UNIT 6
PLANTS AND PHOTOSYNTHESIS

LIFE

Fly

WHAT IS A PLANT?

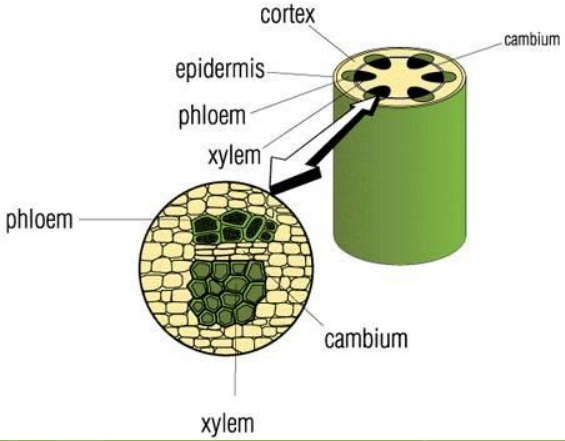
PLANTS ARE MULTICELLULAR EUKARYOTES THAT PRODUCE THEIR OWN FOOD THROUGH PHOTOSYNTHESIS!

Movement of Materials

How do plants get what they need?

- Long distance transport of water and minerals occurs in the **xylem**.
  - A water pressure differences between moist soil and drier air drive the upward movement of water in plants.

- **Xylem:** a specialized conducting tissue in plants that transports water and minerals.

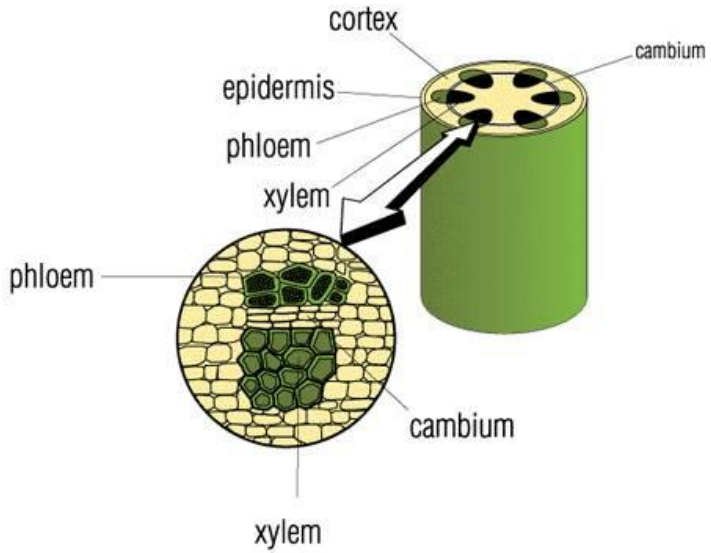


Movement of Materials continued…

Long distance transport of organic molecules (mainly sugar) occurs in the **Phloem.**

Phloem: the specialized portion of the plant's vascular tissue that transports organic molecules throughout the plant

Movement is caused by the difference in pressure of the source of sugar to the sink of sugar (where it is used)

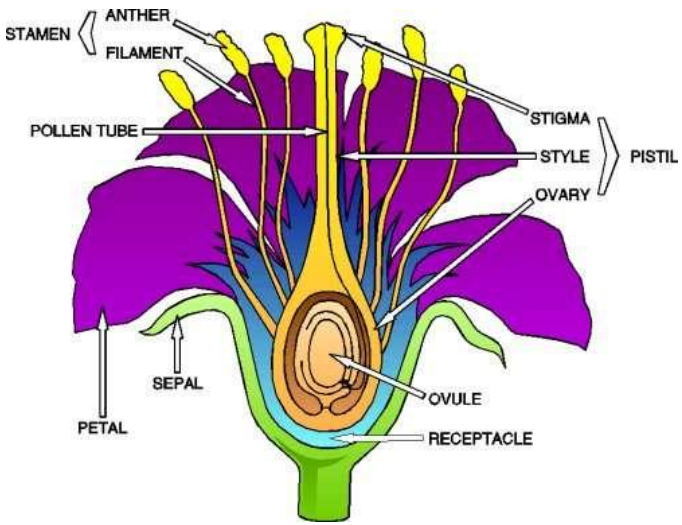


Reproduction

Plants have the ability to reproduce sexually, the process in which two gametes fuse to produce offspring that have unique combinations of genes.

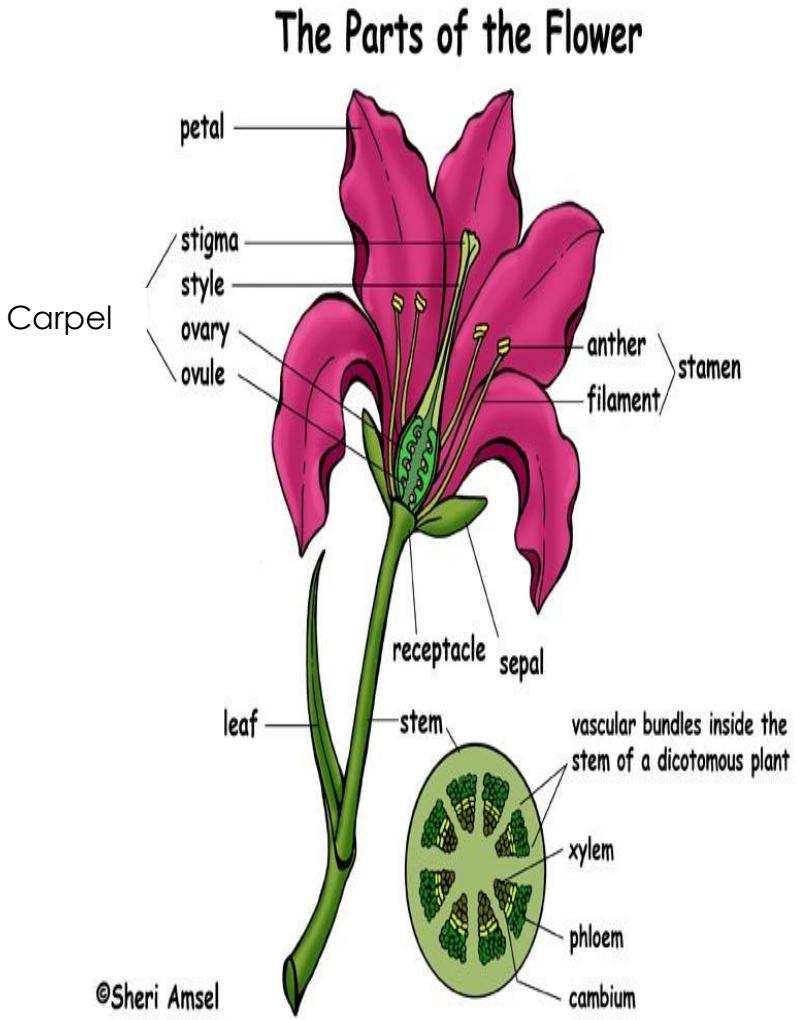
A flower is defined as a reproductive shoot, a stem branch that produces reproductive organs. A flower produces 4 types of organs:

1. Sepals
2. Petals
3. Stamens
4. Carpels



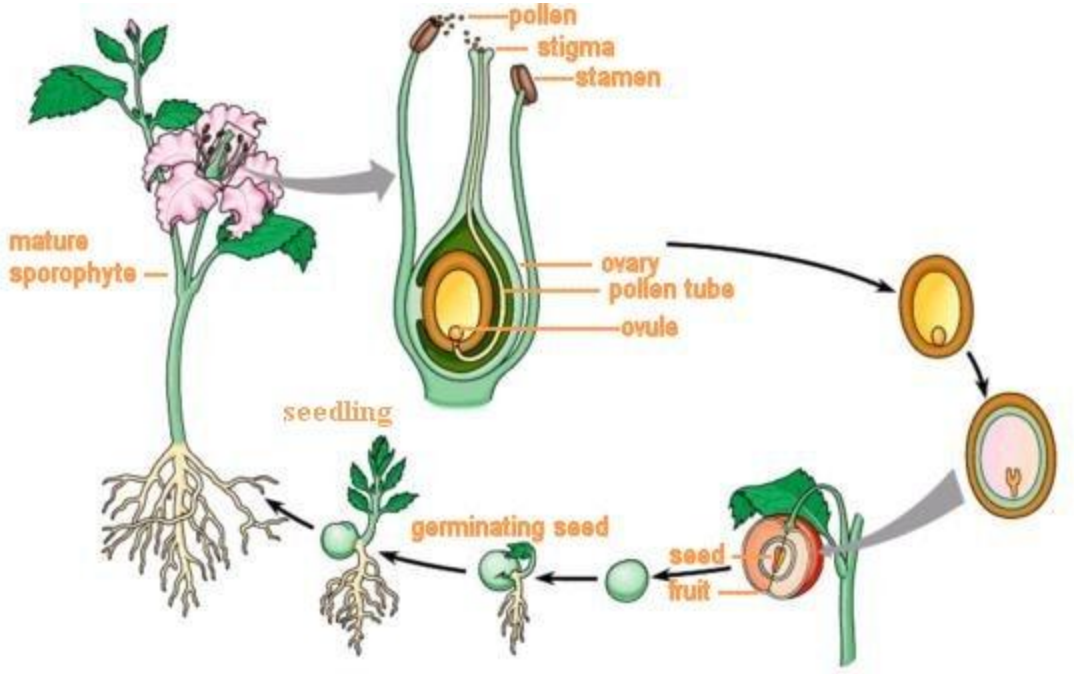
Reproduction continued

1. Sepals: *function to protect the unopened flower bud*
2. Petals: *serve to attract insects or animals for pollen transport*
3. Stamens: *produce the male gametophyte that later develops into sperm cells*
4. Carpels *produce the female gametophyte that develop into egg cells.*

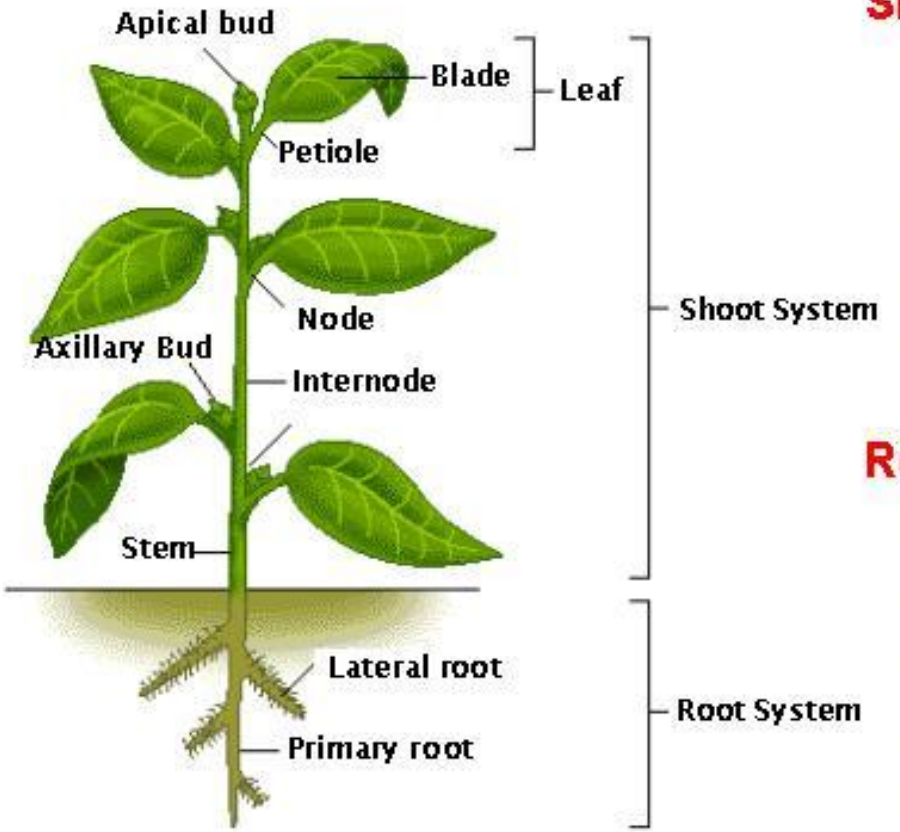


Reproduction continued….

The transfer of pollen (carrying the sperm) from the male reproductive structure of a plant to the female reproductive structure (egg) is called pollination. A tube enables the sperm to pass directly to an egg, this fusion is called fertilization. *A seed is formed and dispersed so that it can develop into a new plant!*



The Plant Body Consists of the Shoot System and the Root System

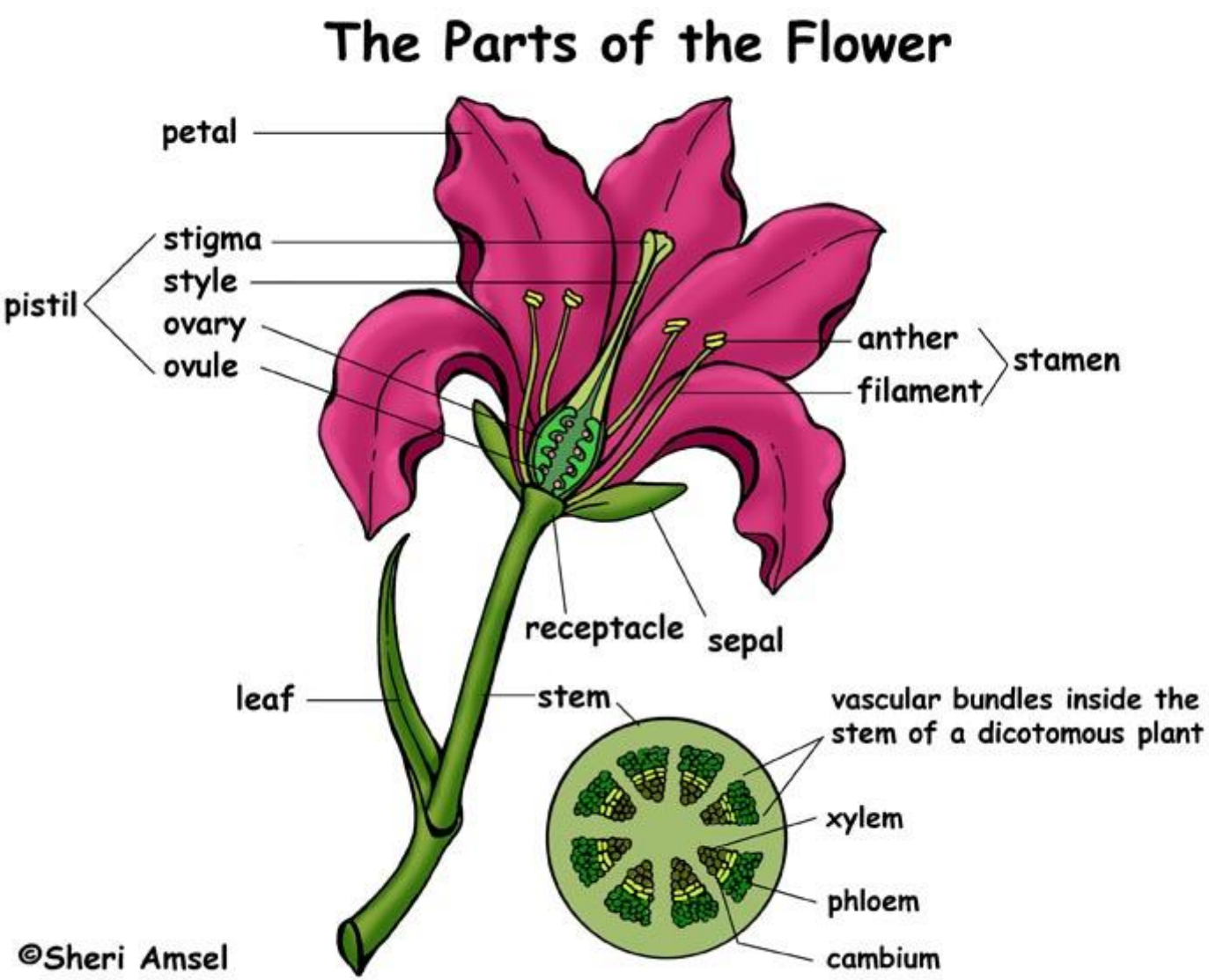


Shoot System - Functions

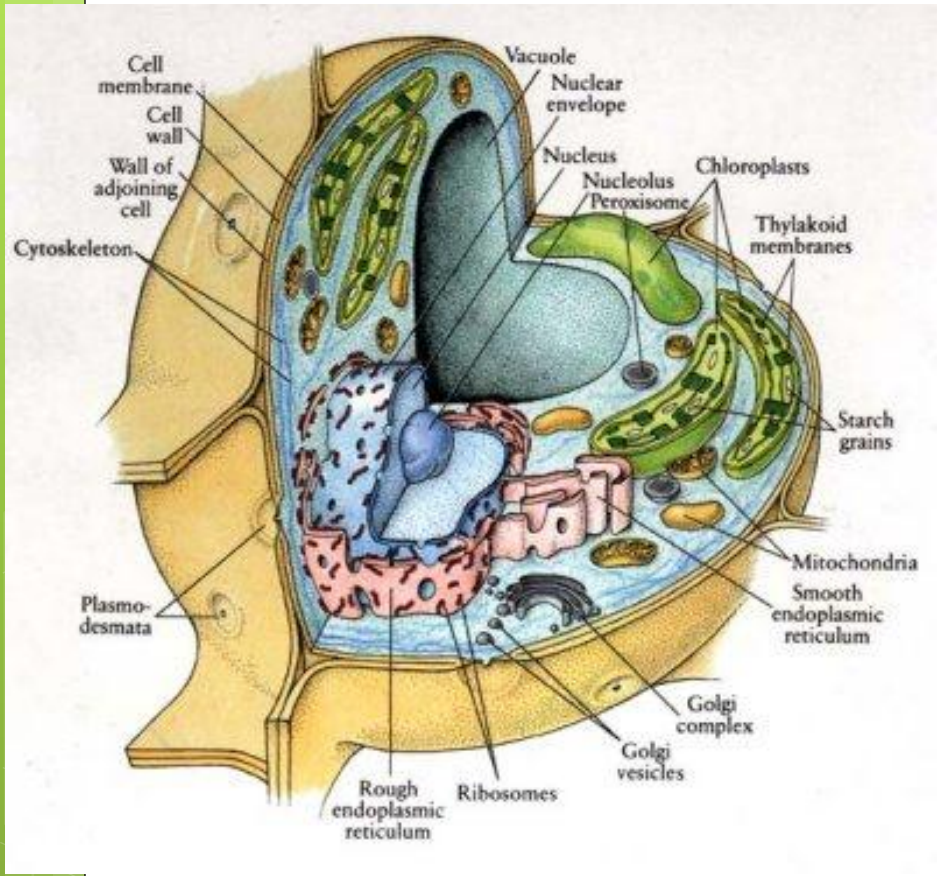
- Photosynthesis
- Reproduction
- Storage
- Transport
- Hormones

Root System - Function

- Anchorage
- Absorption
- Storage
- Transport
- Hormones


The Parts of the Flower
petal
stigma
style
pistil
ovary
ovule
anther
filament
stamen
receptacle
sepal
leaf
stem
vascular bundles inside the stem of a dicotomous plant
xylem
phloem
cambium
©Sheri Amsel

SPECIFIC PLANT PARTS



Other than specialized reproductive and transport parts, cells have specific organelles that are different from other eukaryotic organisms:

Cell Wall: a rigid structure outside of the cell membrane that provides support and protection

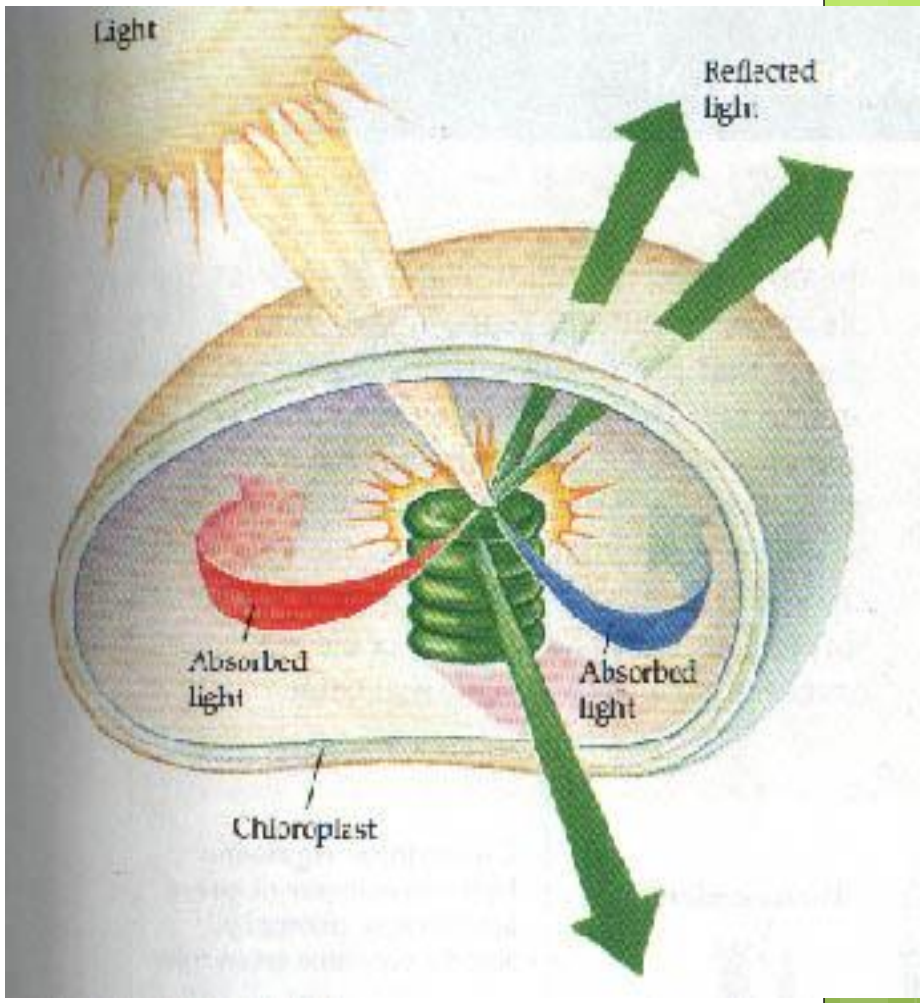
Chloroplasts: an organelle found in plants that carries out photosynthesis

pigments

A pigment is a substance that absorbs certain wavelengths of light and reflects others.

Light is absorbed by plants through pigments (just like our eyes!)

These pigments are located in the chloroplasts



Plant Pigments

Plants contain chlorophyll, a green pigment that absorb light energy used to start photosynthesis.

Chlorophyll absorbs blue and red lights and reflects yellow and green, which make plants appear green.

2 types of chlorophyll:

Chlorophyll *a*- appears bright green to blue green

Chlorophyll *b*- appears olive green

Plant Pigments Cont..

Another pigment in plants is Carotenoid. It absorbs blue and green light and reflects yellow, orange, and red light.

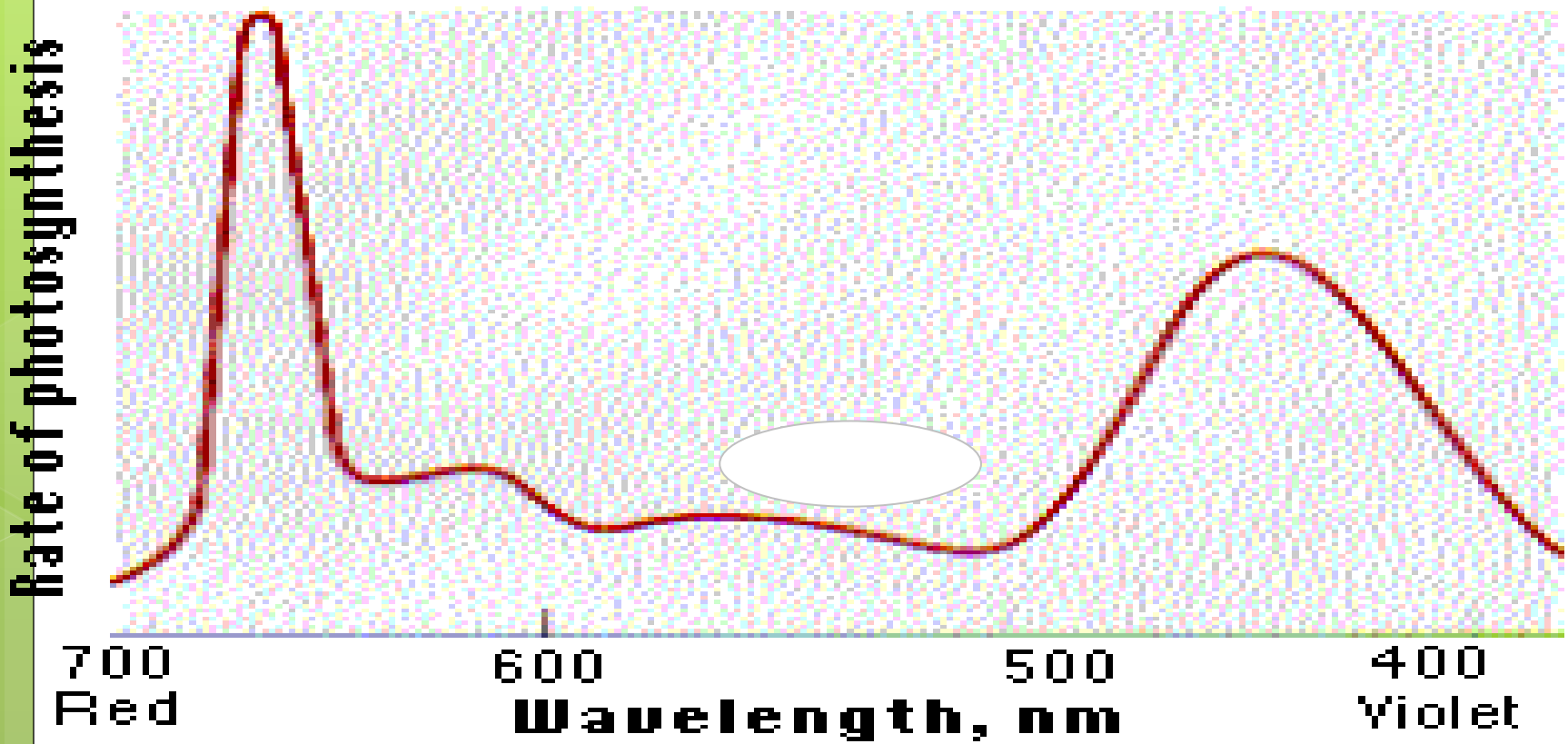
When chlorophyll fades away in the fall, the colors of the carotenoids are exposed. (Leaves changing colors!)

How to Read an Absorption Spectra

Where the curve peaks: much of the light at that wavelength is absorbed (least visible)

Where the curve dips: much of the light at that wavelength is reflected (most visible)

How to read an absorption spectra



red orange yellow green blue violet

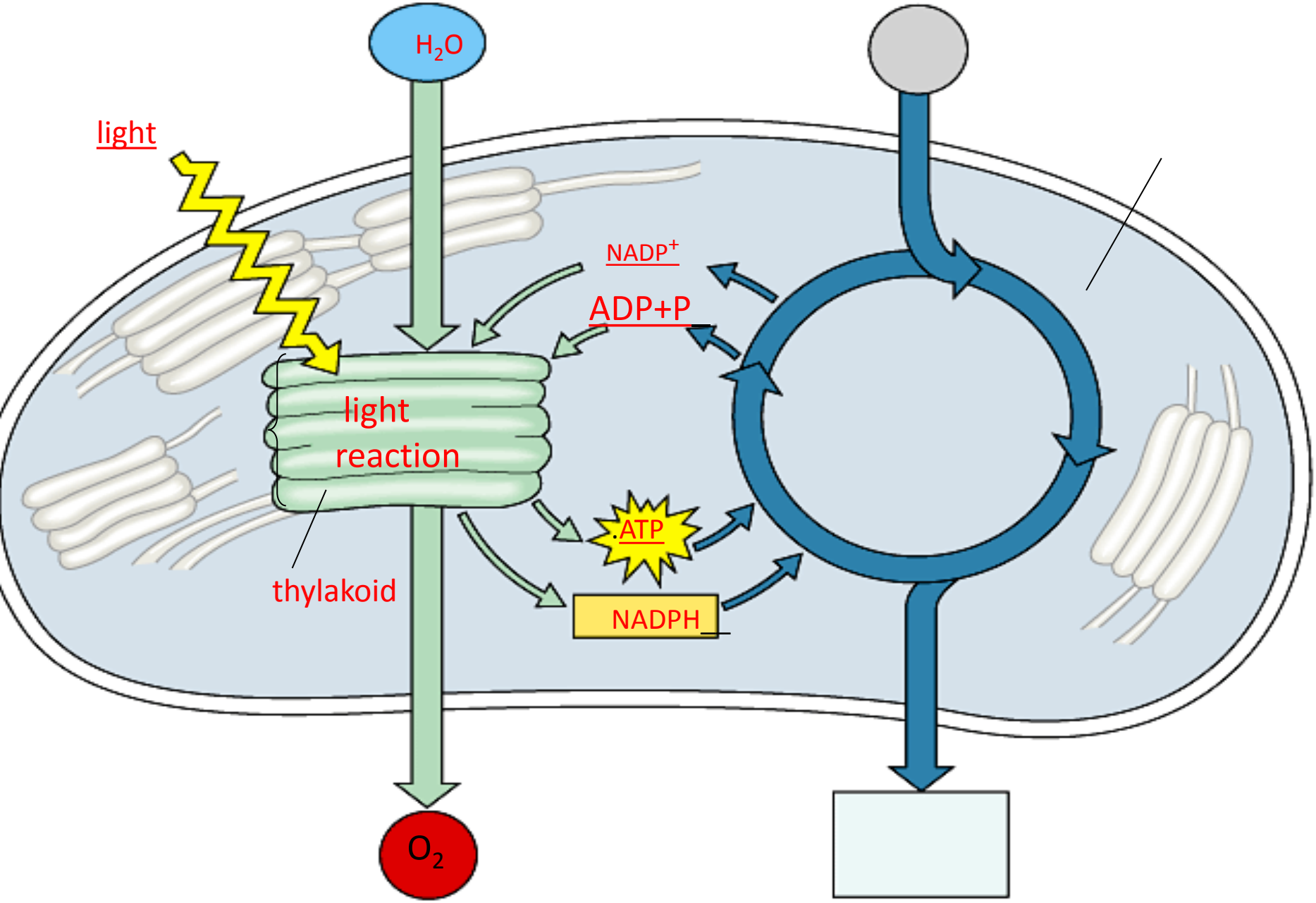
photosynthesis

The process in which plants convert light energy into chemical energy.

Light energy is absorbed by pigments in plants to provide energy for carbon dioxide and water to be converted into glucose and oxygen.

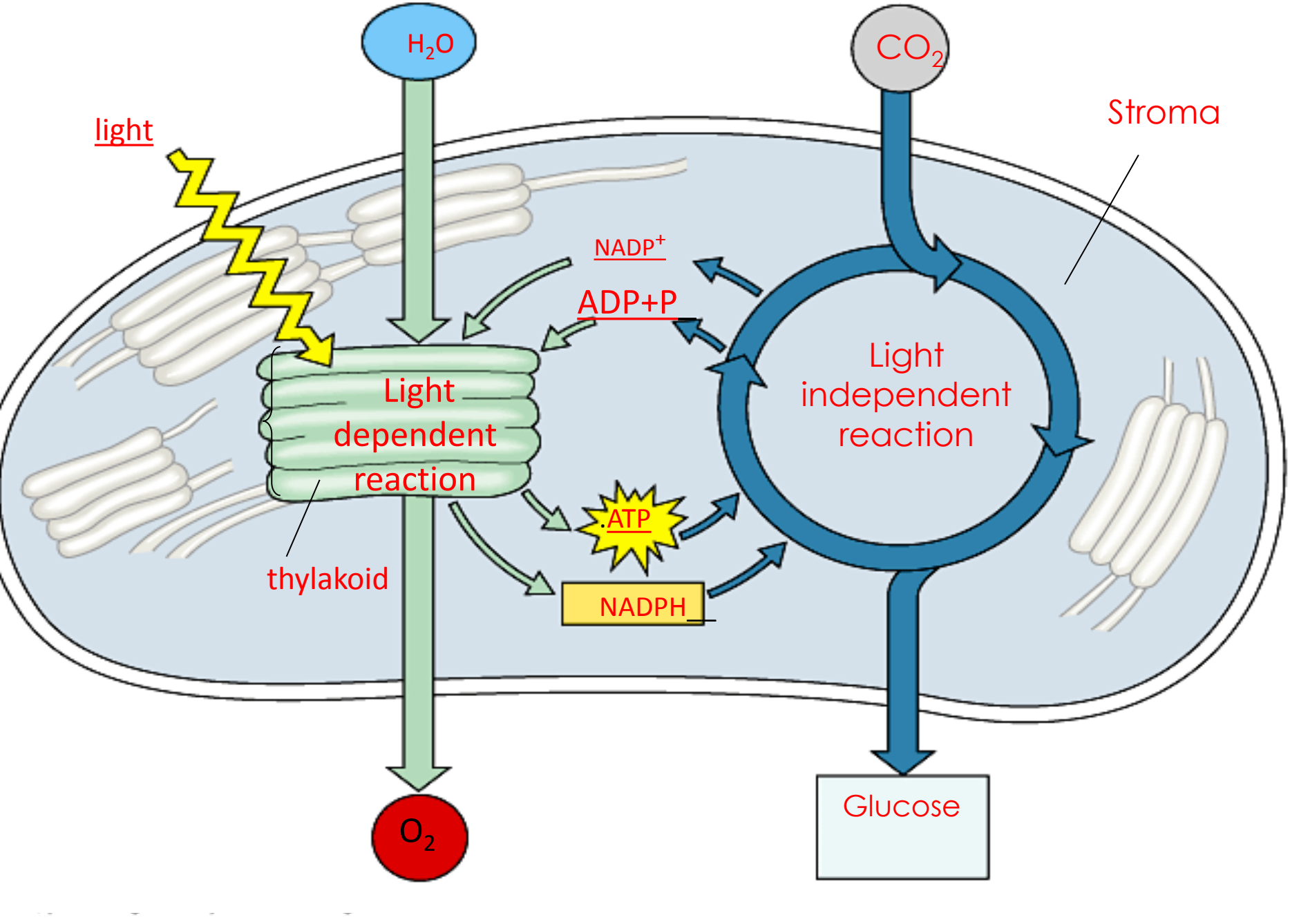
LIGHT DEPENDENT REACTION

1. Pigments absorb light. Energy is absorbed by electrons, increasing their energy and they are passed on to the electron transport chain (ETC). There is a constant supply of electrons from the splitting of water molecules in the thylakoid. (H_2O = 2 electrons, 2 H^+ and 1 O) Oxygen is not used for photosynthesis and is released to the atmosphere.
2. The high energy electrons carry the H^+. $NADP^+$ an electron carrier picks up the high energy electrons carrying the H^+ and becomes NADPH.
3. H^+ ions cannot cross the membrane directly. A protein in the membrane, ATP synthase allows H^+ to cross. As the protein rotates to move the H^+ ions across the membrane it binds ADP with a phosphate group to produce ATP.
4. NADPH and ATP are passed on to the Calvin Cycle or Light independent cycle to finish photosynthesis.


H_2O
light
$NADP^+$
ADP+P
light
reaction
thylakoid
ATP
NADPH
O_2

LIGHT INDEPENDENT REACTION

- Called the dark reaction because light is not a reactant (DOES NOT NEED LIGHT)
- With the ATP and NADPH from the light dependent reaction, CO_2 from the atmosphere is cycled through the stroma 6 times making a glucose ($C_6H_{12}O_6$) molecule.


H_2O
CO_2
light
Stroma
$NADP^+$
ADP+P
Light dependent reaction
Light independent reaction
ATP
NADPH
thylakoid
O_2
Glucose

Rate of photosynthesis

Certain environmental factors can affect the rate at which a plant can photosynthesize:

Light intensity: the rate of photosynthesis increases as light intensity increases until all of the pigments in a chloroplast are being used.

Carbon dioxide concentration: as the concentration of environmental CO_2 increases, the rate of photosynthesis increases. Once a certain level is reached, it will not proceed any faster.

Temperature: photosynthesis is most efficient in a certain range of temperatures, because photosynthesis involves many enzymes, unfavorable temperatures will cause the enzymes to not function.

COMPARING PHOTOSYNTHESIS AND CELL RESPIRATION

Equation for photosynthesis:

$$\text{Energy} + 6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$$

Equation for aerobic cellular respiration:

$$6O_2 + C_6H_{12}O_6 \longrightarrow 6H_20 + 6CO_2 + 36ATP$$