PLANT PHYSIOLOGY

INTRODUCTION

- Animals move in search of food, shelter and for reproduction.
- Unlike animals, plants do not move on their own from one place to another, but can move their body parts for getting sunlight, water and nutrients.
- They are sensitive to external factors like light, gravity, temperature etc *Helianthus annuus*
- (sunflower) follows the path of the sun from dawn to dusk, (from east to west). These movements are triggered by an external stimulus.

TROPISM IN PLANTS

- Tropism is a unidirectional movement of a whole or part of a plant towards the direction of stimuli.

TYPES OF TROPISM

Based on the nature of stimuli, tropism can be classified as five types

PHOTOTROPISM:

Movement of a plant part towards light. e.g. shoot of a plant.

GEOTROPISM:

Movement of a plant in response to gravity. e.g. root of a plant.

HYDROTROPISM:

Movement of a plant or part of a plant towards water. e.g root of a plant.

THIGMOTROPISM:

Movement of a plant part due to touch. e.g. climbing vines.

CHEMOTROPISM:

Movement of a part of plant in response to chemicals. e.g growth of a pollen tube in response to sugar present on the stigma.

POSITIVE AND NEGATIVE TROPISM

- Tropism is generally termed **positive** if growth is **towards the signal** and **negative** if it is away from the signal.
- Shoot of a plant moves towards the light, the roots move away. Thus the shoots are positively phototropic.

POSITIVE PHOTOTROPISM (NEGATIVELY GEOTROPIC)

- **Usually shoot system of a plant is positively phototropic and negatively geotropic and root system is negatively phototropic and positively geotropic.**

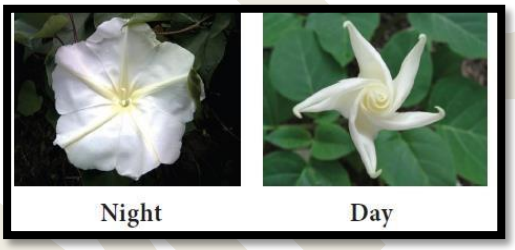
NEGATIVE PHOTOTROPISM (POSITIVELY GEOTROPIC)

NASTIC MOVEMENT

- Nastic movements are non-directional response of a plant or part of a plant to stimulus. Based on the nature of stimuli.
- Nastic movements are classified as follows.

PHOTONASTY

- Movement of a part of a plant in **response to light.** e.g blooms in morning and closes in the evening.
- *Ipomea alba* (Moon flower), opens in the night and closes during the day.



PHOTONASTY IN MOON FLOWER

- Thigmonasty: Movement of a part of plant in response to touch.
- Eg. *Mimosa pudica*, folds leaves and droops when touched. It is also known as **Seismonasty**

THIGMONASTY IN MIMOSA PUDICA

THERMONASTY

- Movement of part of a plant is associated with change in temperature.
- Eg. *Tulip* flowers bloom as the temperature increases.

THERMONASTY IN TULIP

DIFFERENCES BETWEEN TROPIC AND NASTIC MOVEMENTS

Tropic movements	Nastic movements
Unidirectional response to the stimulus.	Non-directional response to the stimulus.
Growth dependent movements.	Growth independent movements.
More or less permanent and irreversible.	Temporary and reversible.
Found in all plants.	Found only in a few specialized plants.
Slow action.	Immediate action.

PHOTOSYNTHESIS

- '**Photo**' means **'light'** and '**synthesis'** means **'to build'**. Thus photosynthesis literally means 'building up with the help of light'.
- During this process, the light energy is converted into chemical energy.
- Green plants are autotrophic in their mode of nutrition because they prepare their food materials through a process called photosynthesis.

The overall equation of photosynthesis can be given as below:

$$\underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{6H_2O} \xrightarrow[\text{Chlorophyll}]{\text{Photosynthesis}} \underset{\text{Gluose}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_2}\uparrow$$

- The end product of photosynthesis is glucose which will be converted into starch and stored in the plant body.
- Plants take in carbon dioxide for photosynthesis; but for its living, plants also need oxygen to carry on cellular respiration.

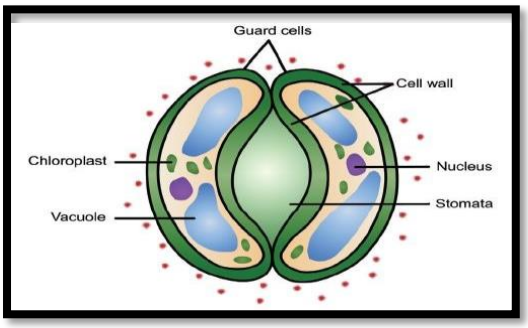
Things are necessary for photosynthesis

- Chlorophyll - Green pigment in leaves
- Water
- Carbon dioxide (from air)
- Sun light

TRANSPIRATION

- The loss of water in the form of water vapour from the aerial parts of the plant body is called as transpiration.
- The leaves have tiny, microscopic pores called **stomata**.
- Water evaporates through these stomata. Each stomata is surrounded by guard cells.
- These guard cells help in regulating the rate of transpiration by opening and closing of stomata.

STRUCTURE OF STOMATA



TYPES OF TRANSPIRATION

There are three types of transpiration:

STOMATAL TRANSPIRATION

Loss of water from plants through stomata. It accounts for 90- 95% of the water transpired from leaves.

CUTICULAR TRANSPIRATION

Loss of water in plants through the cuticle.

LENTICULAR TRANSPIRATION

- Loss of water from plants as vapor through the lenticels.
- The lenticels are tiny openings that protrude from the barks in woody stems and twigs as well as in other plant organs.

SIGNIFICANCE OF TRANSPIRATION

- ❖ It creates a pull in leaf and stem.
- ❖ It creates an absorption force in roots.
- ❖ It is necessary for continuous supply of minerals.
- ❖ It regulates the temperature of the plant.

EXCHANGE OF GASES

- ❖ The leaves have minute pores called **stomata** through which the exchange of air takes place.
- ❖ These minute pores can be seen through a microscope

- Air exchange takes place continuously through the stomata. Plants exchange gases (CO2 to O2) continuously through these stomata.