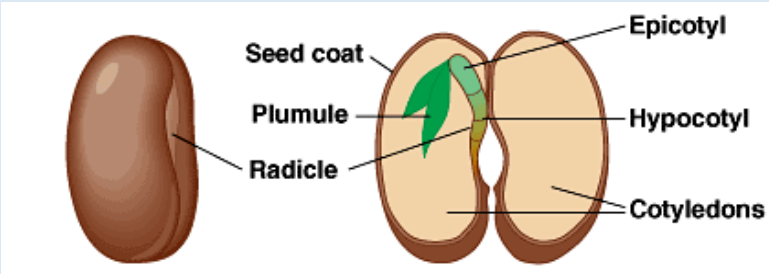
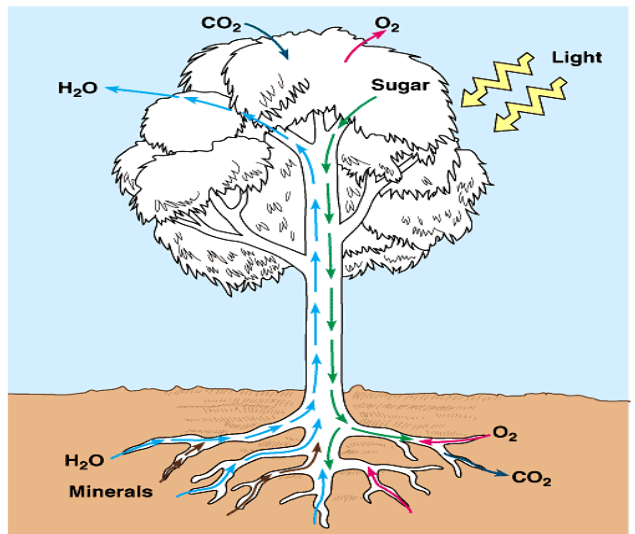


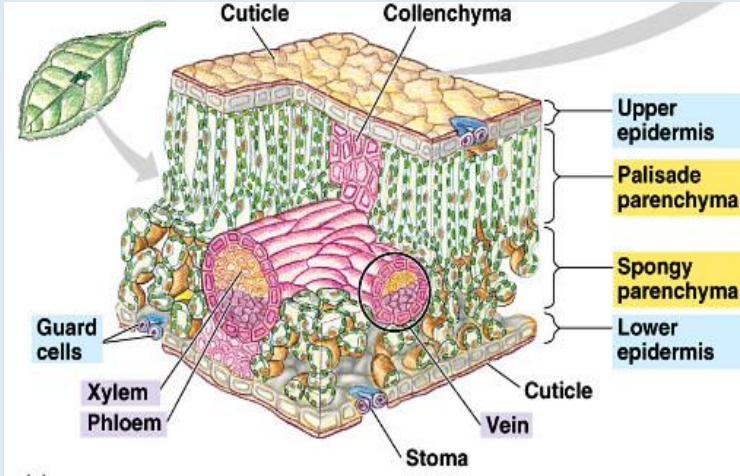
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Plant



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(a)
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Heterotroph vs. Autotroph

1. Organisms that can not make their own food are **heterotrophs**

Example: **some bacteria, mushrooms, animals**

2. Organisms that make their own food are **autotrophs**

Example: **some bacteria, algae, plants**

Types of Autotrophs

There are two types of autotrophic organisms, those that use **chemicals** to make food, and those that use **light** to make food;

1. **Chemosynthesis** –instead of using light energy to make organic compounds, they use energy from other chemical compounds. They turn carbon dioxide and inorganic substances like nitrogen (NH_3) and sulfur (H_2S) into the food they need. (Organisms at the bottom of the ocean)

Types of Autotrophs Con't

2. **Photosynthesis** – use the energy from light to make organic compounds. They turn carbon dioxide, water and the energy from light into organic compounds.

Photosynthesis

A. What is photosynthesis?

1. Definition: Photosynthesis is the **process of converting light energy into food.**

Raw Materials

(ingredients)


- Carbon dioxide (CO₂)
- Water (H₂O)
- Light energy

Products

- Oxygen (O₂)
- Water (H₂O)
- Glucose (food)

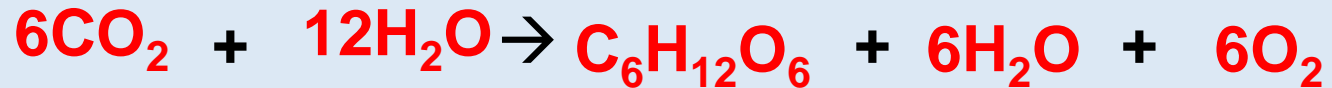
Photosynthesis-Chemical Process

2. Chemical Process:

•Word Equation: 

Carbon Dioxide + Water → Glucose + Water + Oxygen

•Molecular Equation (chemical):

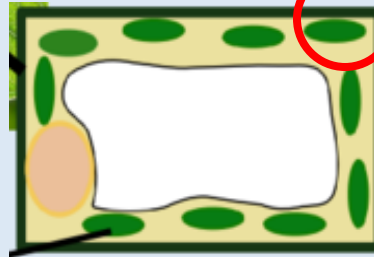


Photosynthesis-Where Does it Occur?

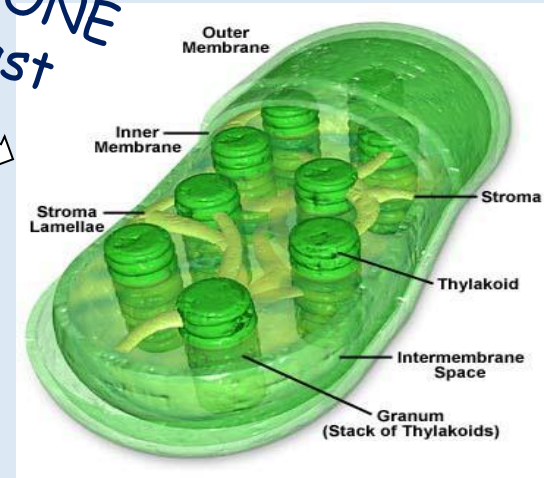
1. Chloroplast Structure



Enlarge
ONE cell



Enlarge ONE
chloroplast



Three membranes

- Outer membrane
- Inner membrane
- Thylakoid membrane
- Grana (stack of thylakoids)
- Fluid matrix

Photosynthesis-Where Does it Occur?

Chloroplast Function

2. Chloroplast function

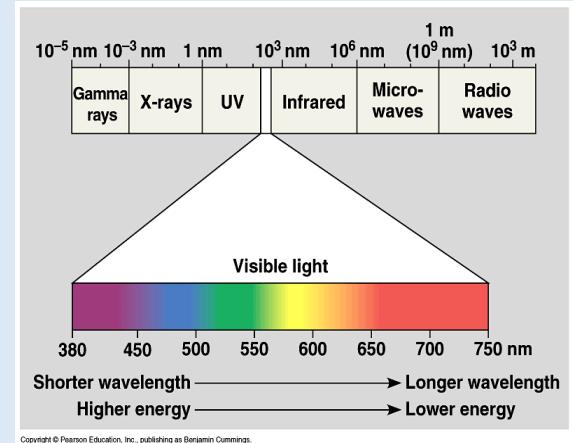
a) Chemical Reaction

- Converts light energy to food energy (**glucose**)
- Chlorophyll pigment is light absorbing (green in color)

Photosynthesis-Where Does it Occur?

Chlorophyll

- b) Chlorophyll
- Chlorophyll reflects **green light**.
Plants grown under green light will not grow well



White- **reflects all** wavelengths

Black- **absorbs all** wavelengths

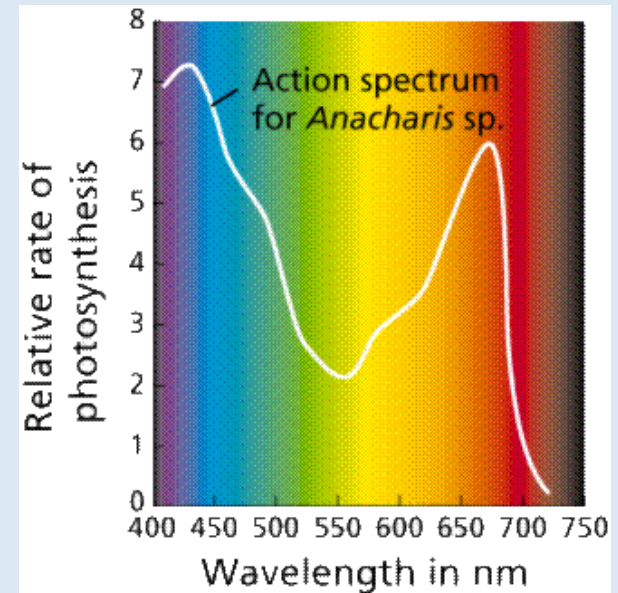
Green- **reflects** green light and absorbs all the other colors

Photosynthesis-Where Does it Occur?

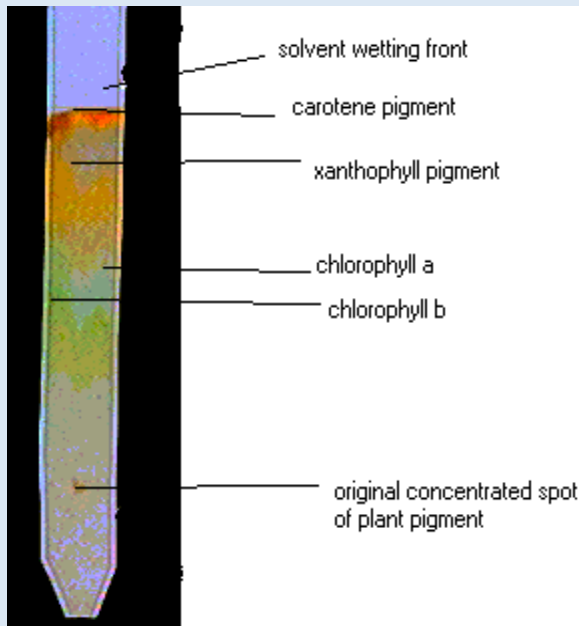
Chlorophyll-Con't

- What wavelength of light does chlorophyll use in photosynthesis?

Blue and **red** wavelengths produce the greatest rate of photosynthesis. Plants grown under blue or red light will grow the best



Photosynthesis-Pigments in Chlorophyll



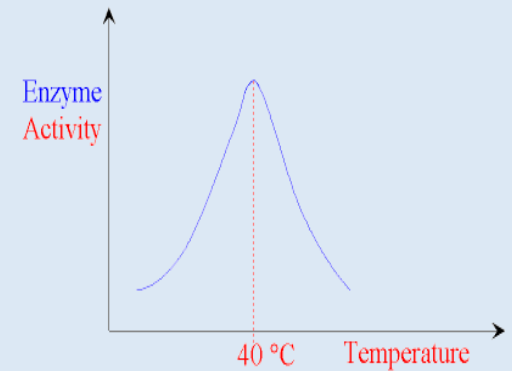
Chromatogram separates the different molecules (pigments) in chlorophyll. Chlorophyll contains

- ✓ **Chlorophyll b** (khaki green)
- ✓ **Chlorophyll a** (bright green)
- ✓ Xanthophyll (yellow)
- ✓ Carotene (yellow orange)

What factors influence the rate of photosynthesis?

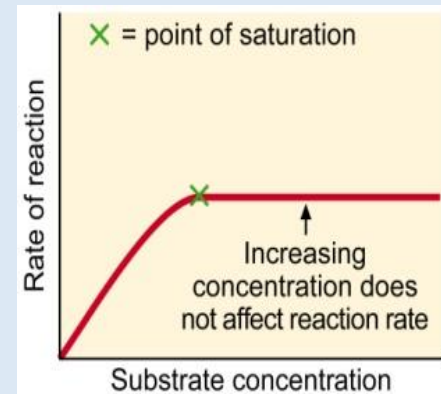
Three factors can affect the rate of photosynthesis:

1. **Temperature** : as temperature increases rate will increase until the **OPTIMUM** temperature is reached. Above the optimum temperature enzymes **DENATURE** and **can no longer function** (shape change)



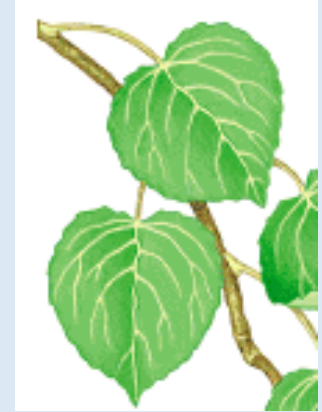
What factors influence the rate of photosynthesis?

2. **Light intensity**- below a certain amount of light-there is not enough energy for photosynthesis
3. **Concentration of CO₂ and H₂O**- rate of reaction increases until all substrate and/or enzyme is being used (**saturation**)



Plant Anatomy

Leaf



1. Function

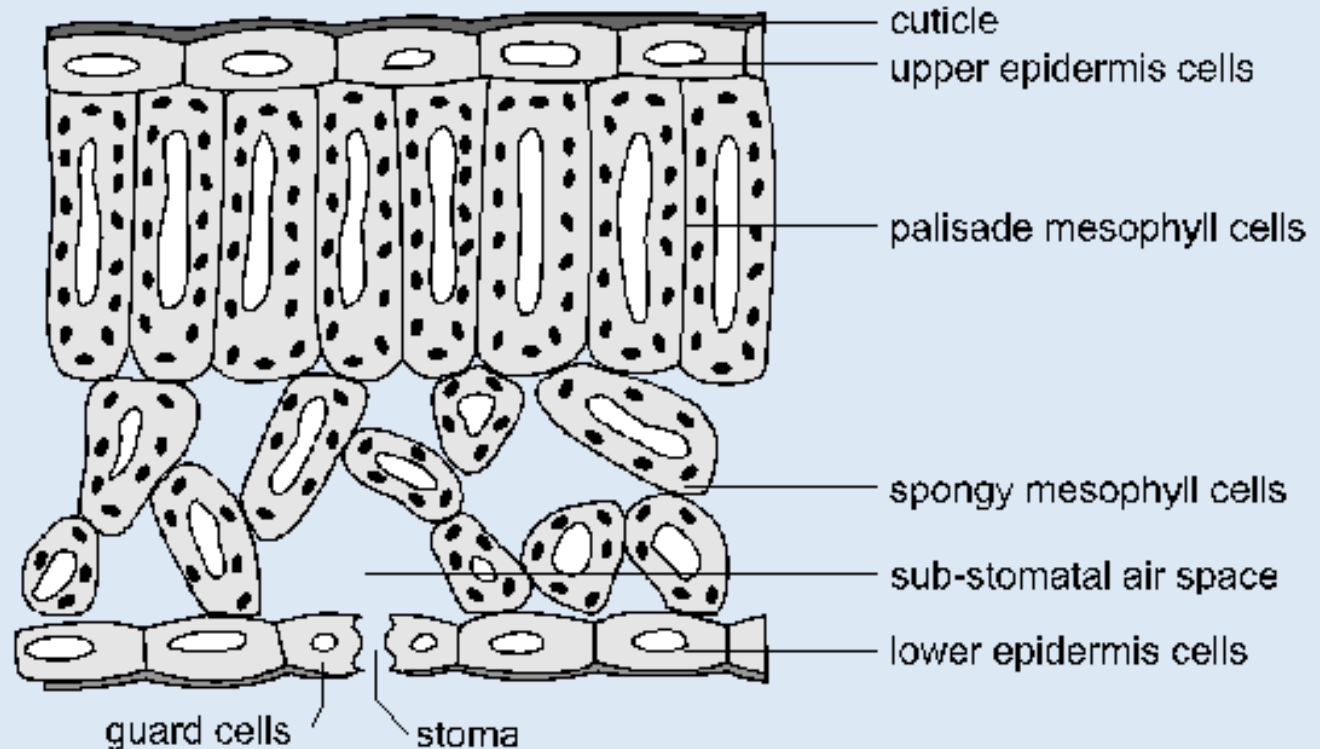
- Site of **photosynthesis**
- **Large surface area** for sunlight absorption
- **Gas exchange** take in carbon dioxide and give off oxygen
- Plants can also lose water from the leaf (**transpiration**)

Plant Anatomy

Leaf-Cross Section

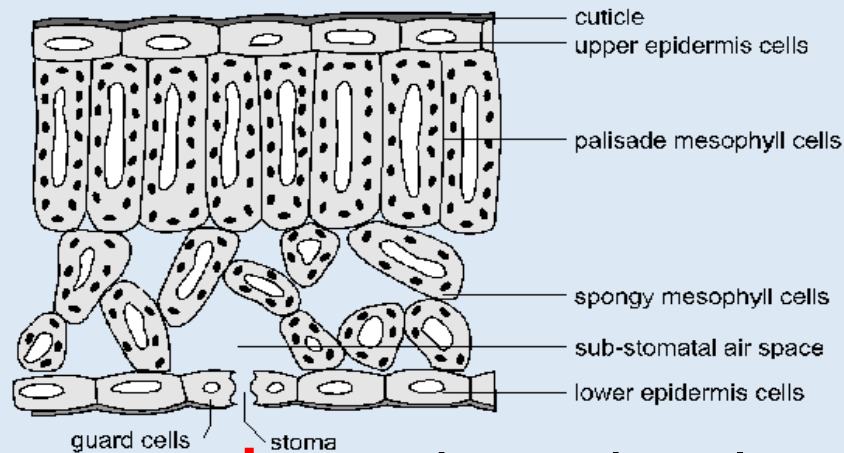
2. Structure (Cross Section)

You need to know the function of EACH leaf part



Plant Anatomy

Leaf-Cross Section-Parts & Pieces



- a) **Cuticle-waxy covering** to keep the plant from **losing water**.
- b) **Upper Epidermis** -Upper layer of the leaf.
- **Protects the leaf** from physical and mechanical injury
 - Protects the leaf from **infection from fungi**

Plant Anatomy

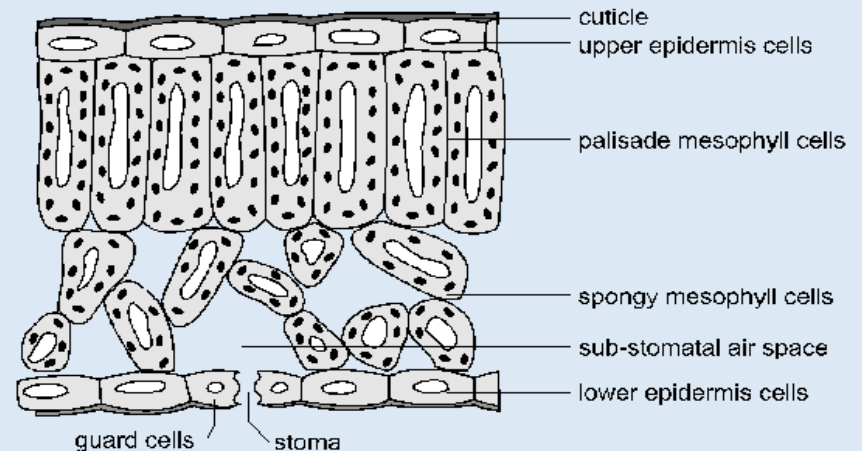
Leaf-Cross Section-Parts & Pieces

c) **Palisade Mesophyll** - contains large numbers of **chloroplasts**

- Main area of **photosynthesis**

d) **Spongy Mesophyll** - contains **chloroplasts** and **air spaces**

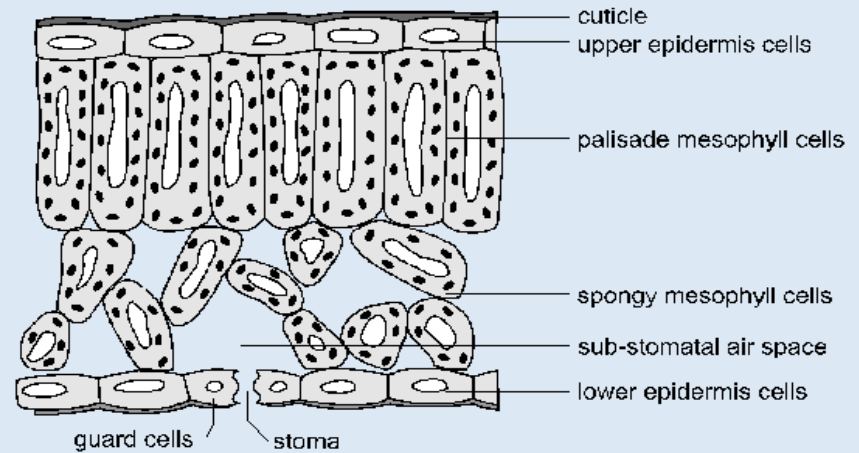
- Region of **photosynthesis**
- **Air spaces** which are surrounded by moist surfaces for the exchange of gases (**carbon dioxide** in and **oxygen** out)



Plant Anatomy

Leaf-Parts & Pieces

e) Lower Epidermis-contains openings called stomata

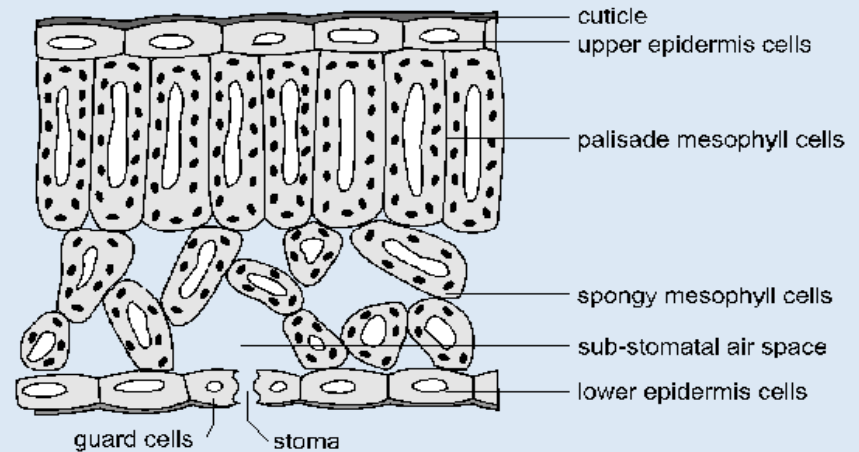


- **Stomates** - Openings in the lower epidermis which allow for the **exchange of oxygen, carbon dioxide,** and **water** between the external environment and internal air spaces.
- **Guard Cells** -sausage shaped cells which boarder the stomata and **regulate the size of the stomata opening**

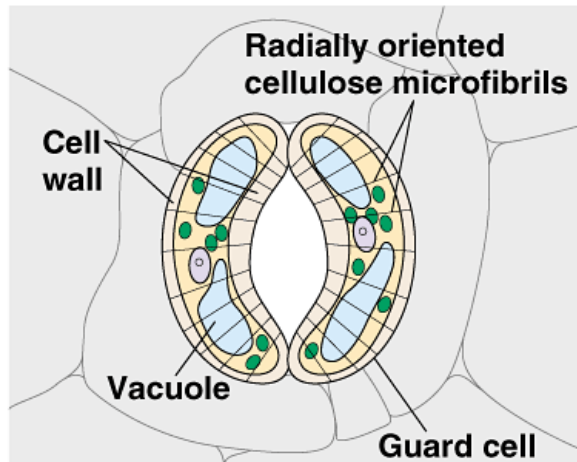
Plant Anatomy

Leaf-Cross Section

Stomata OPEN:
gas exchange



Cells turgid/Stoma open



Cells flaccid/Stoma closed

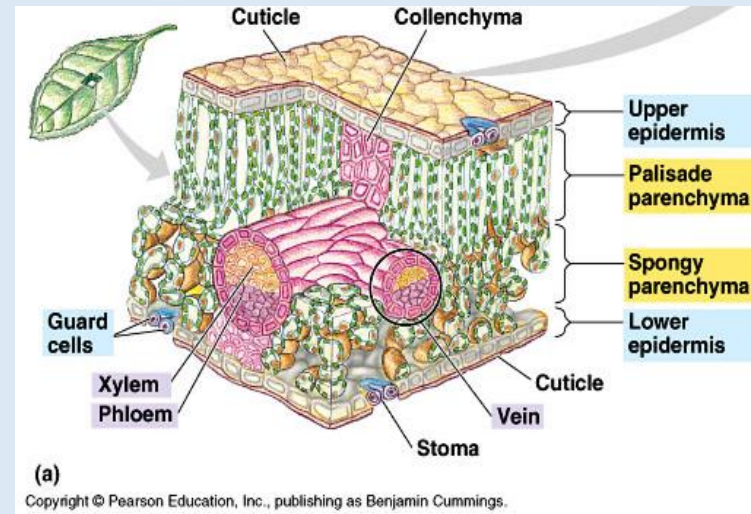


Stomata CLOSED:
no gas exchange

(a) Changes in guard cell shape and stomatal opening and closing (surface view)

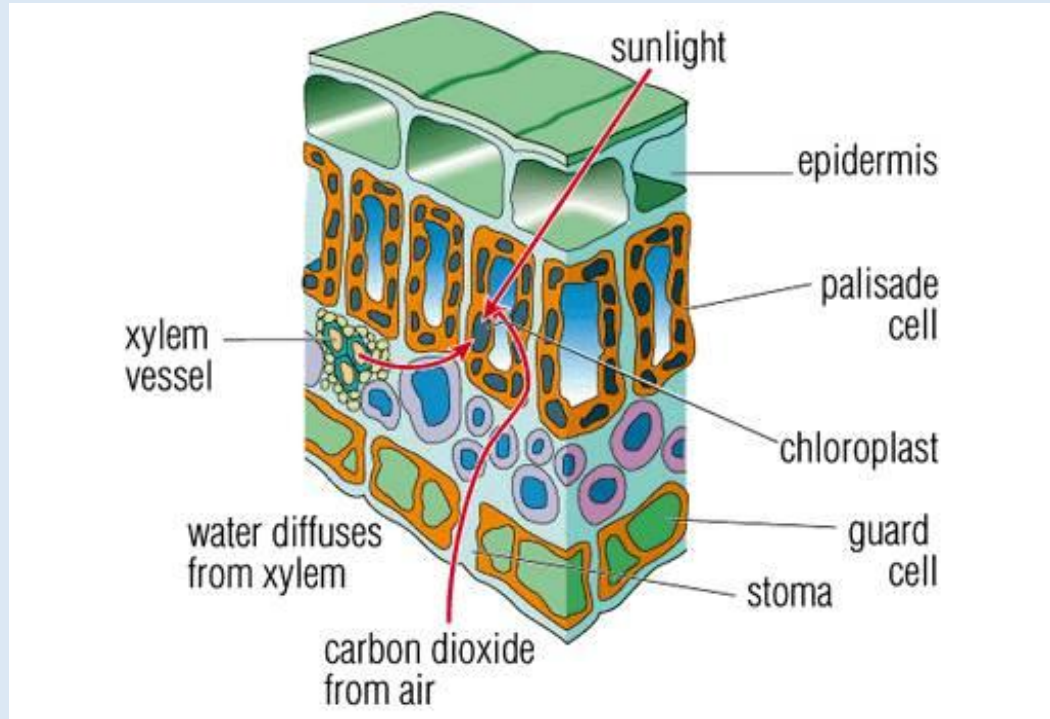
Plant Anatomy Leaf-Parts & Pieces

f) **Veins-vascular bundles** for transport of **water and food**. You know the vascular bundles as the **veins of the leaf**. They are the conducting tissue of the plant



- **Xylem-Transports water and minerals** (upwards from the root)
- **Phloem-transport food (sugar)** between the leaf and root (food travels downward in the summer and upward in the spring)

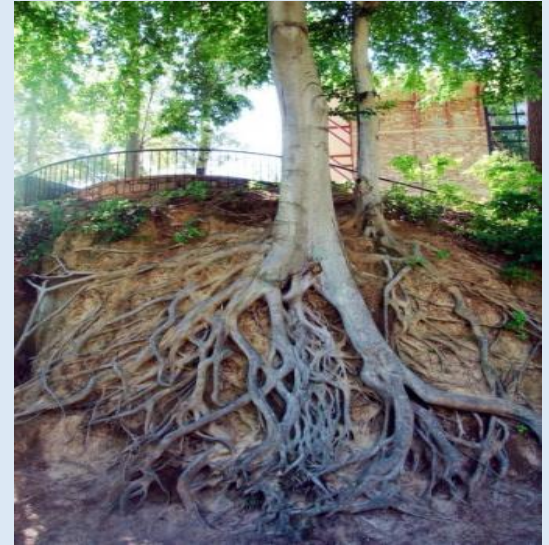
Leaf Summary



Plant Anatomy

ROOT

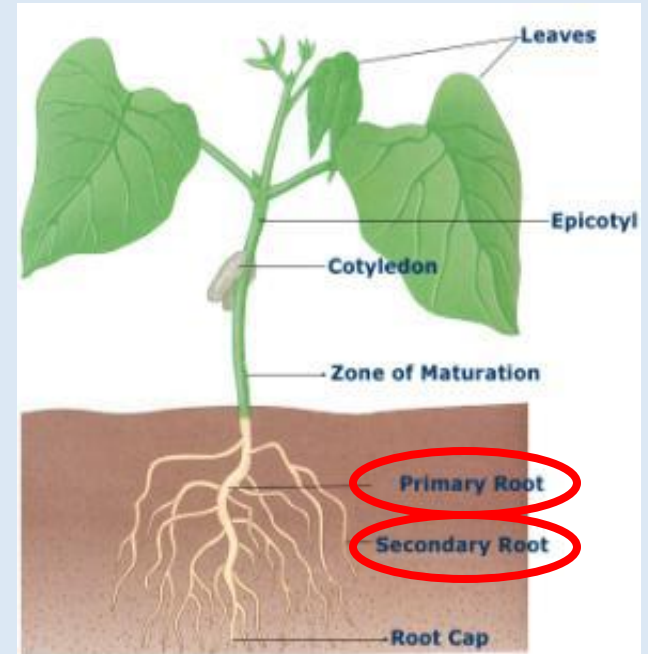
1. Function-The root has three major functions;
 - **Anchor** - plant stays put
 - **Food storage** - when leaves are not there to make food
 - **Absorption of water** for photosynthesis- the more surface area (**root hairs**) the better



Plant Anatomy

ROOT-Structure

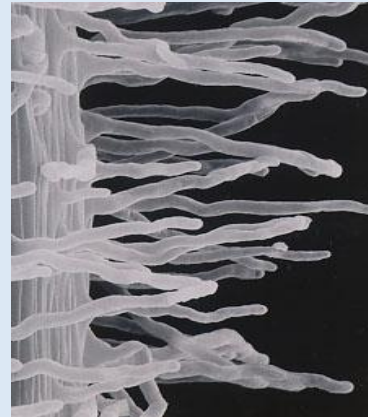
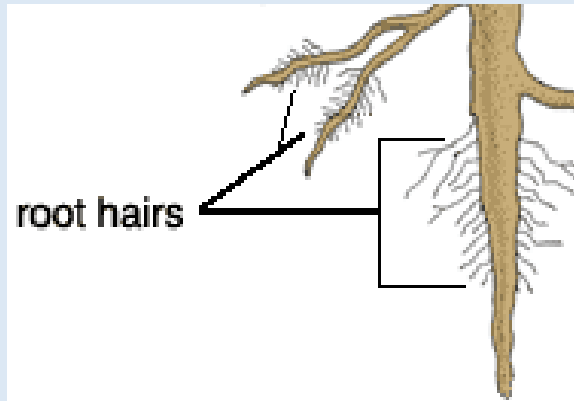
2. Structure of a root:
- Primary root (main/tap root like a carrot)
 - Secondary root-branch from main root



Plant Anatomy

ROOT-Structure

2. Structure of a root:
- Root hairs-extensions of the epidermal cells. They **increase** surface area so that more **water** and **minerals** can be absorbed by **diffusion** (osmosis).



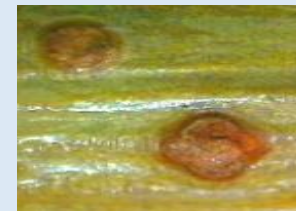
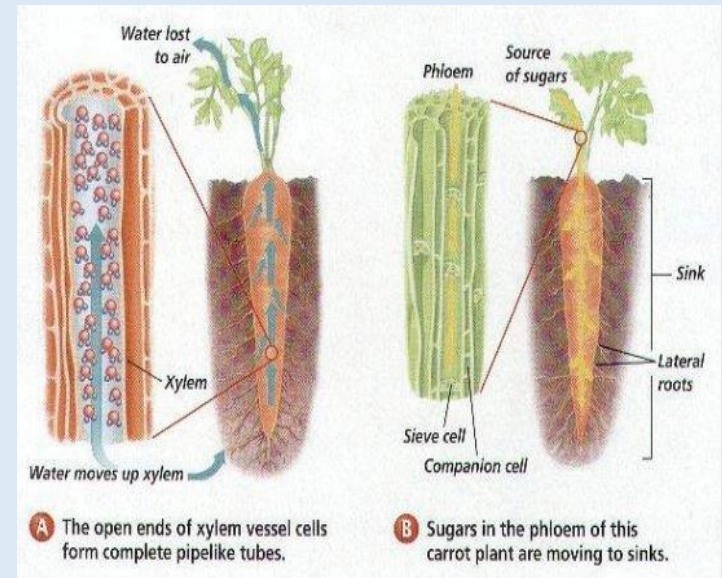
Plant Anatomy

STEM

c. Stem

1. Structure

- **Xylem** - transport water and minerals up
- **Phloem** - transport food (glucose) up or down depending on the season
- **Lenticils** - tiny openings in the stem that allow for gas exchange.



Plant Anatomy

STEM

2. Function

- Support against gravity
- Transport of water and food



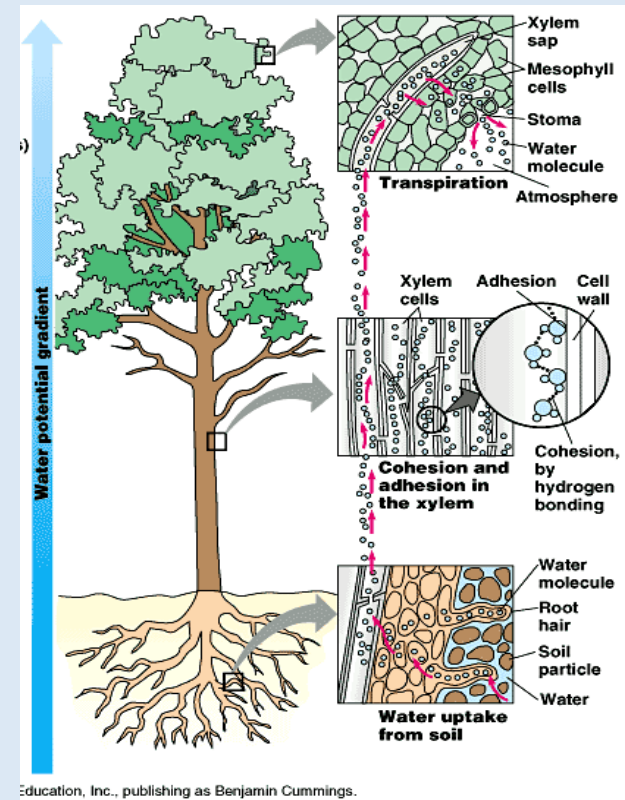
Water Transport

D. How is water transported from the root through the stem and into the leaf?

1. **Root Pressure** - forces water upward

2. **Transpiration Pull**

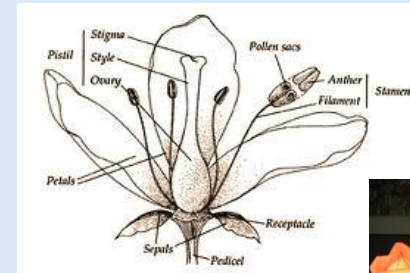
Transpiration is the evaporation of water vapor through the stomates. There is a pulling force on the column of water in the **xylem**.



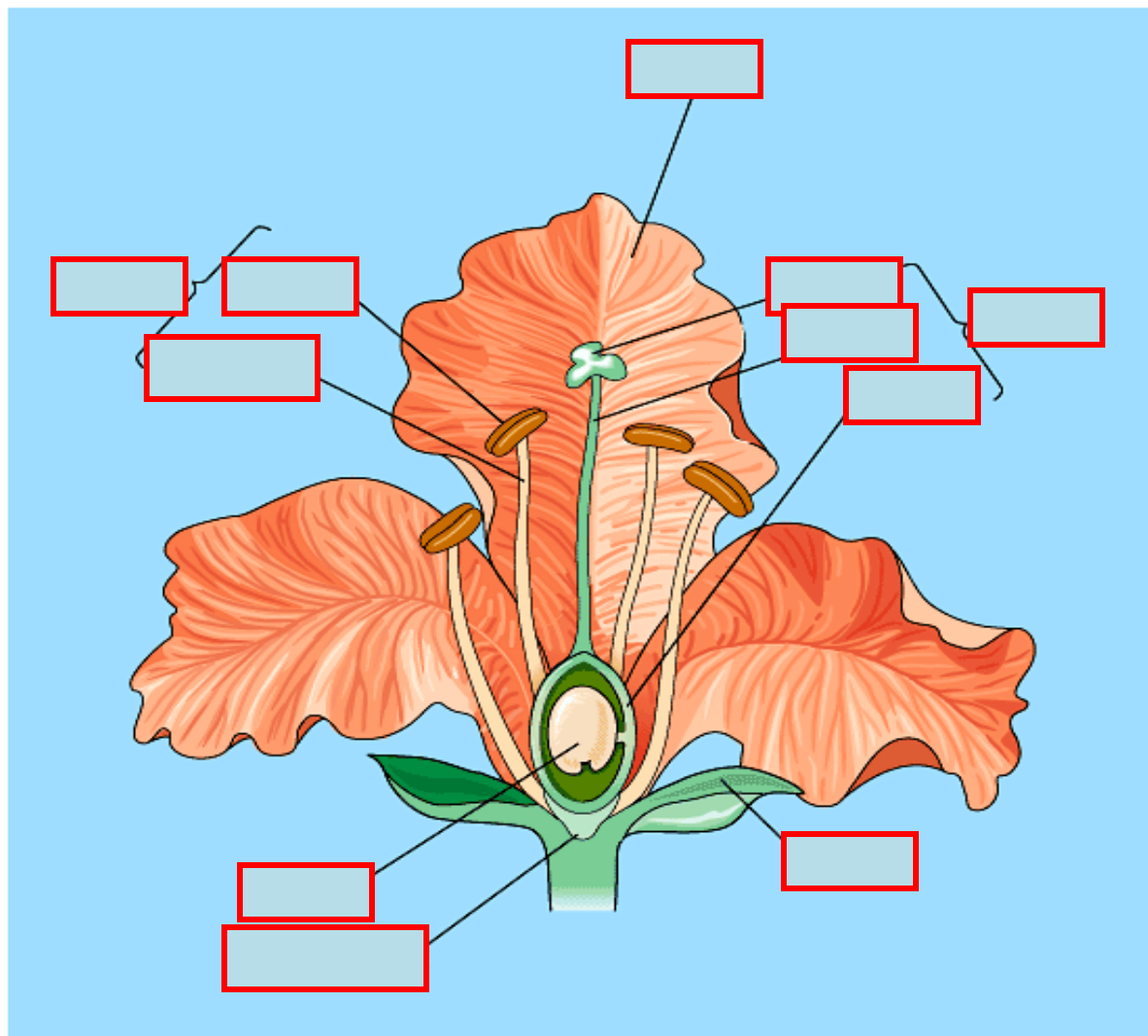
Plant Reproduction

A. Flower Structure and Function

1. The flower is specialized for **sexual** reproduction
2. Flowers which contain BOTH male and female reproductive structures are called **perfect** or **complete**. Imperfect or incomplete flowers will have just **male OR female** structures.

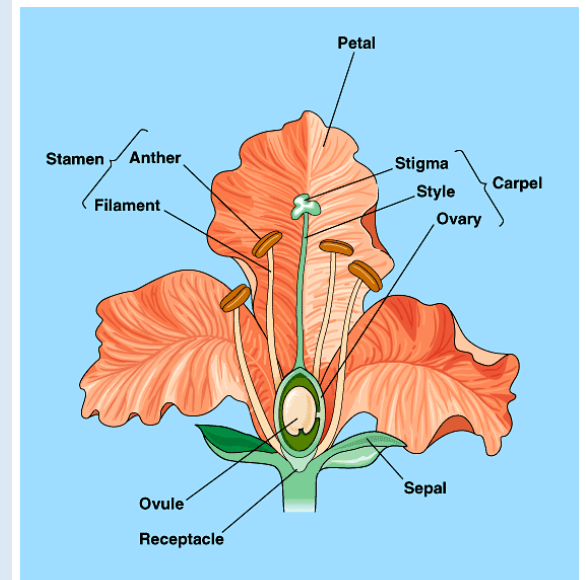


Flower Structure-Diagram



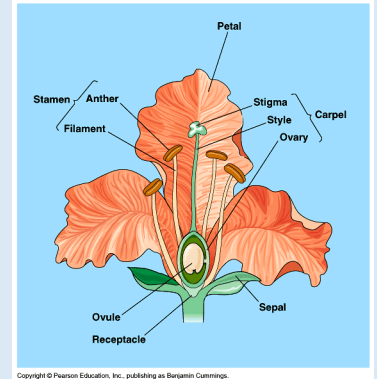
Flower Structure-Function

- a) **Petal** -usually **brightly colored** and **sweet smelling** leaf like structures used to **attract insects** for pollination
- b) **Sepals** -surround the flower and **protect the flowers bud**. Many times they are green in color.
- c) **Receptacle** - the base of the flower

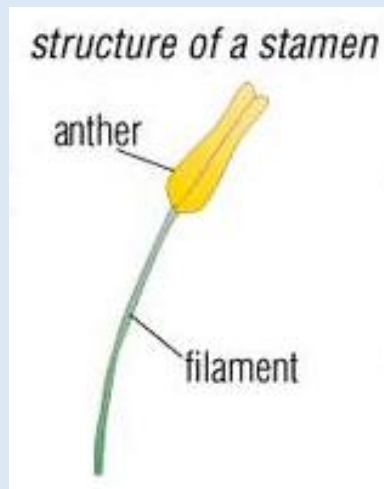


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Flower Structure-Male



- d) **Stamen** - **male** reproductive organ
- **Anther** - knob like structure at the end of the stamen which **produces the pollen** (**male gamete** by meiosis).
 - **Filament** - long slender stalk which **supports the anther**



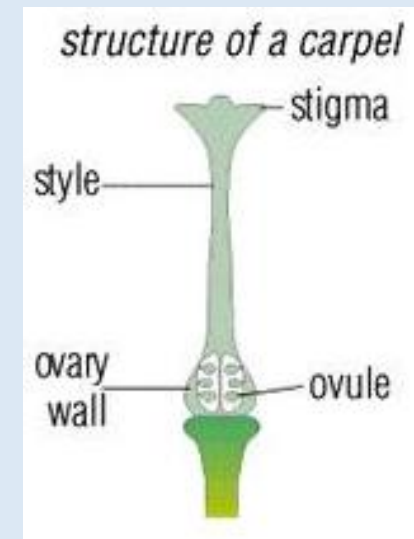
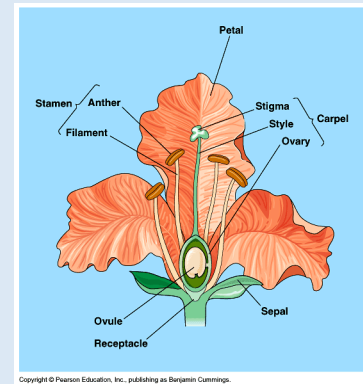
Pollen grains



Flower Structure-Female

e) **Pistil** (carpel)- the **female reproductive** organ of the flower.

- **Stigma** -located at the top.
It is **sticky to catch the pollen grains**
- **Style** -long tube connecting the stigma to the ovary
- **Ovary** -contains the **ovules**
(egg –female gamete by meiosis)

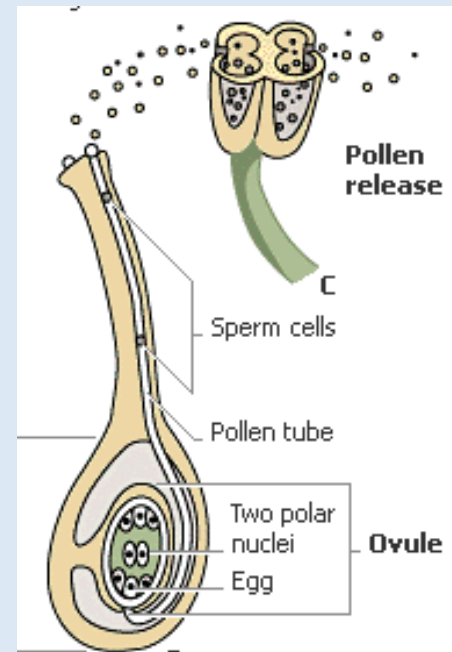


DID YOU KNOW- The fruit of a plant develops from the ovary and the seeds are from the ovules!



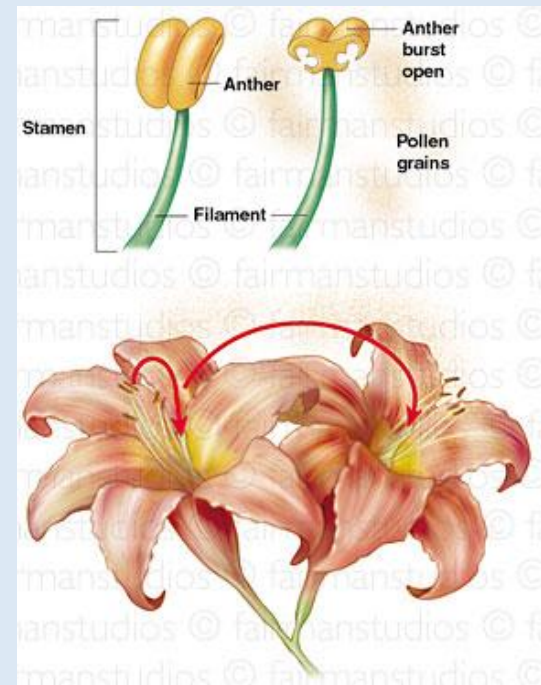
Pollination

Pollination is the transfer of pollen (sperm) from the anther to the stigma



Pollination (Self-pollination)

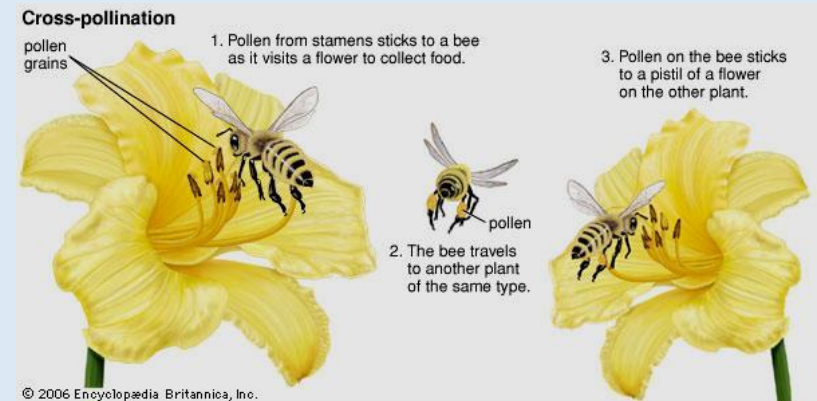
- **Self-pollination** the transfer of pollen from the anther to the stigma of the **SAME** flower or plant.



Pollination (Cross-pollination)

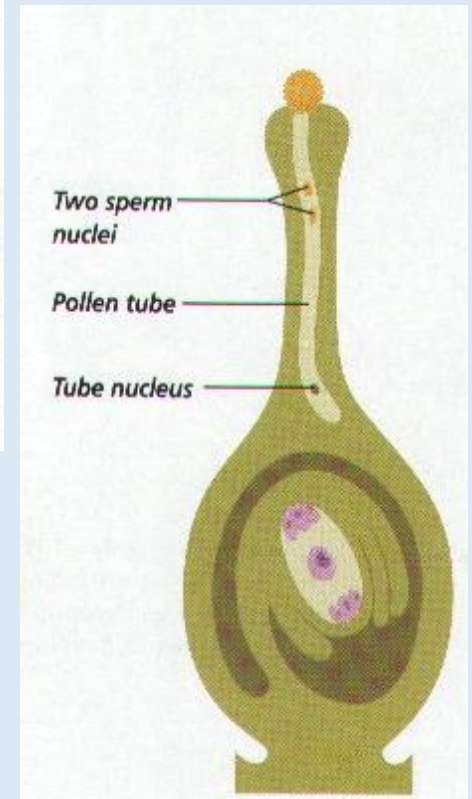
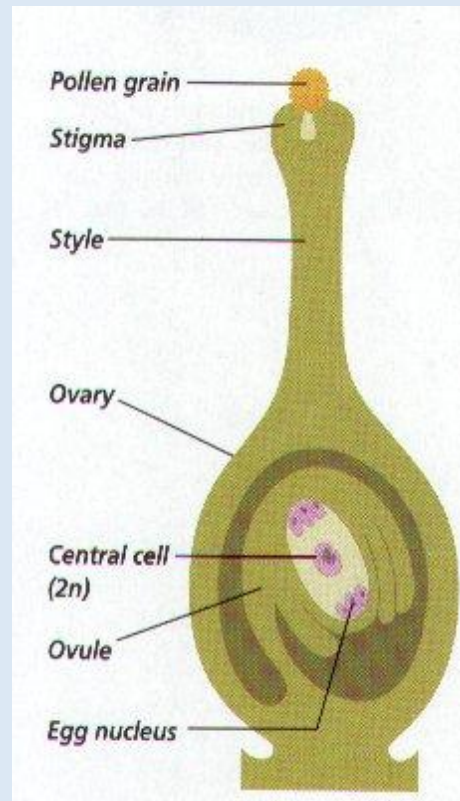
- **Cross-pollination** is the transfer of pollen from the anther on one flower to the stigma of a **DIFFERENT** plant. Cross-pollination is an adaptation which **increases** variety. Cross-pollination is accomplished by:

- ✓ Insects
 - ✓ Wind
 - ✓ Animals



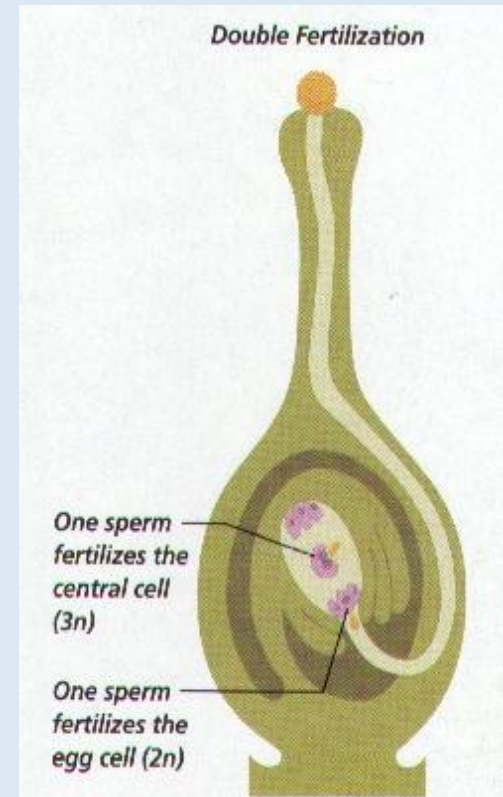
Fertilization

1. Once the **pollen** lands on the **sticky stigma**, the pollen **germinates** forming two sperm nuclei which find their way through the **style** and to the **ovary**
2. The sperm nuclei digests a tube through the style called a **pollen tube**.



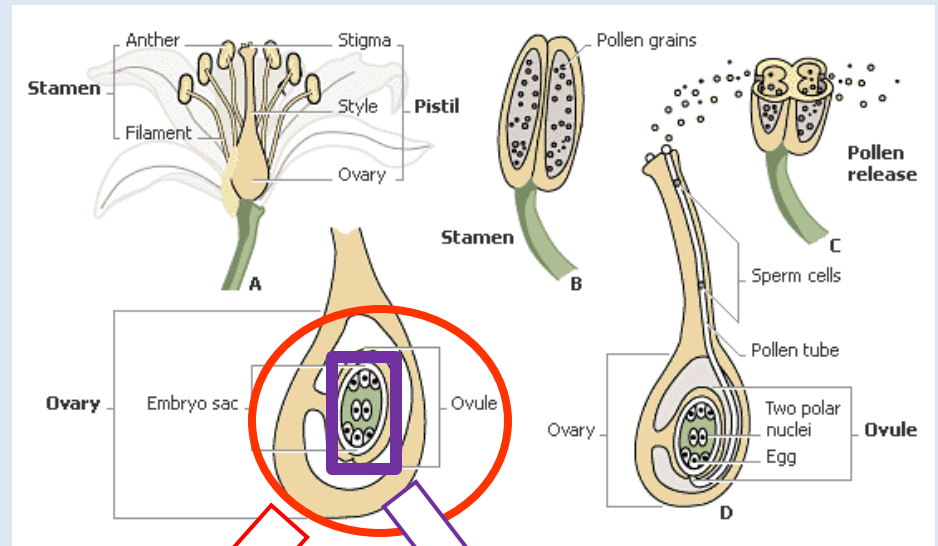
Fertilization Con't

3. Once they reaches the ovary one sperm nuclei **fertilizes the ovule (egg)** forming the **zygote (fertilized egg)**.
4. The second sperm nucleus fertilizes a structure (polar nuclei) which will **provide the food** for the embryo plant. This process is called **DOUBLE FERTILIZATION**



Fertilization Con't

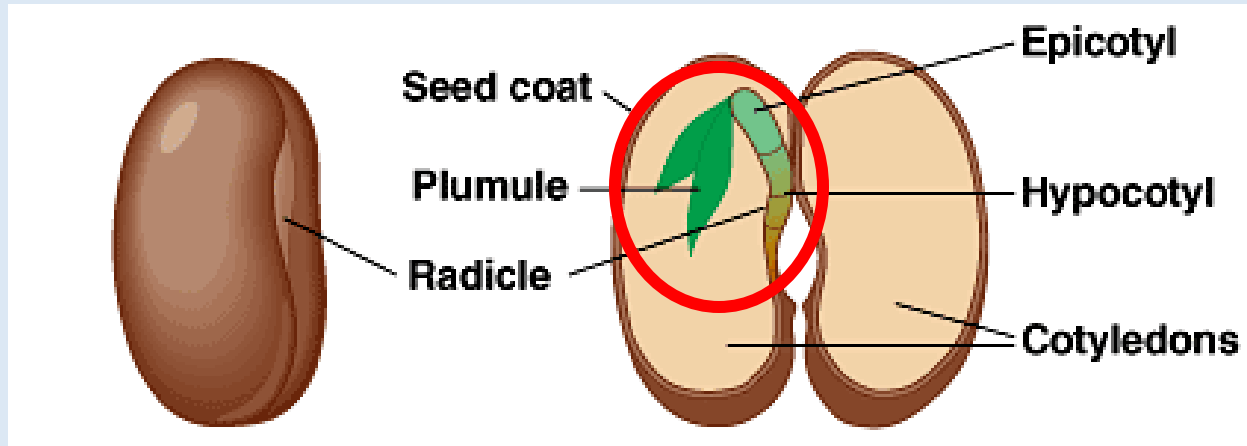
- Once fertilization takes place the ovary becomes the **fruit** and the seed develops within the fruit.



SEED STRUCTURE

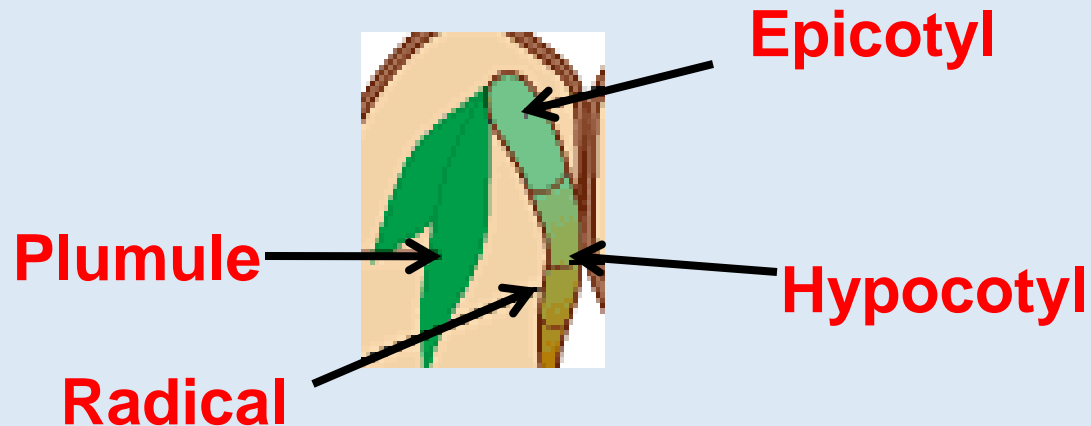
The seed contains

1. **Seed coat** – outer protective covering
2. **Cotyledon** -the food for the developing embryo
3. The embryo



EMBRYO

3. **Embryo** -has three parts
- a) **Epicotyl** -upper stem (has the leaves)
 - b) **Hypocotyl** -lower stem
 - c) **Radical** -forms the roots.
 - d) Plumule-first leaves



GERMINATION

Seeds will remain **dormant** (embryo is alive but not growing, until certain conditions are present to allow the embryo to begin to grow.

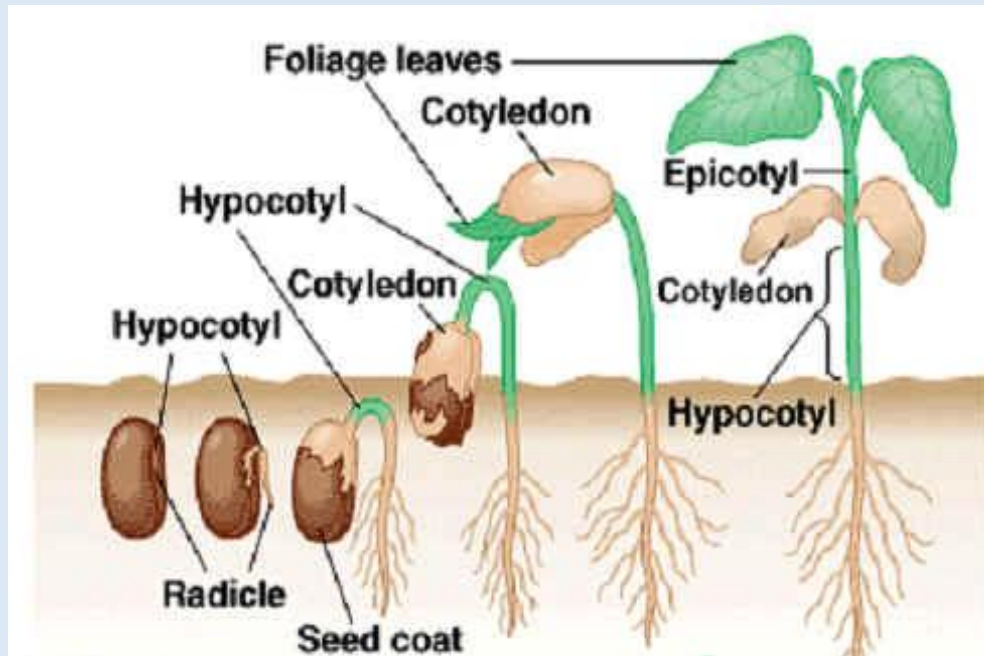
Germination-early growth stages of the plant embryo

1. There three (3) conditions needed for the seed to grow or germinate:
 - **Moisture (water)**
 - **Heat**
 - **Carbon dioxide**

GERMINATION

2. Germination Process

- Cell division (**mitosis**)
- **Differentiation** -cells taking on a specific function

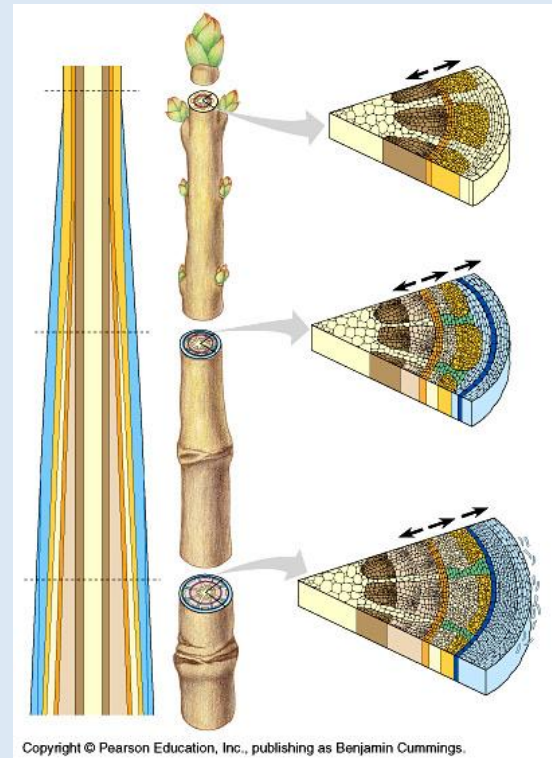
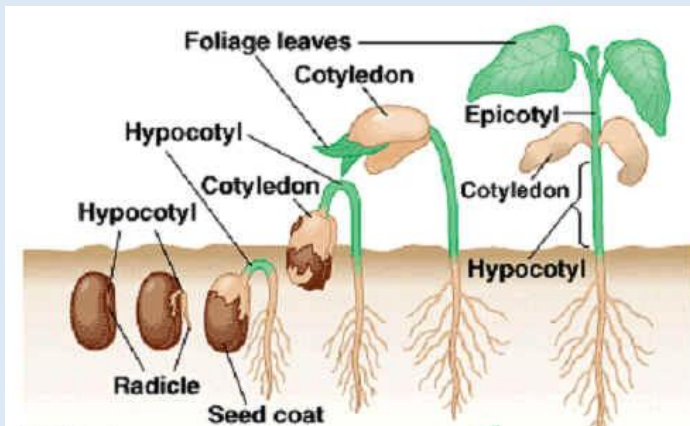


GERMINATION (Con't)

2. Germination Process

- **Growth**

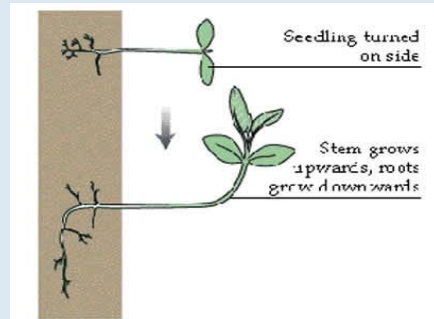
- ✓ The plants grow in the tips of the **roots** and **stems**
- ✓ The special tissues found in these regions are called **apical meristems**



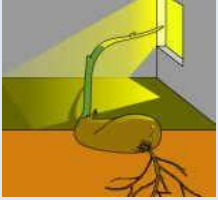

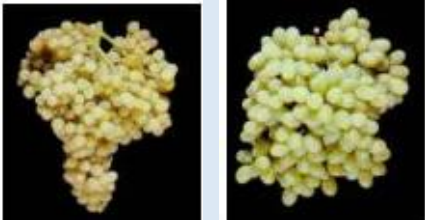

PLANT REGULATION

1. What are hormones

Hormone - a chemical substances that **control** a plant's patterns of **growth and development**, and their **response** to environmental conditions.



Types of Plant Hormones

Hormone	Function	Example
Auxin	Allows plants to respond to light and gravity (Tropisms)	
Cytokinins	Causes lateral buds to grow and allows seeds to germinate	
Gibberellins	Growth promotes substance which increase the size of stems and fruits	
Ethylene	Causes fruits to ripen	

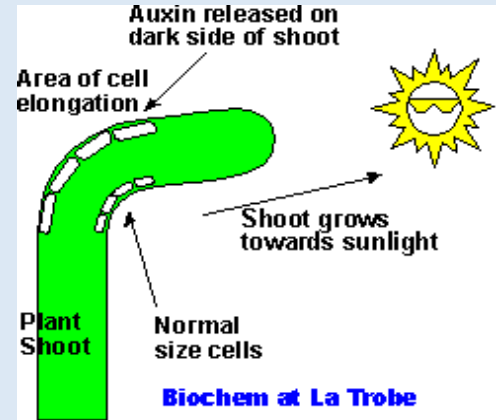
Tropisms

1. **Tropisms** -growth response in plants usually the result of auxins
 - Tropisms are caused by the unequal distribution of **auxin** caused by **light**, **gravity** or **water**. **Positive** tropisms allow the plant to grow toward the environmental cue, **negative** tropisms allow the plant to grow away from the environmental cue



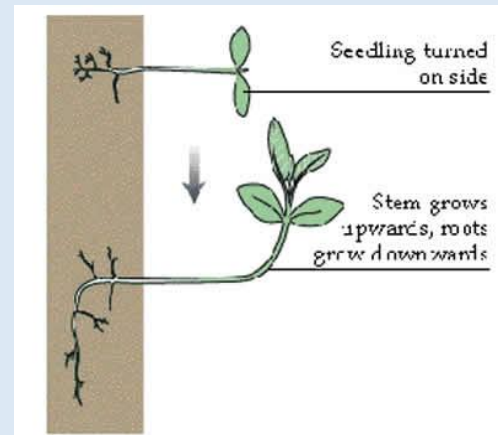
Phototropism

- **Phototropism** – is the response to **light**. Plant grows **toward the light** as a result of **unequal distribution of auxin**. The light causes auxin to be more concentrated on the dark side of the plant which causes the cells on the dark side of the plant to grow more. This causes the plant to **bend toward the light**.



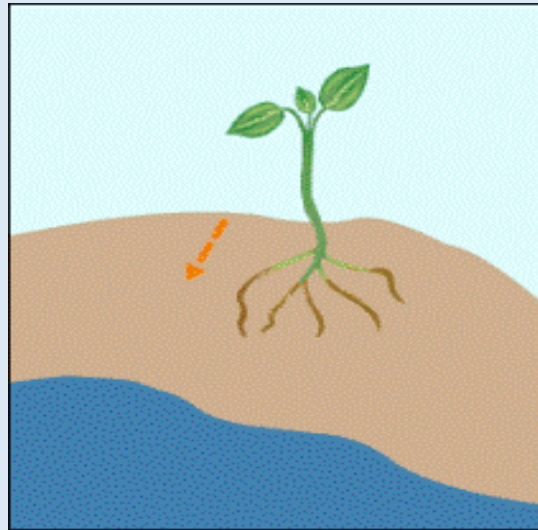
Geotropism

- **Geotropism** – is the response to **gravity** (*roots have positive geotropism, stems have negative geotropism.*)



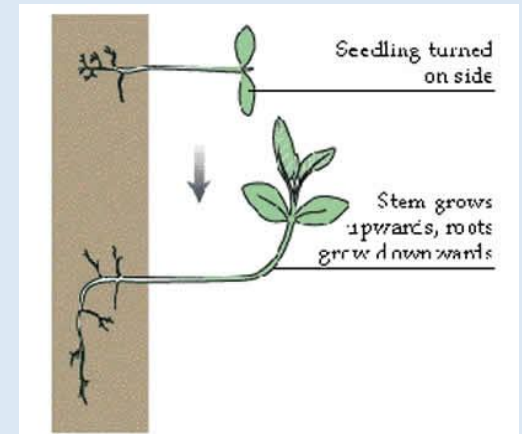
Hydrotropism

- **Hydrotropism** – is the response to **water** (roots grow toward a source of water-**positive** hydrotropism)



Geotropism

- **Geotropism** – is the response to **gravity** (roots have **positive geotropism**, stems have **negative geotropism**).



- **Thigmotropism**- plant response to touch.



THE END