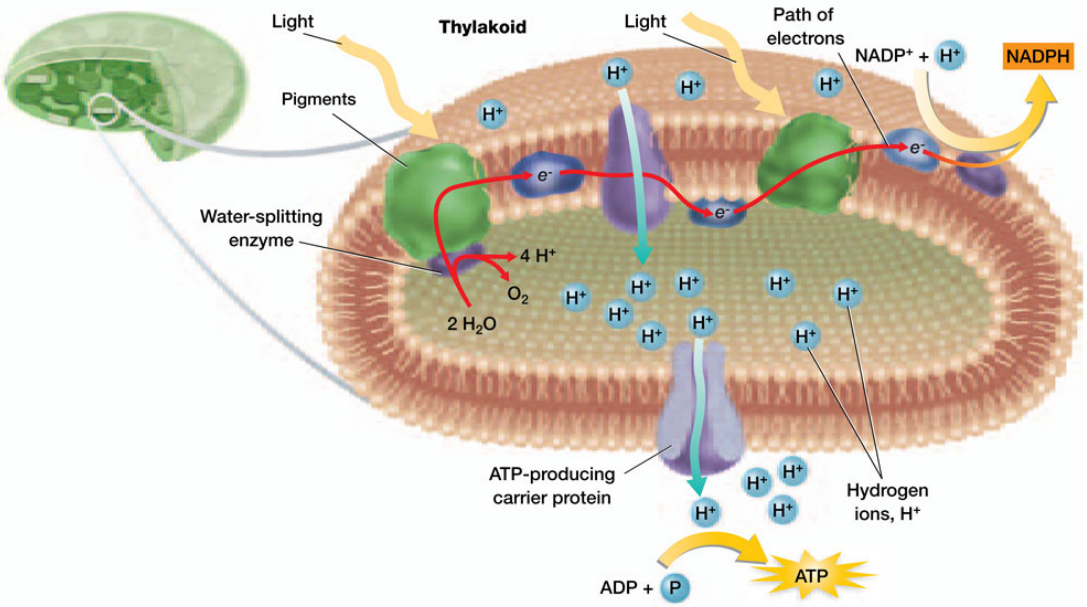
Hydrolysis of Water



The Electron Transport Chains of Photosystems I and II



Summary of Processes in Light Reactions



No need to write: Question: Is there a net gain or loss of energy after the light reactions?

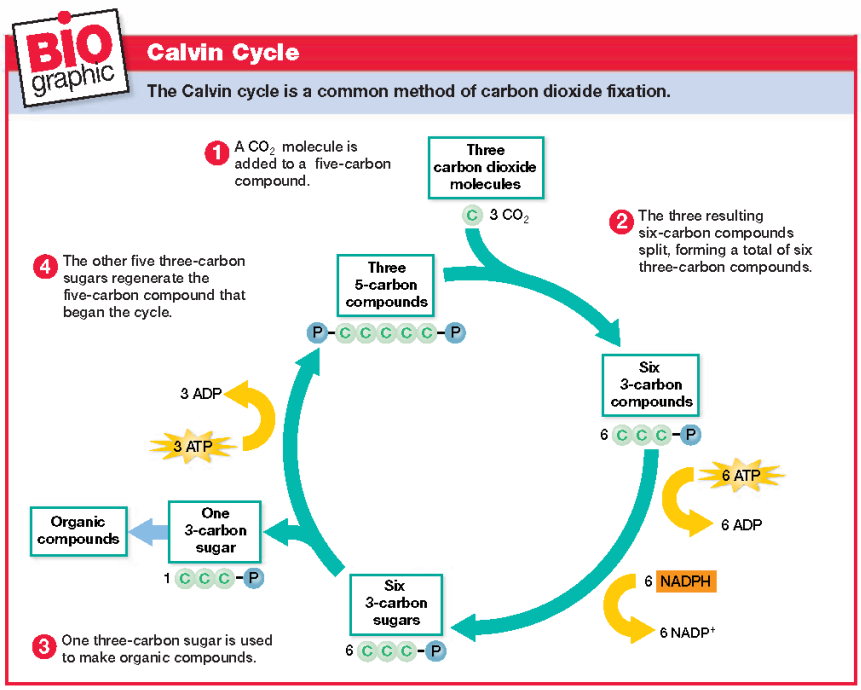
Net Gain: The organism did not need to use it's own energy to form ATP and NADPH

It got this energy from the Sun!

8. Light Independent/Dark Reaction/Calvin Cycle, light is optional

A. Uses chemical energy from NADPH and ATP to fix carbon into organic compounds- sugar
B. Since the reactions are tied, it is a coupled reaction
C. occur in the stroma inside the chloroplast

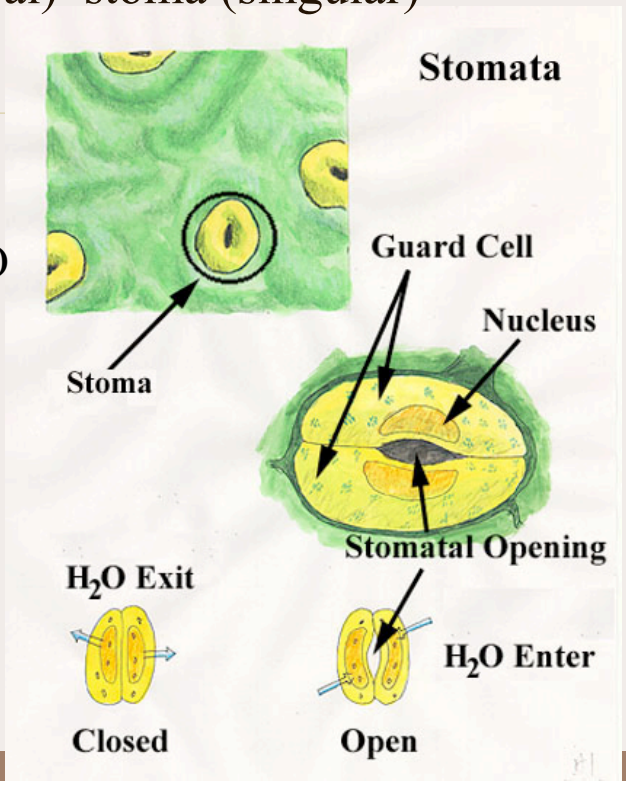
The Calvin Cycle



9. Stomata (plural) stoma (singular)

A. Important to move O_2 out and CO_2 into the cell and to release H_2O vapor.

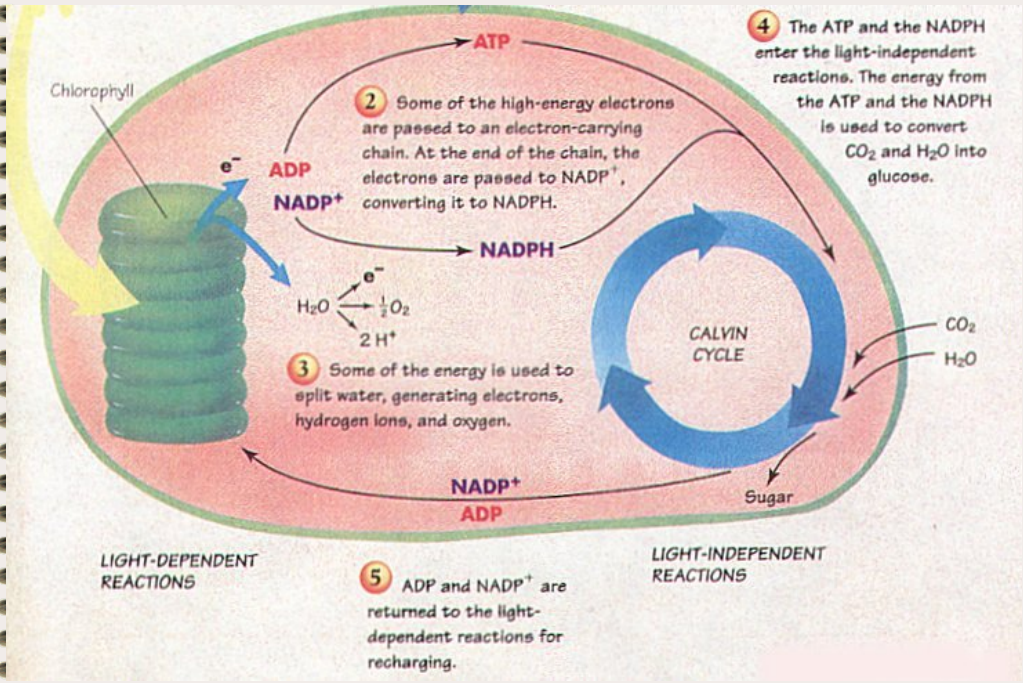
B. Surrounded by guard cells that fill with water in response to the environment



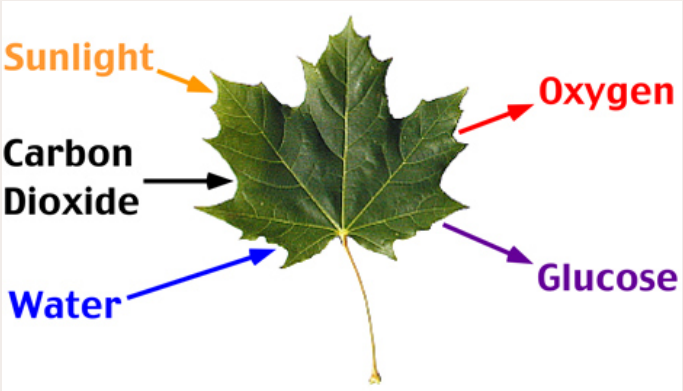
10. Environmental Factors

a) Light
b) CO_2
c) Temperature
d) Water

Visual Concept



The "ins" and "outs" of photosynthesis



$$6CO_2 + 6H_2O \xrightarrow{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

Calvin Cycle Light reaction Calvin Cycle Light reaction