

# Energy Notes



# Learning Objectives

- Explain where plants get the energy they need to produce food
- Describe the role of ATP in cellular activities

Where does the energy that living things need come from?

Food!

# Autotrophs

Autotrophs - organisms that are able to use light energy from the sun to produce their own food



Example: Plants

# Heterotrophs

Heterotrophs - Obtain energy from the foods they consume



Example: Animals

# Heterotrophs

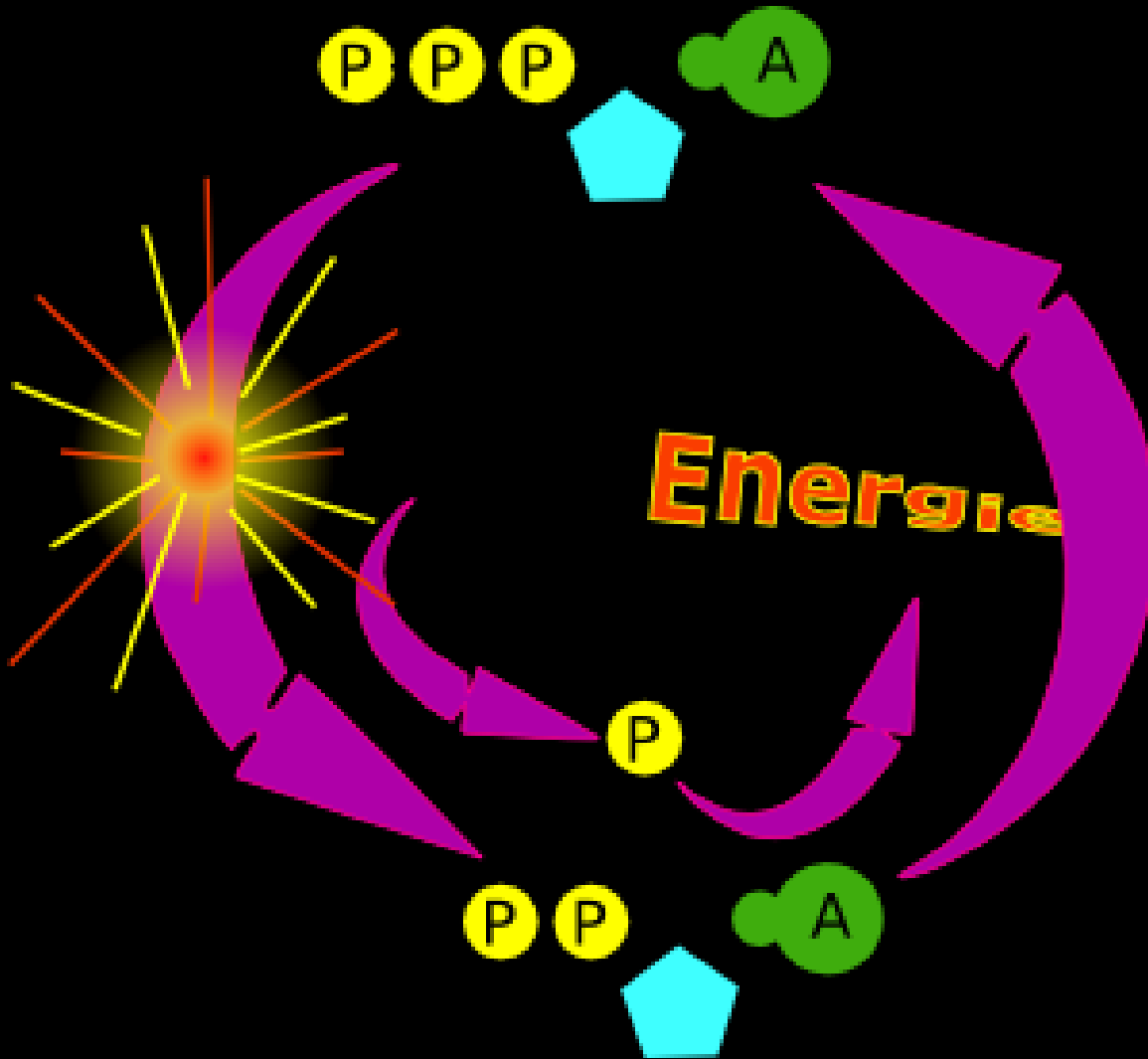


Heterotroph eats  
Autotroph



Heterotroph eats  
Heterotroph

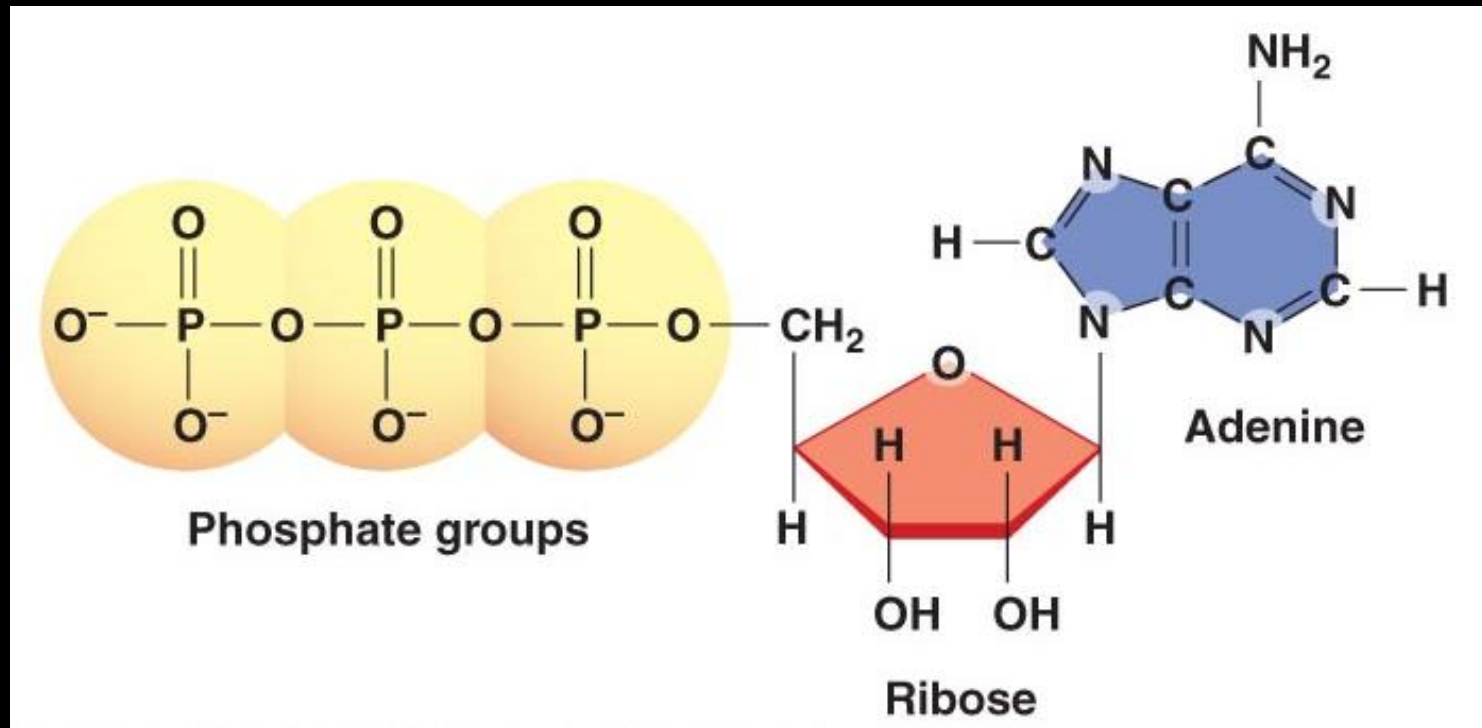
# Chemical Energy



Living things  
use chemical  
fuels that store  
and release  
energy.

ATP

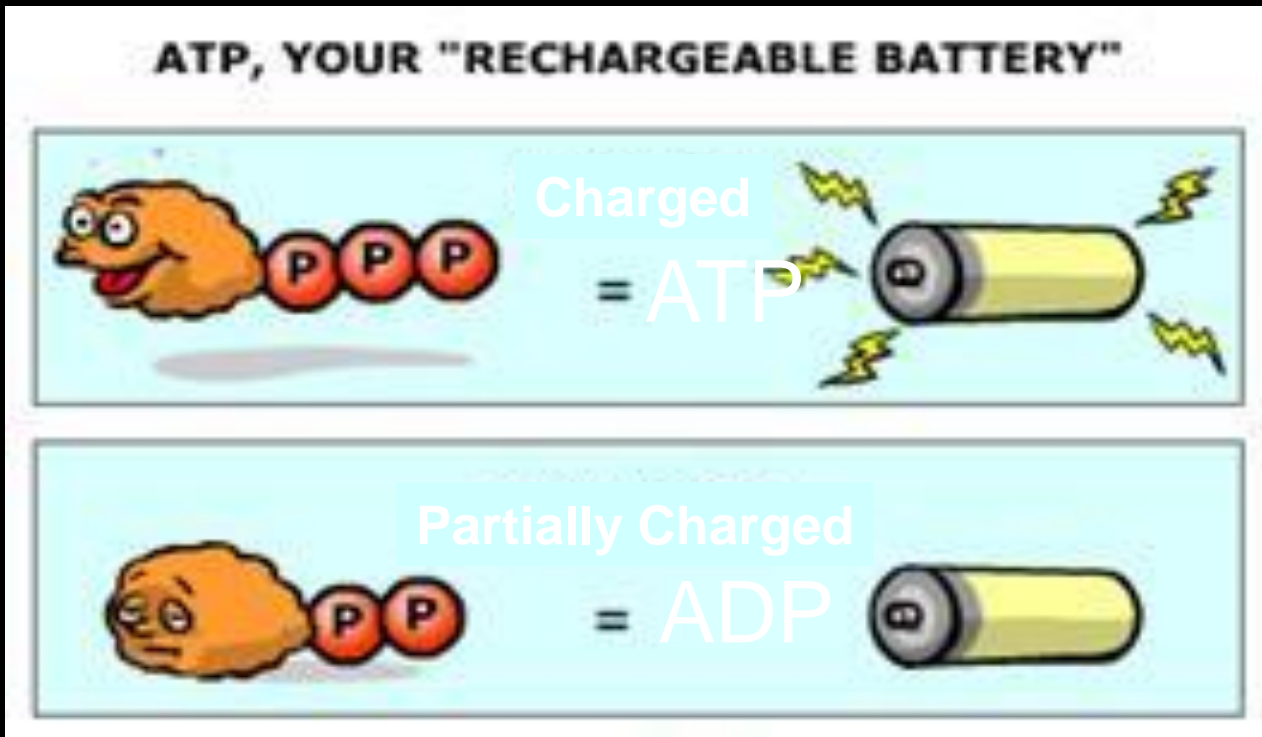
# Adenosine TriPhosphate (ATP)



3 Phosphate groups, Ribose sugar, Adenine



# Storing and Releasing Energy



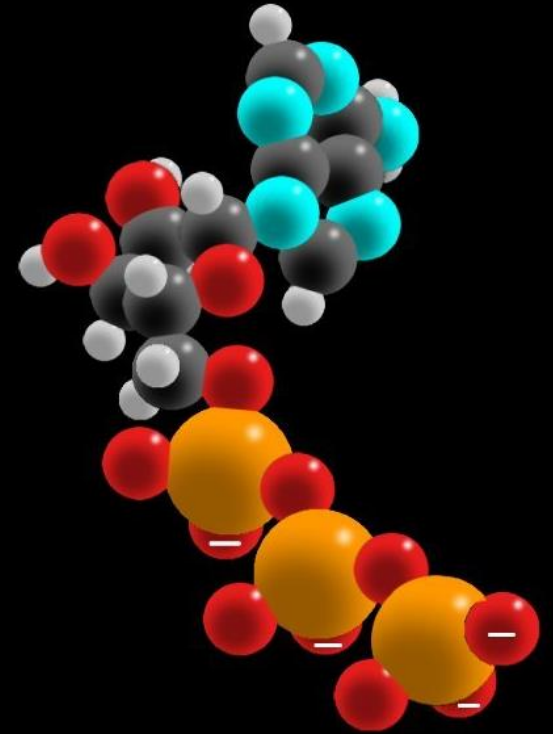
Adenosine  
Triphosphate -  
Fully Charged

Adenosine  
Diphosphate -  
Partially  
Charged

Energy is released when a phosphate group is removed.

# Functions of ATP

- Stores and releases energy used by the cell.
- Powers important cellular activities



BASIC ENERGY SOURCE OF ALL CELLS

YouTube

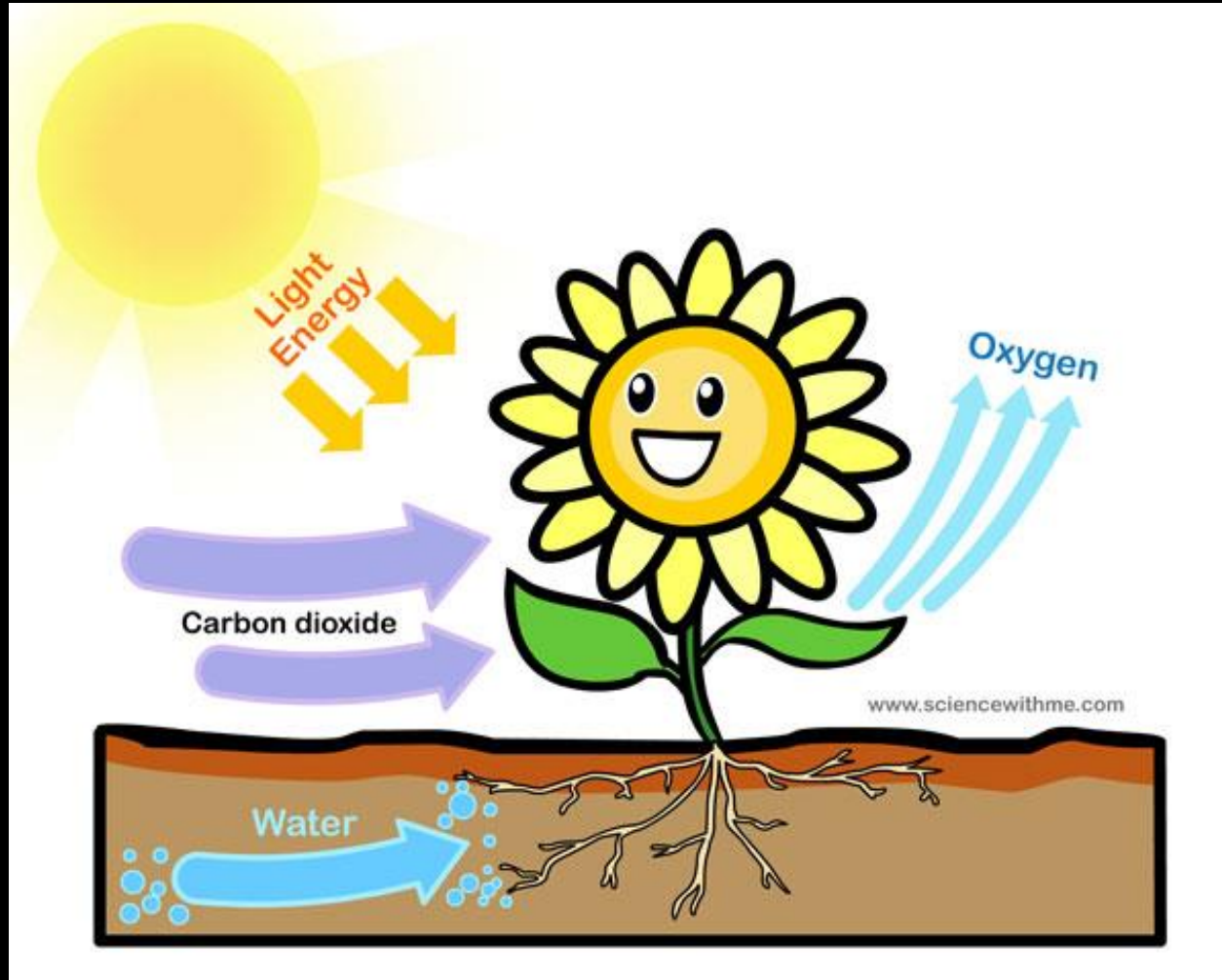
What is ATP?

Stop Here



# Photosynthesis Notes

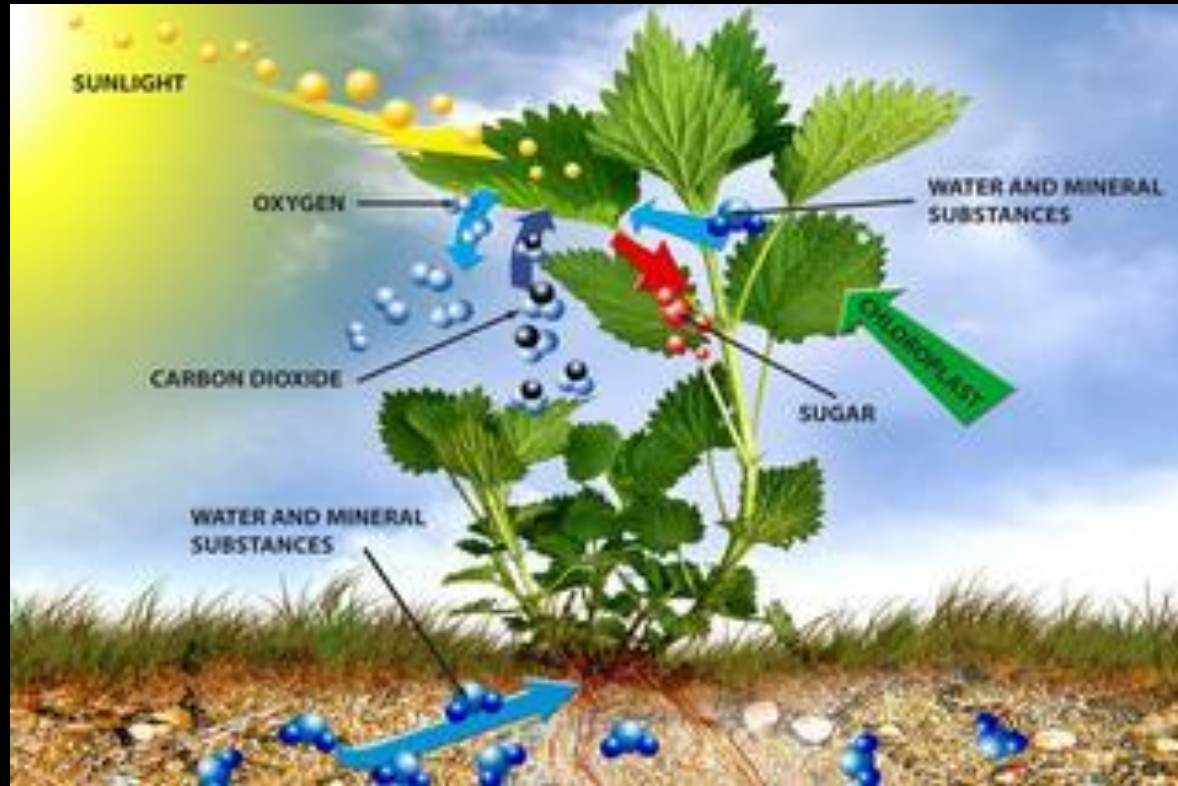
## Part 1



# Learning Objectives

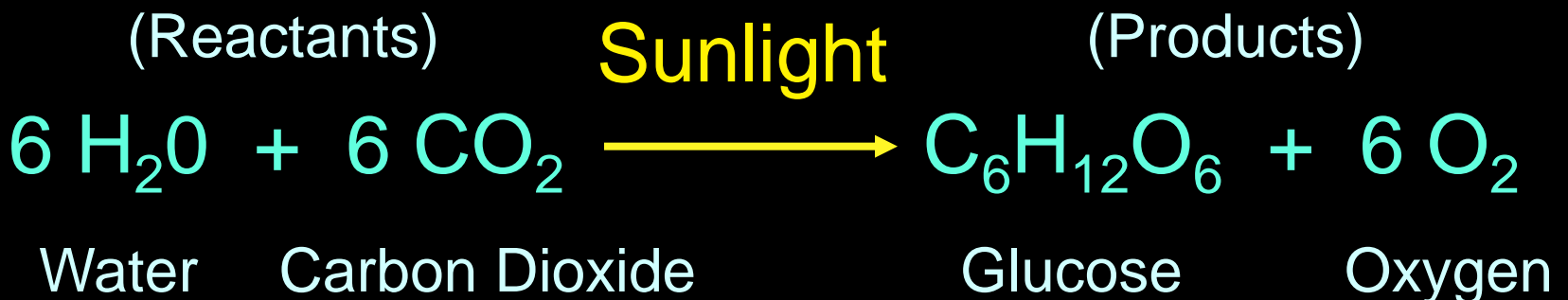
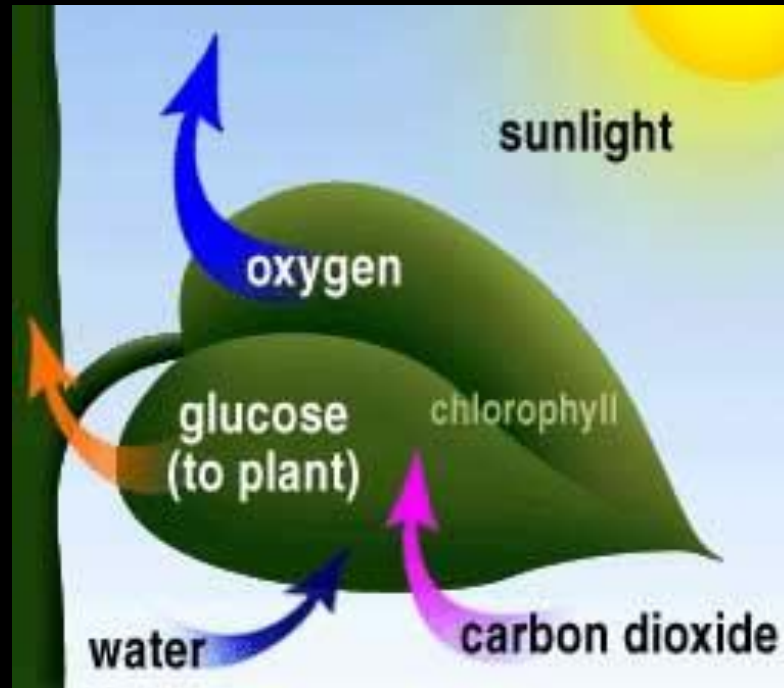
- State the overall equation for photosynthesis
- Describe the role of light and chlorophyll in photosynthesis
- Describe the structure and function of chloroplasts

# Photosynthesis



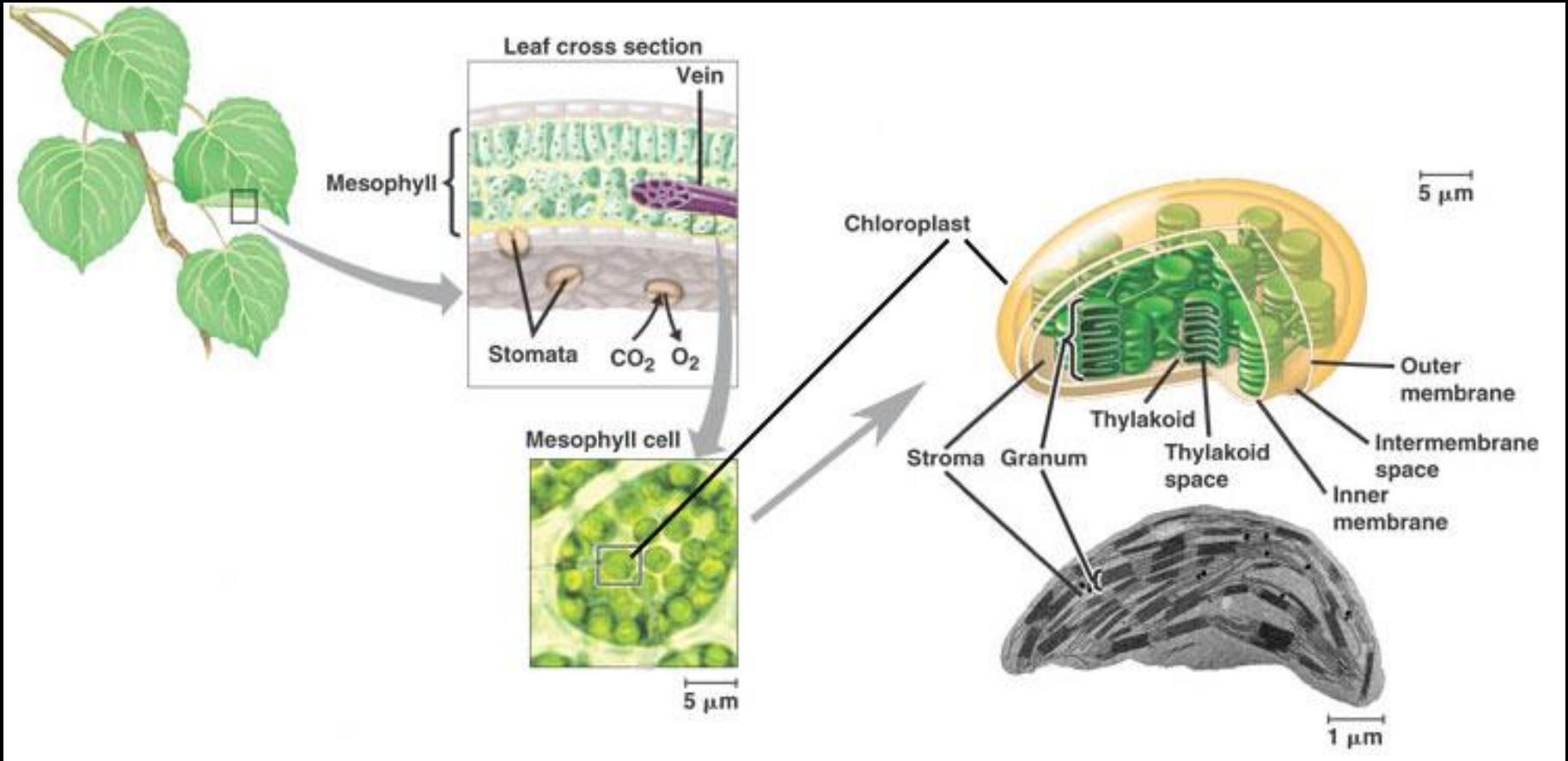
Plants use the energy of sunlight to convert water and carbon dioxide into sugars and oxygen - Photosynthesis (light + make)

# The Photosynthesis Equation





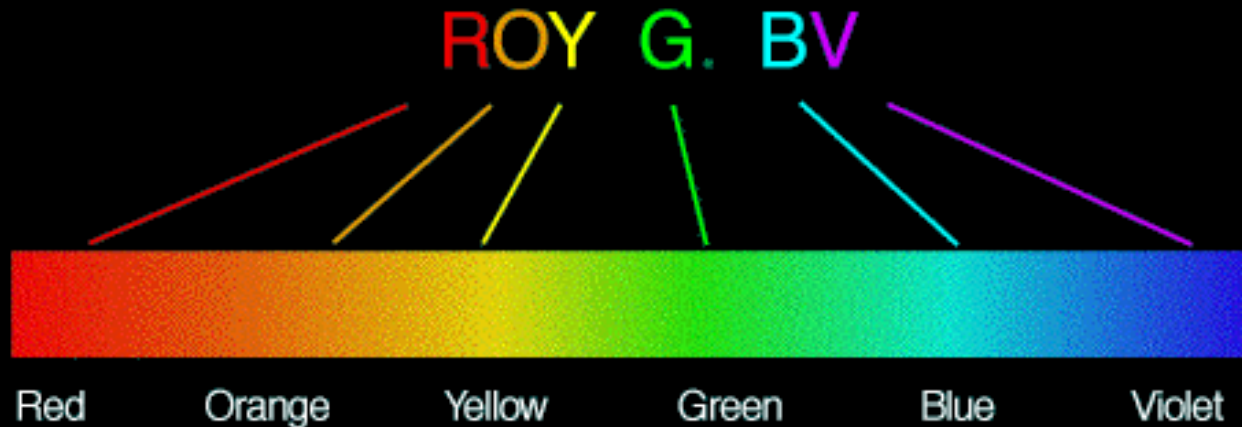
# Where does photosynthesis occur?



Photosynthesis takes place inside **chloroplasts**

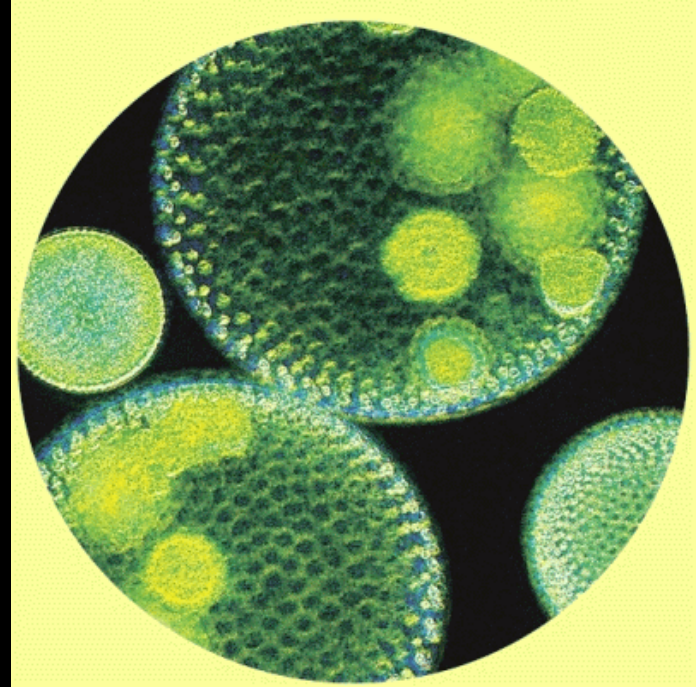
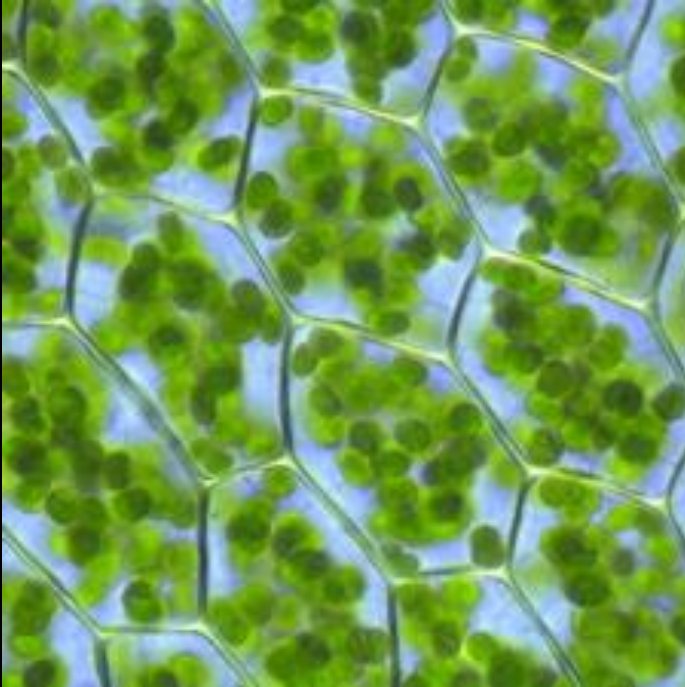
# Lights and Pigments

Plants absorb visible light for photosynthesis



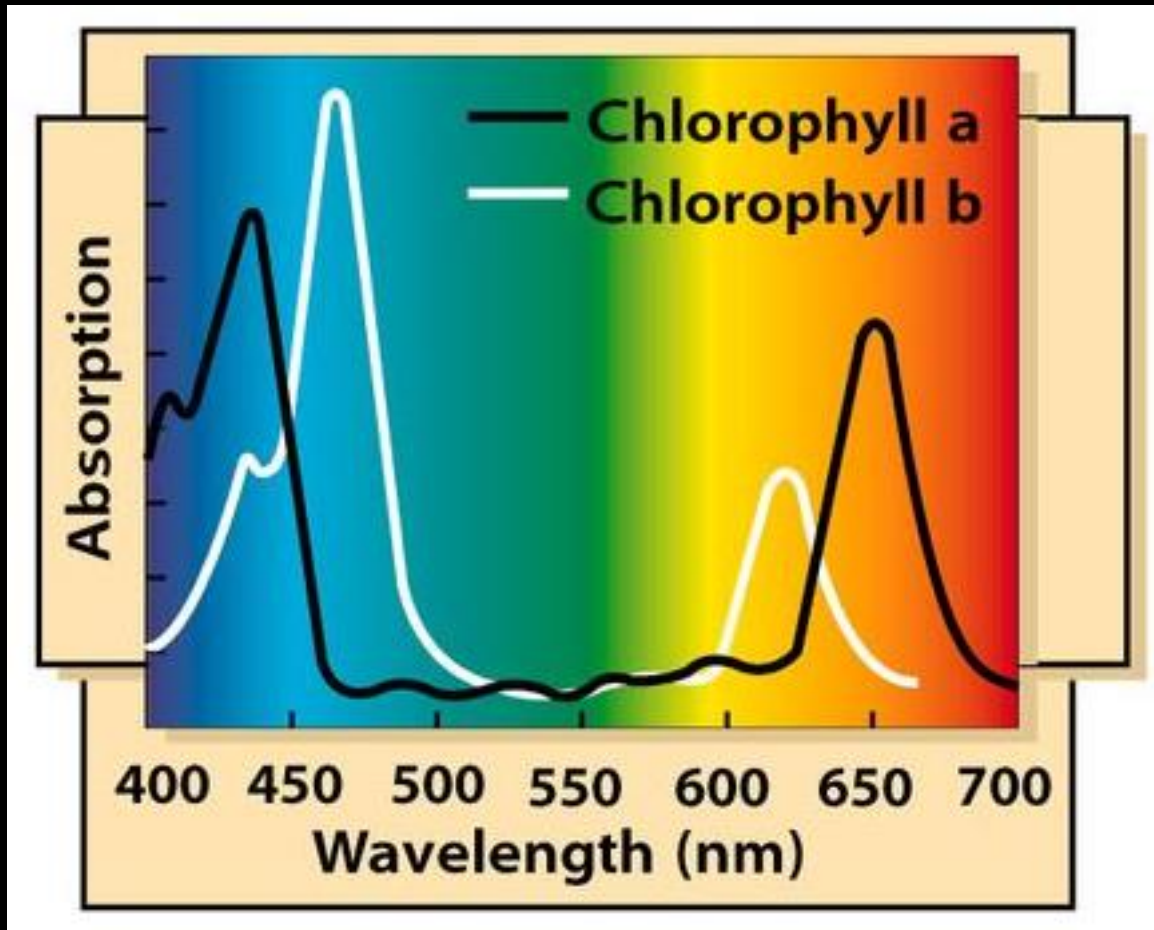
Visible light appears white, but it is made of a variety of colors = visible spectrum

# Pigments



**Chlorophyll** is a pigment in chloroplasts that absorbs the visible light for photosynthesis.

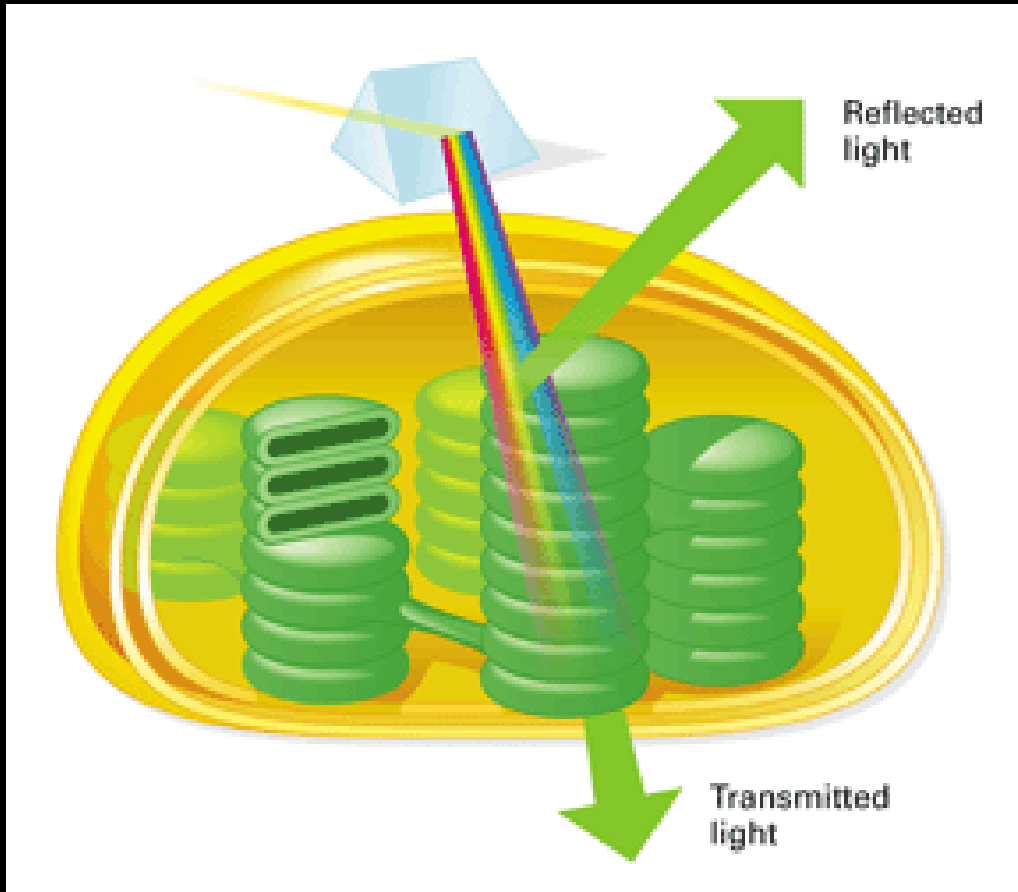
# Chlorophyll



Two Types:  
Chlorophyll a  
Chlorophyll b

Absorbs  
mostly red  
and blue light

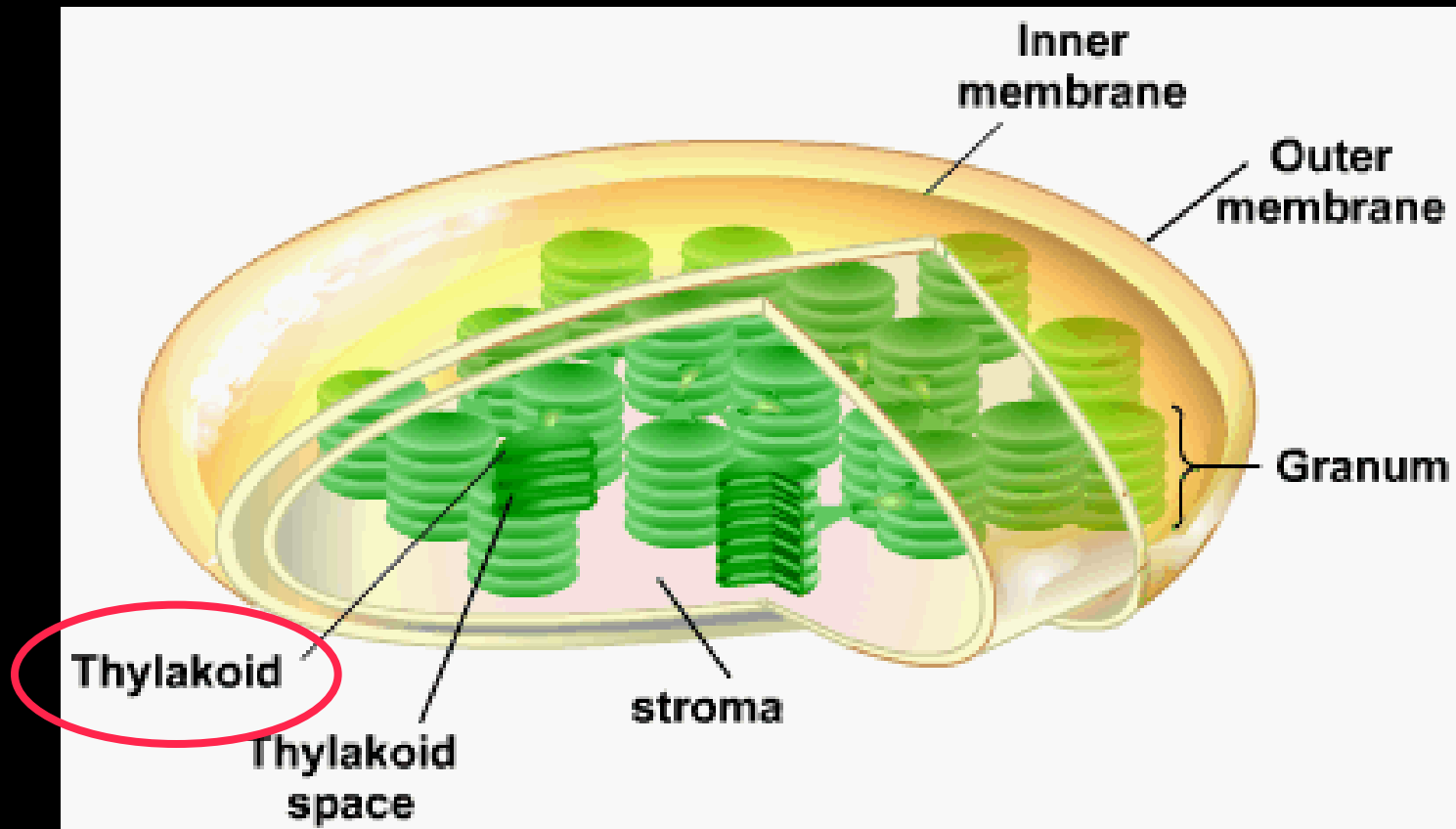
# Chlorophyll



Chlorophyll  
does not  
absorb green  
light

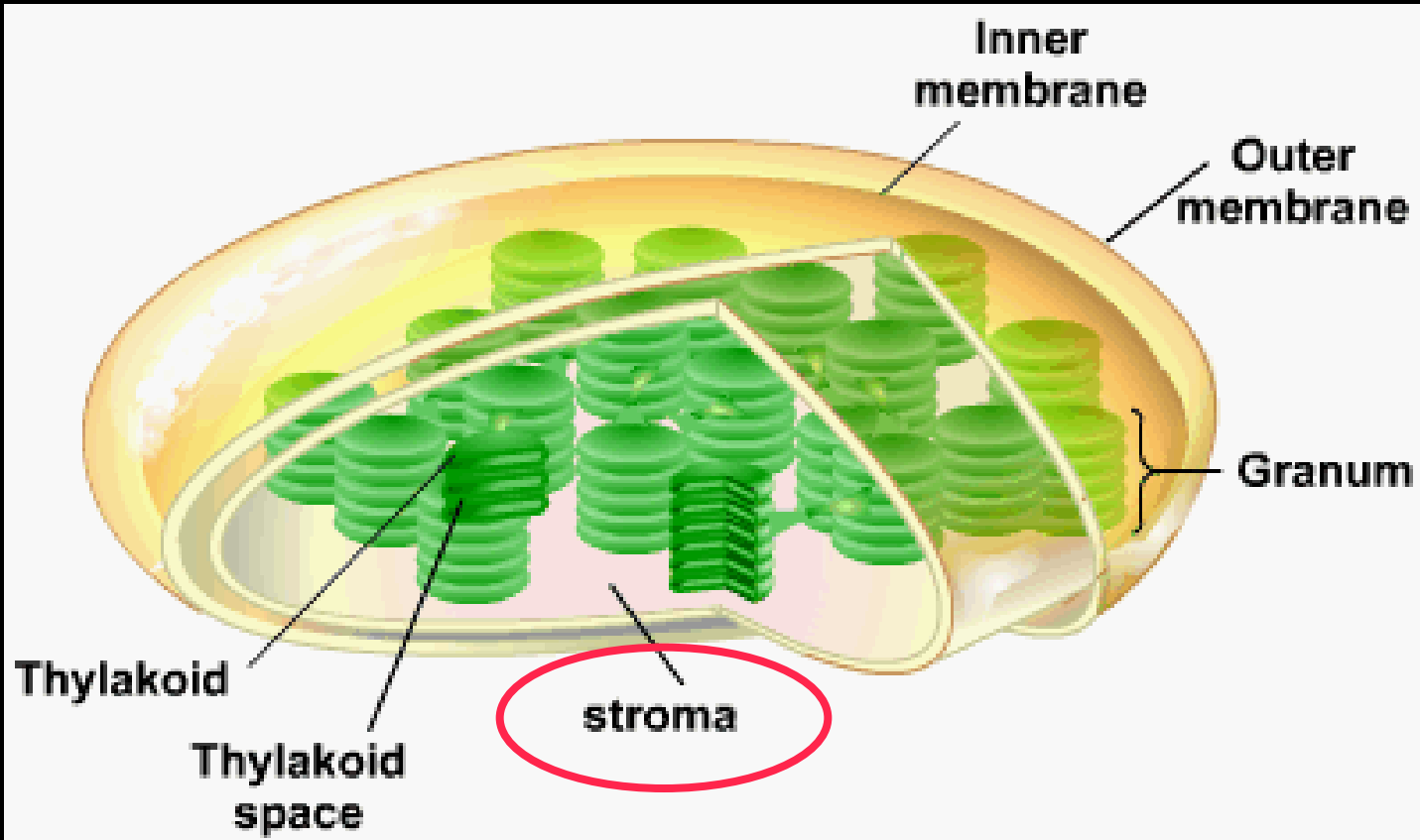
Green color is reflected

# Thylakoid



Thylakoids are membrane compartments that contain chlorophyll. The Light-dependent reaction occurs here.

# Stroma



The stroma is the area outside the thylakoids where the Calvin Cycle takes place.

# YouTube Video

## Chloroplast Structure and Function

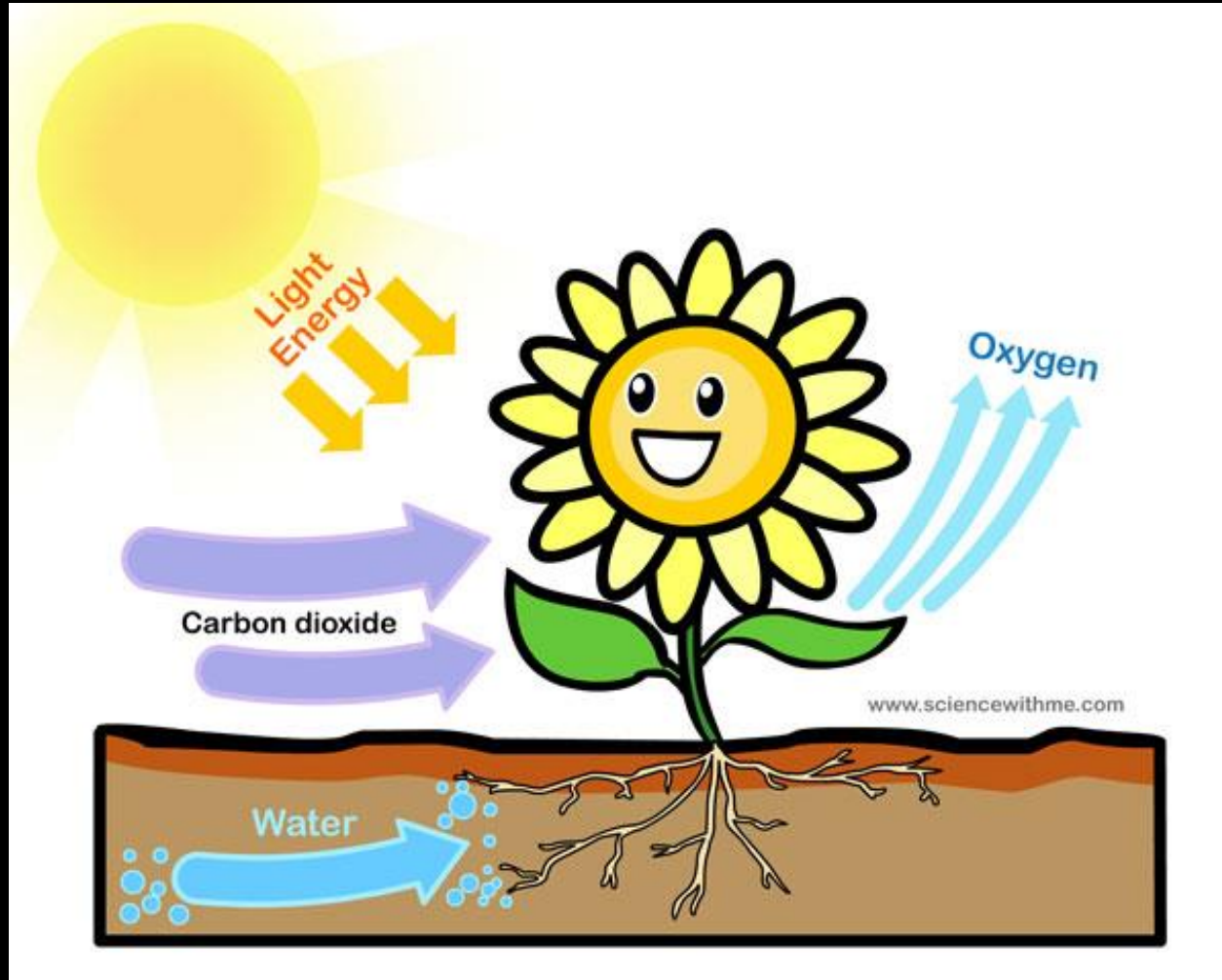


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# Photosynthesis Notes

## Part 2

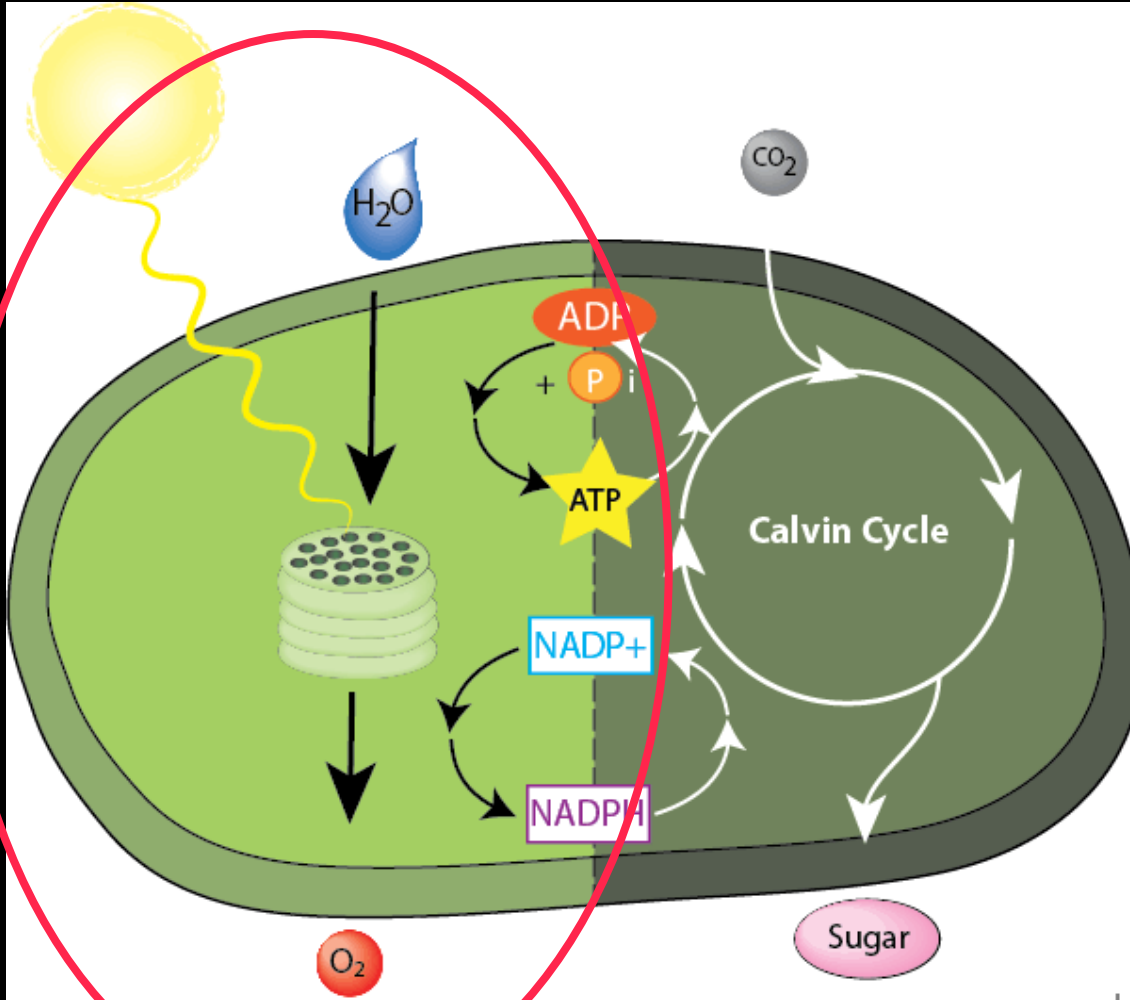


# Learning Objectives

- Describe what happens in the light-dependent reaction
- Explain what the Calvin Cycle is
- Identify the factors that affect the rate of photosynthesis

# First Stage of Photosynthesis

## Light-Dependent Reaction



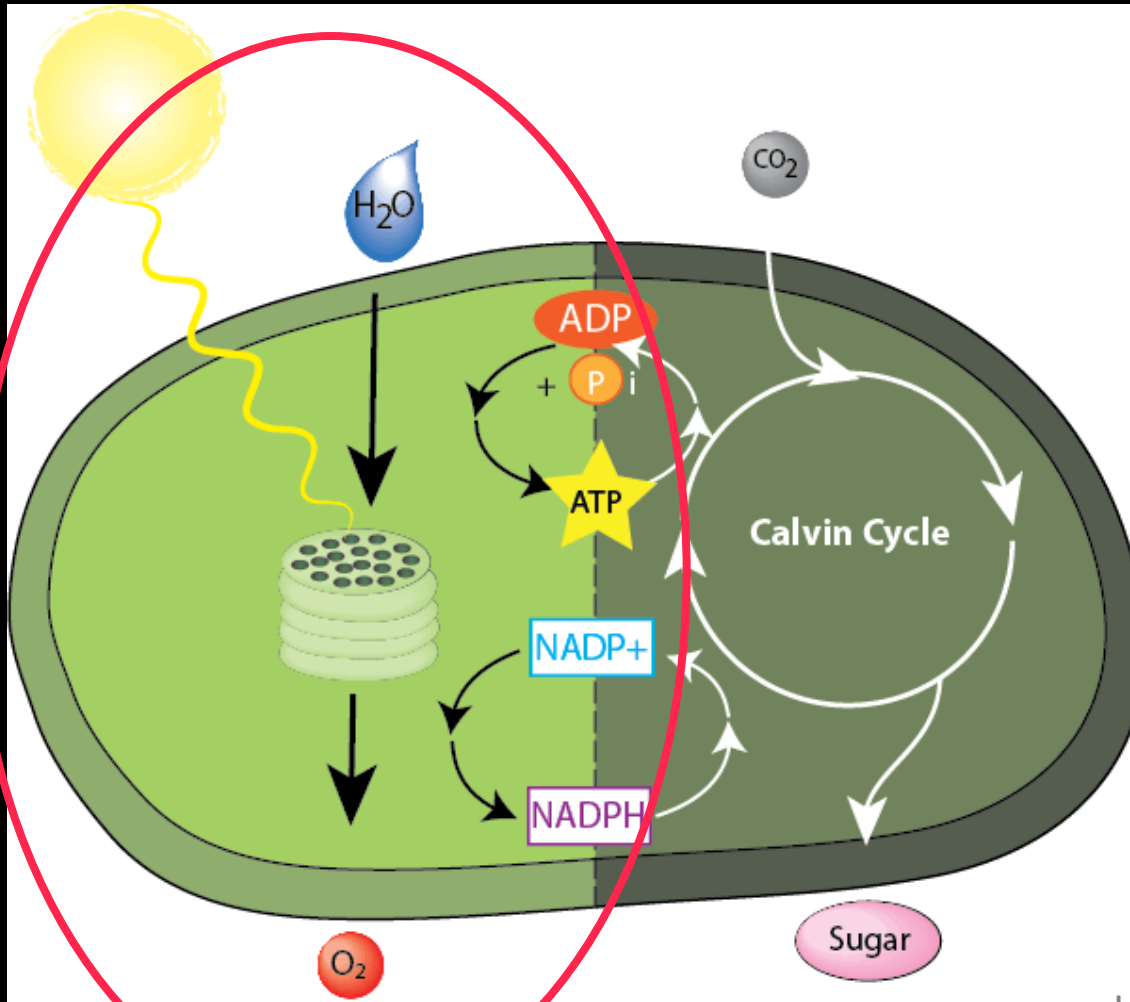
Takes place in the thylakoids

Chlorophyll captures sun's energy

Water molecules are broken down

Produces oxygen, energy (ATP), and NADPH (electron carrier)

# Goal of the Light-Dependent Reaction

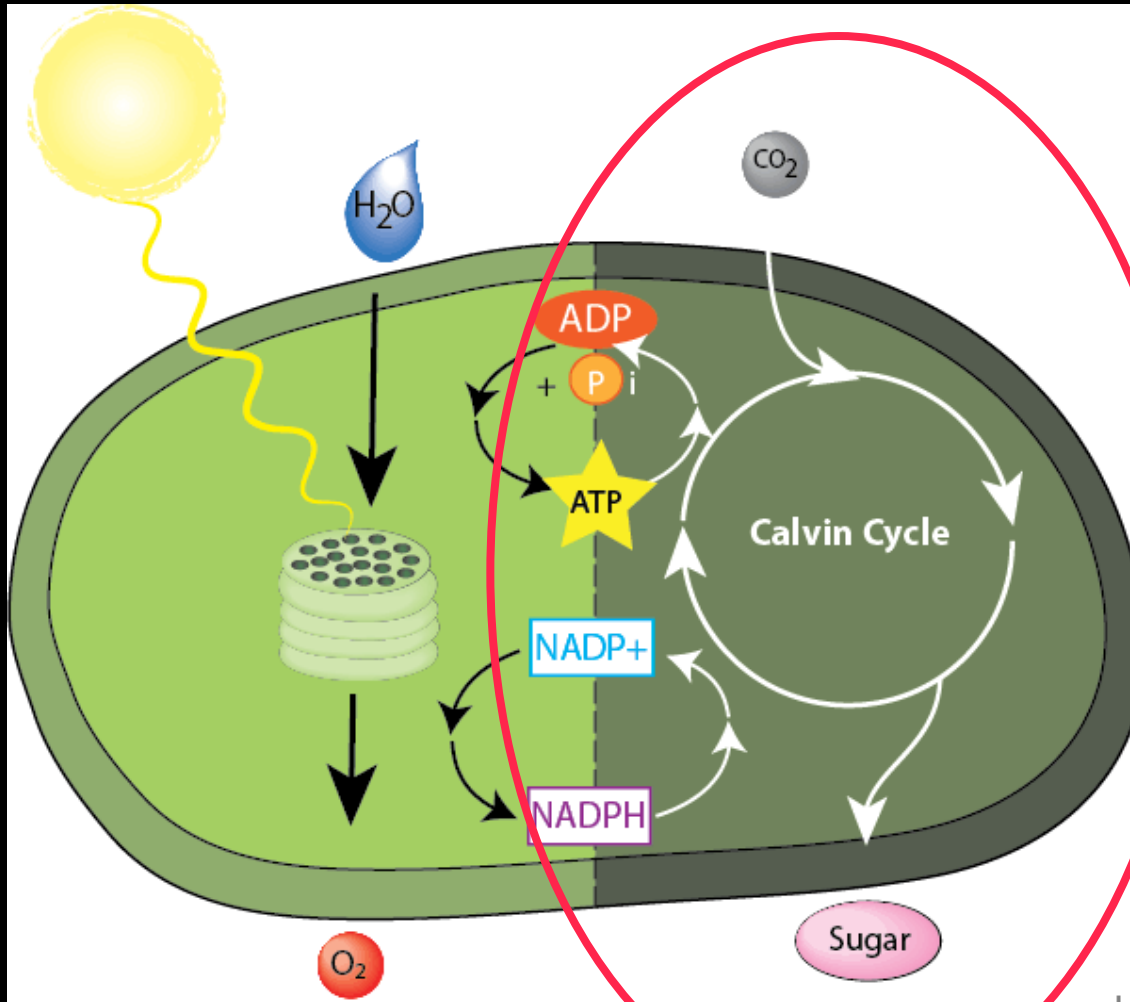


The light-dependent reaction **makes ATP and NADPH** for the Calvin Cycle.

The by-product is oxygen.

# Second Stage of Photosynthesis

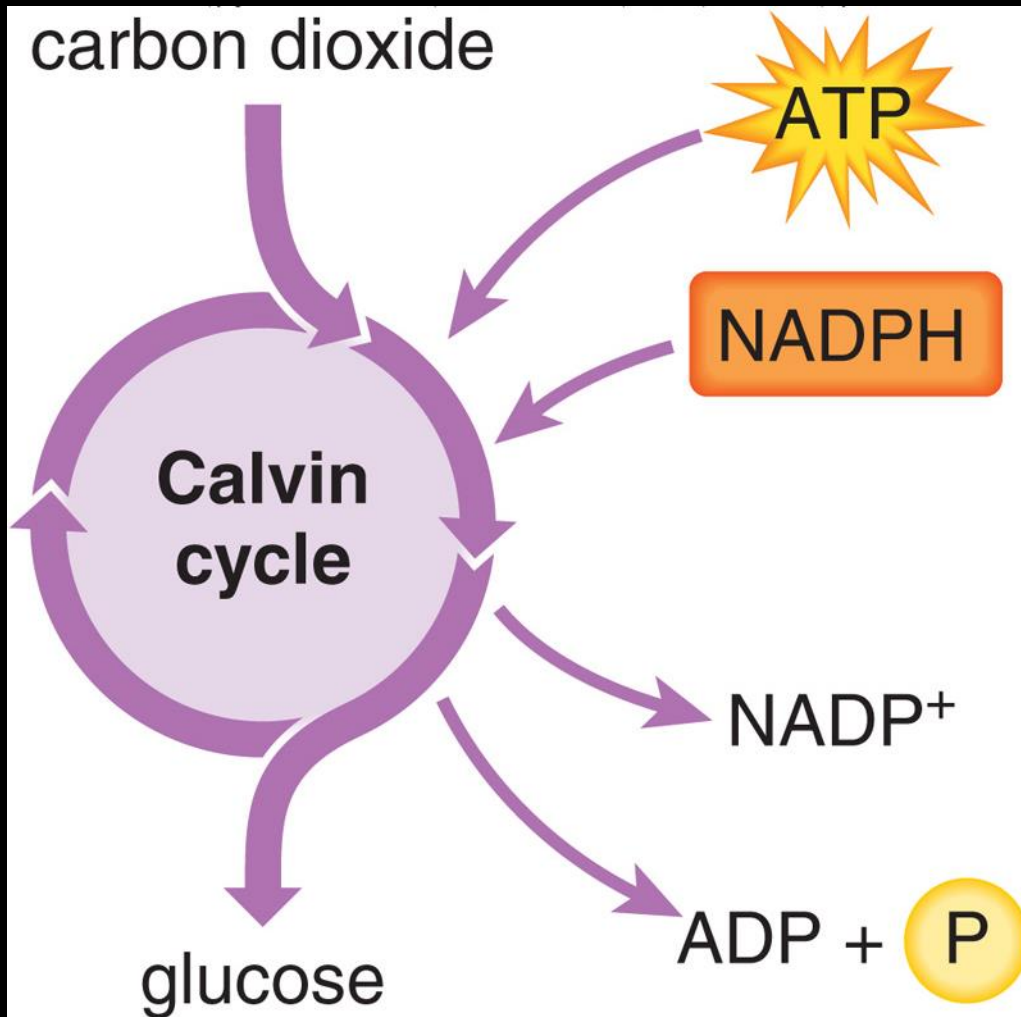
Light-Independent Reaction aka Calvin Cycle



Takes place in the stroma

Does not require light

# Light-Independent Reaction aka Calvin Cycle



CO<sub>2</sub>, ATP and NADPH enter the Calvin Cycle

NADP<sup>+</sup> and ADP return to the light reactions

**Glucose is produced**

# Functions of Photosynthesis



Produces food for  
all organisms



Removes  $\text{CO}_2$   
from atmosphere



# Factors that Affect Photosynthesis

Water

Carbon Dioxide

Light Intensity

Temperature

YouTube  
Photosynthesis

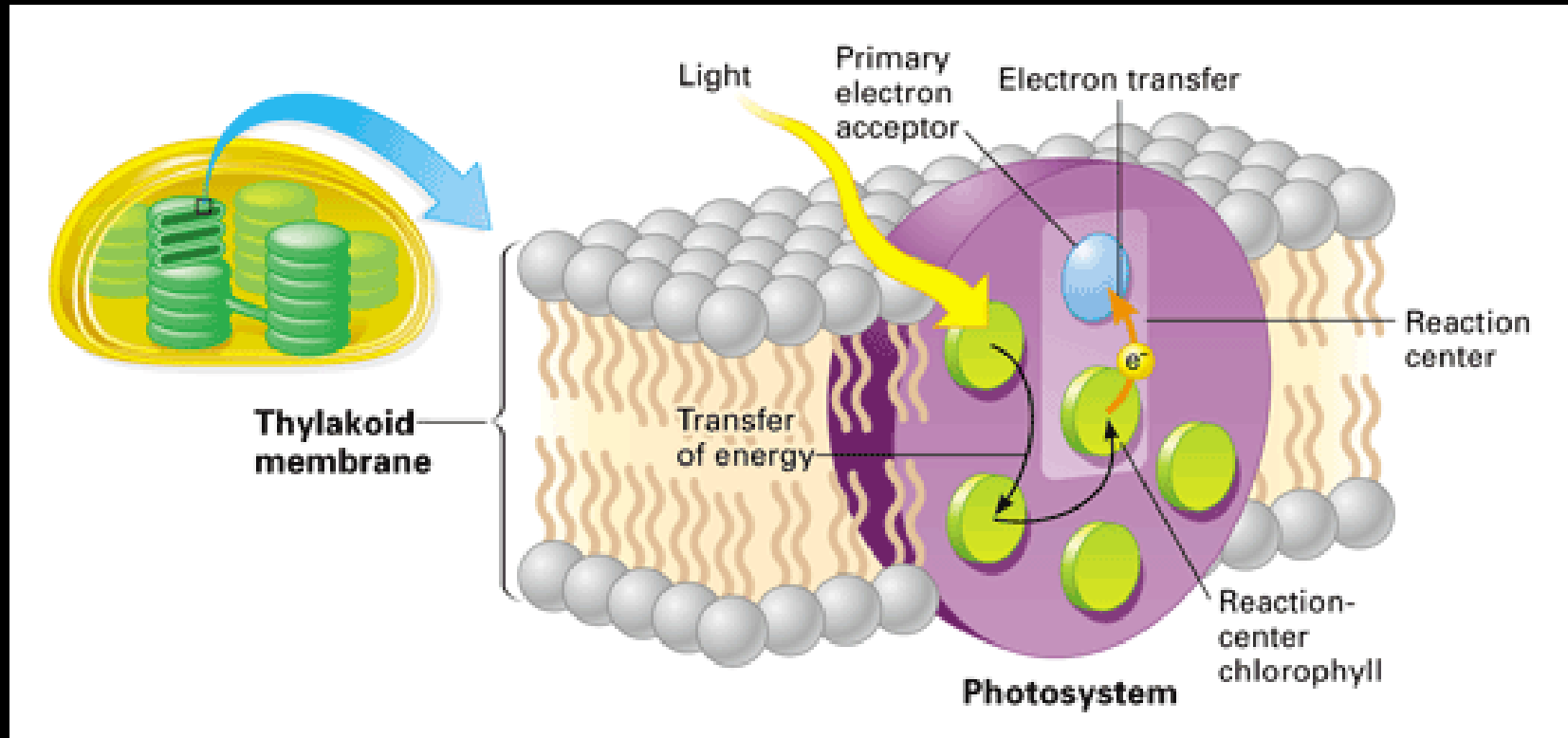
# YouTube Video

Light Reaction and  
the Calvin Cycle

Stop Here

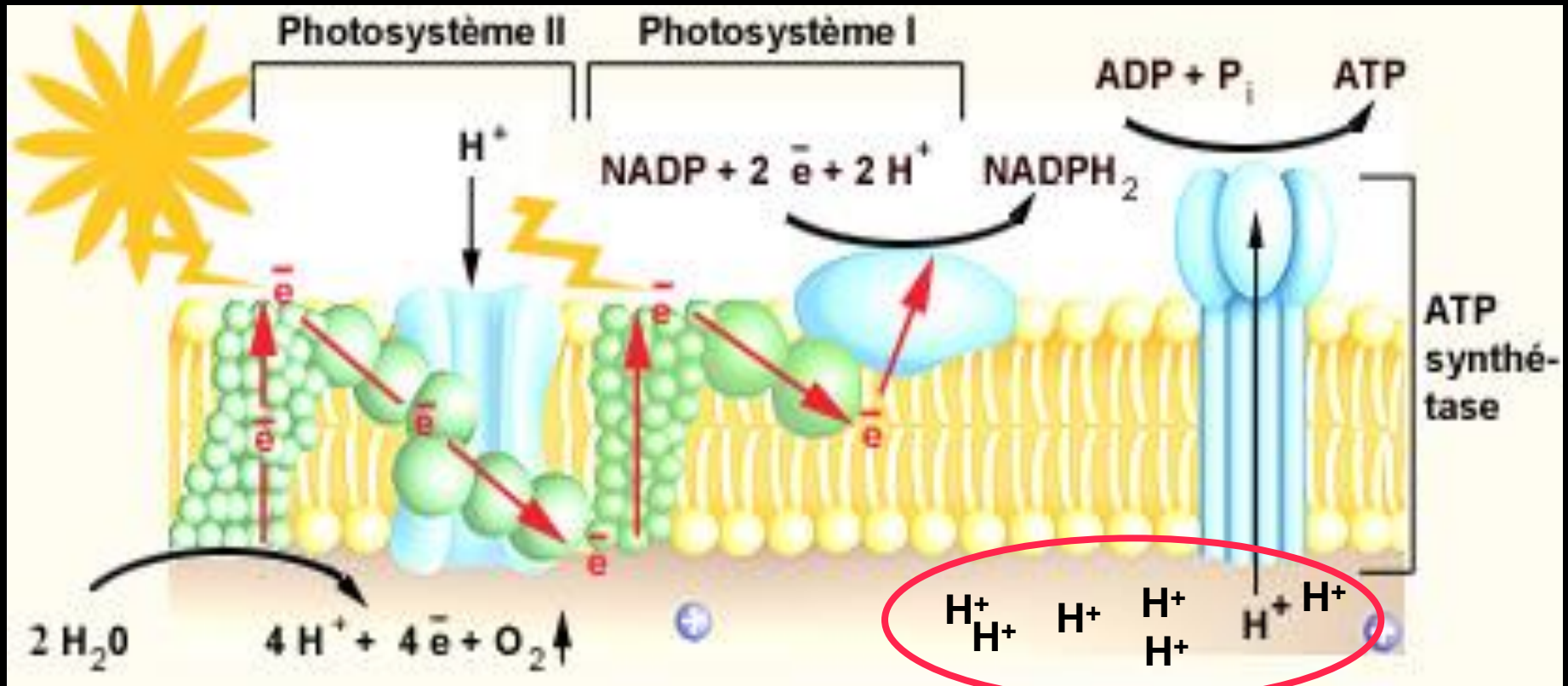


# Light-Dependent Reaction



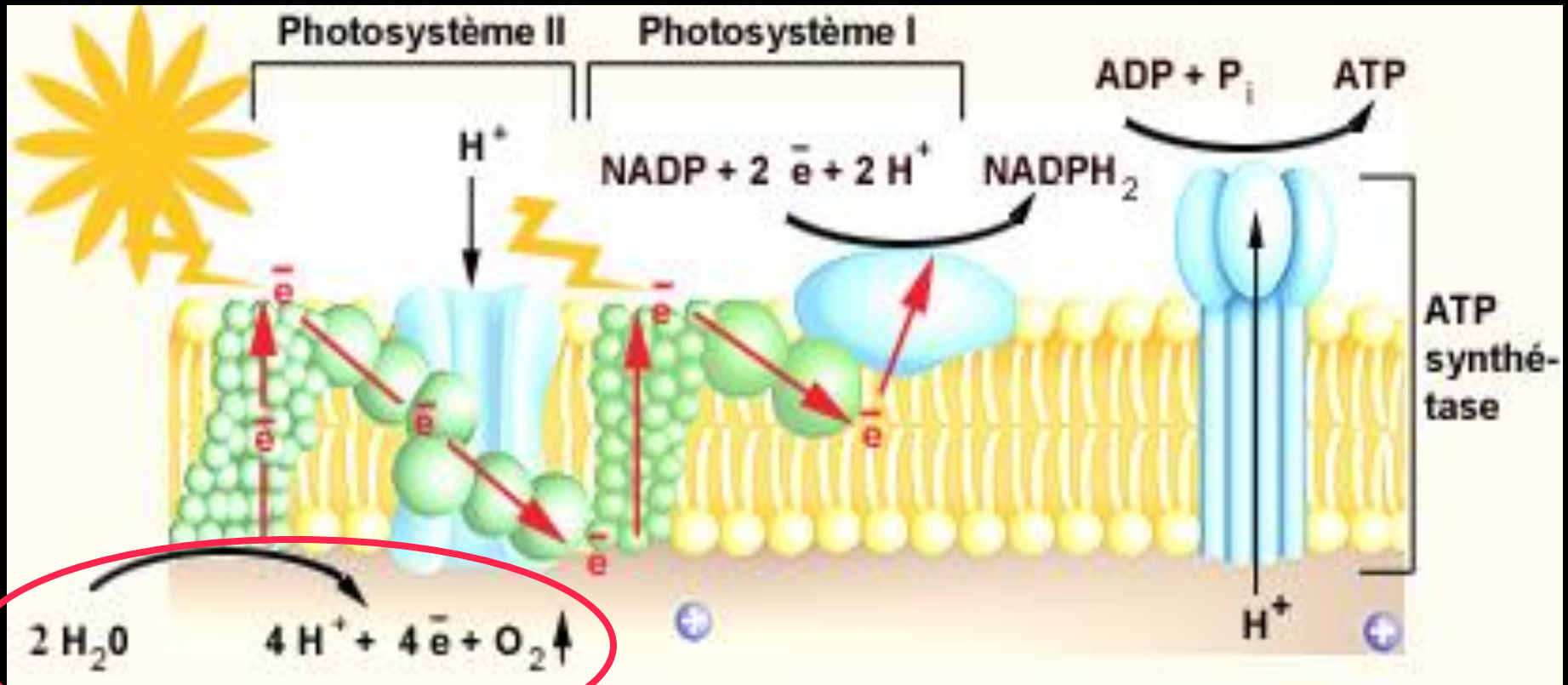
Pigment molecules in each photo system absorb light and transfer its energy to the reaction center. Electrons are emitted.

# Light-Dependent Reaction



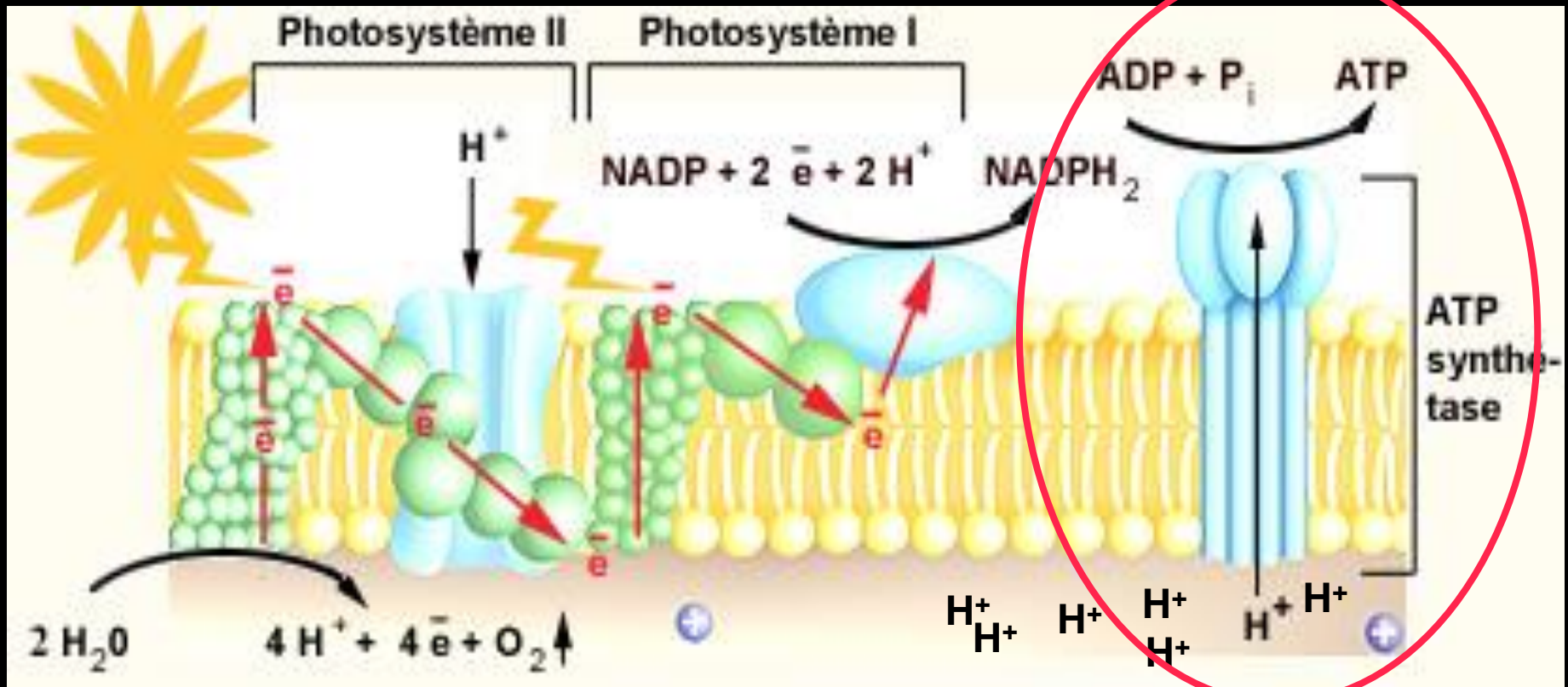
As electrons flow along the electron transport chain, protons are transported to the inside of the thylakoid.

# Light-Dependent Reaction



At the reaction center of PSII, water is split, freeing electrons ( $e^-$ ), protons ( $\text{H}^+$ ) and oxygen ( $\text{O}_2$ ).

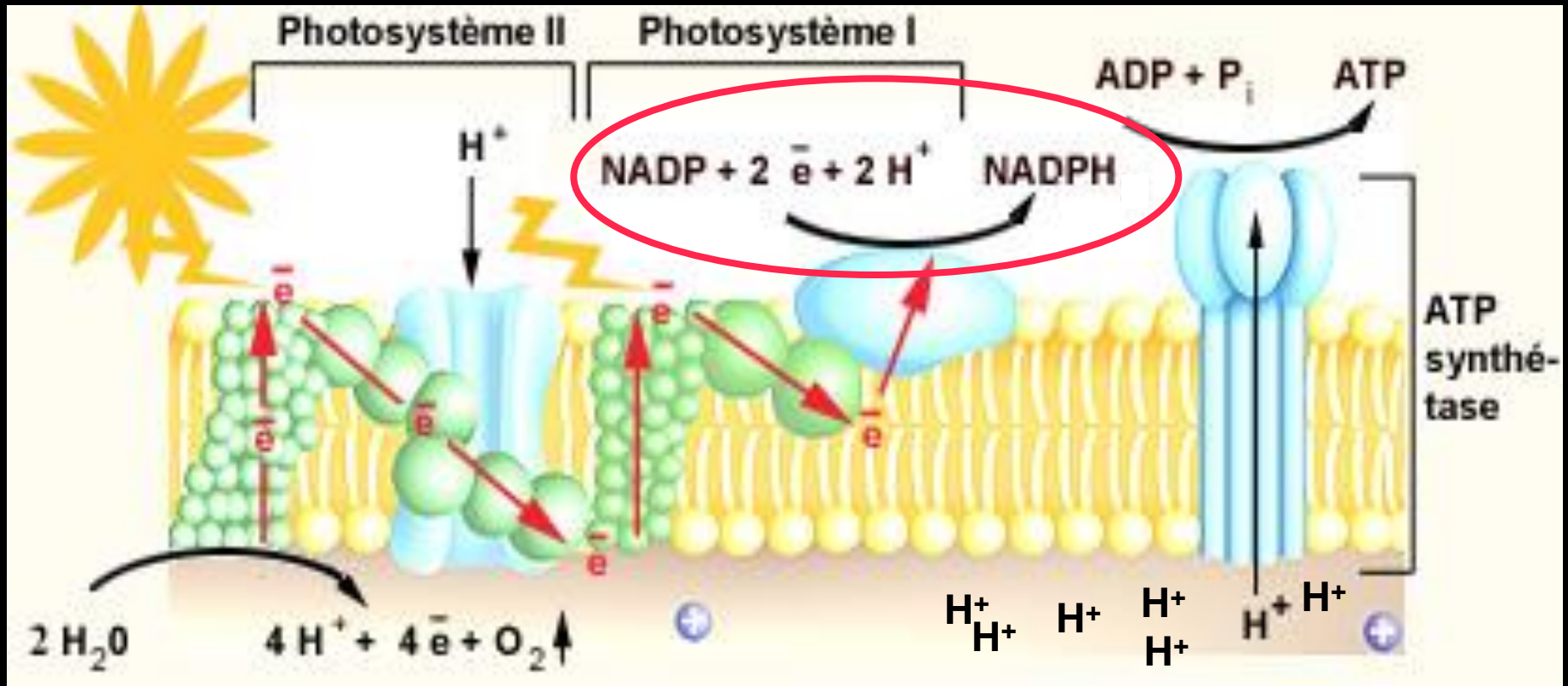
# Light-Dependent Reaction



The proton gradient drives ATP synthase to make ATP.



# Light-Dependent Reaction



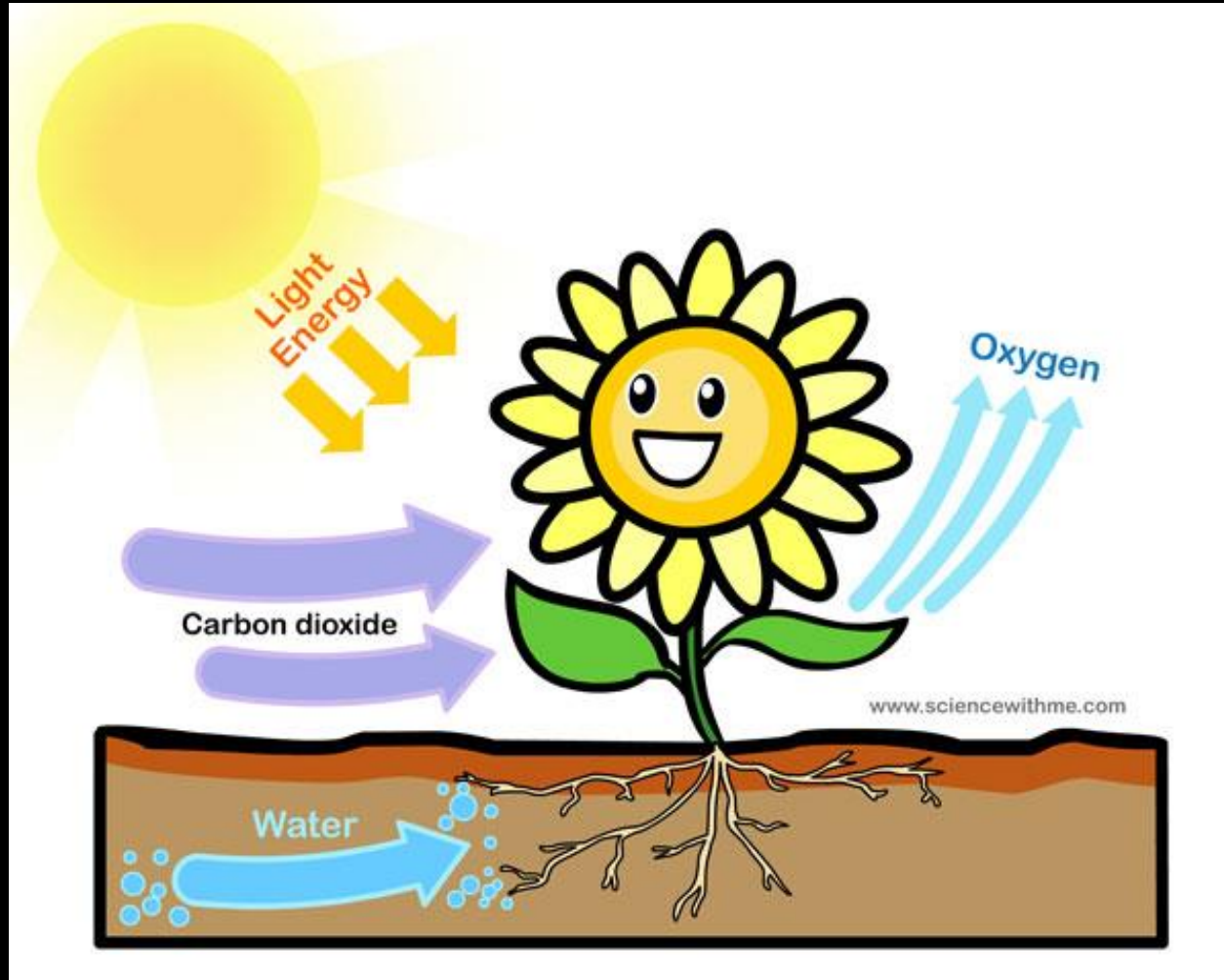
Electrons and protons join  $\text{NADP}^+$  to make NADPH.

YouTube Video

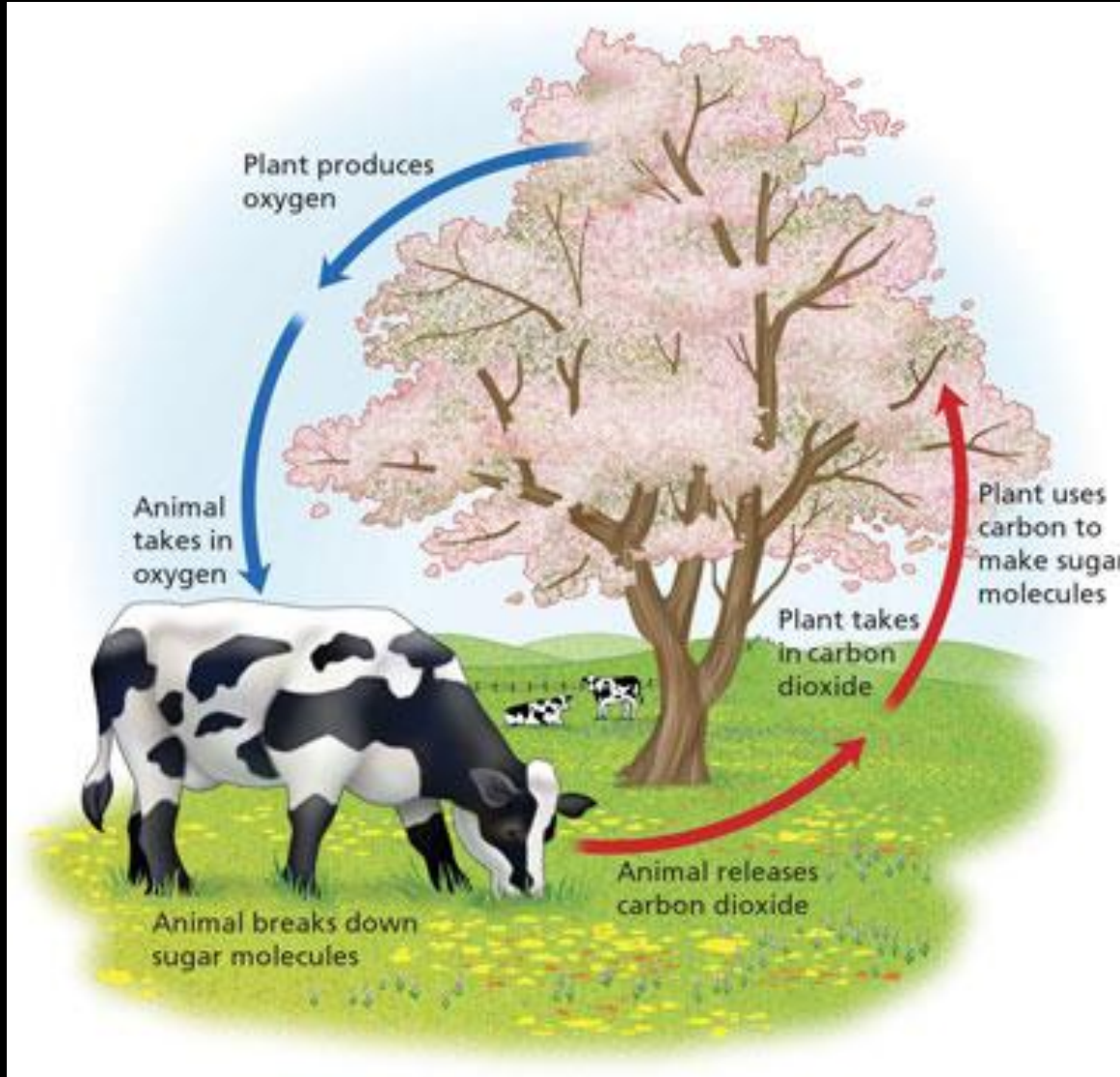
Photosynthesis Animation

# Photosynthesis Notes

## Part 3



# The Cycle



1. Plant produces oxygen and sugar
2. Animal uses oxygen and sugar made by a plant to make energy
3. Animal releases carbon dioxide
4. Plant uses carbon dioxide to make sugar and oxygen

YouTube Video

ATP Synthase