

المحاضرة الحادية عشرة

Lecture. 11

Plant Hormones

- **What are plant hormones (Phytohormones)?**

They are chemical molecules produced within the plant, and occur in extremely low concentrations.

- **Functions of the plant hormones?**

1. Hormones regulate cellular processes (growth, development, and differentiation) in targeted cells locally and in other functional parts of the plant.
2. Hormones also determine the formation of flowers, seeds, stems, leaves, the shedding of leaves.
3. They determine the development and ripening of fruit.

Hormones are vital to plant growth, and, **lacking them**, plants would be mostly a mass of **undifferentiated cells**. So some of them are also known as **growth factors or growth hormone**.

- **Phytohormones = Plant hormones**

They are found not only in higher plants but in **algae**, showing similar functions, and in

microorganisms, such as unicellular fungi and bacteria, but in these cases they play no

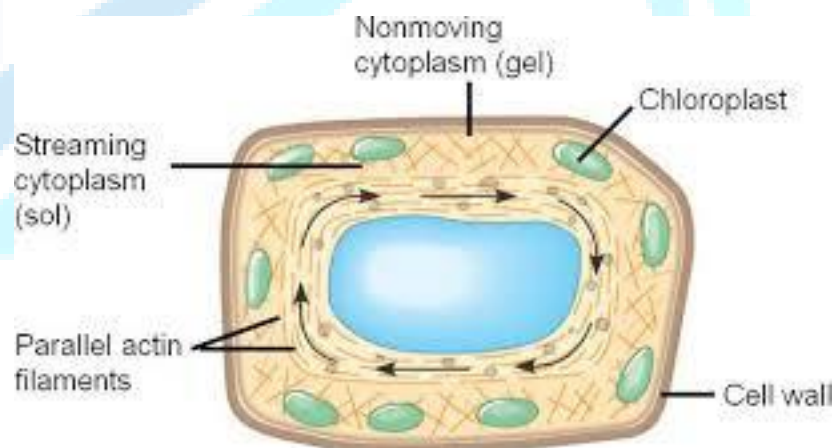
hormonal or other immediate physiological role in the producing organism and can, thus, be regarded as **secondary metabolites**.

Transportation of plant hormones:

Hormones are transported within the plant by utilizing many types of movements:

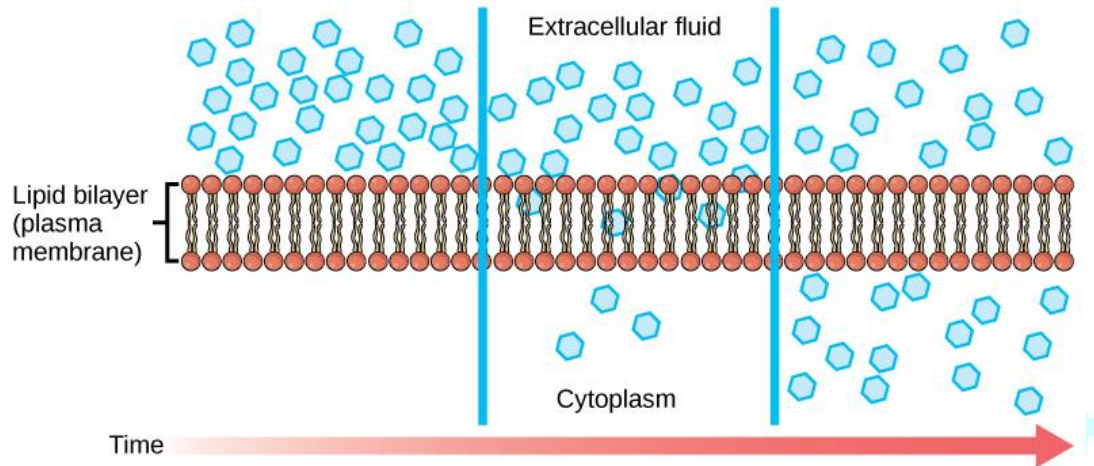
1. Cytoplasmic streaming within cells.

The movement of the fluid substance (cytoplasm) within a plant or animal cell. The motion transports nutrients, proteins, and organelles within cells.



2. Slow diffusion between cells are utilized.

Diffusion is the movement of a substance from an area of higher concentration to one of lower concentration (down a gradient). It occurs on its own without the input of energy. Many waste materials exit the cell through diffusion because that is their natural direction of movement as they build up within the cell.



3. Vascular tissues are used to move hormones from one part of the plant to another.

Which is called Long-distance transport of phytohormones.

- **Classes of plant hormones:**

There are five major classes of plant hormones:

1. **Auxins:**

They are a powerful growth phytohormones. They promote cell division, stem and root growth

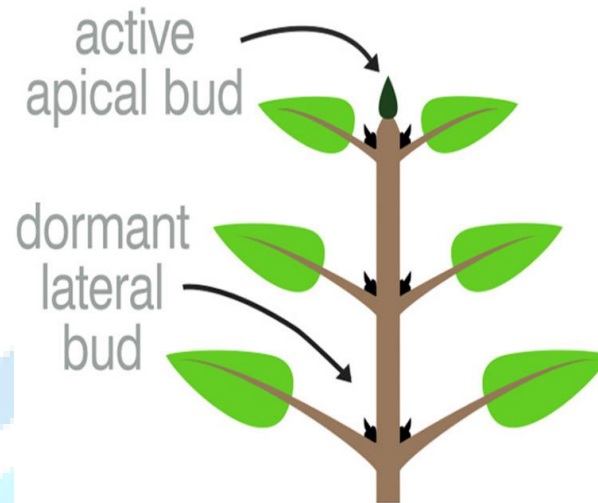
Location: They are found in shoot and root tips.

Function:

- **Stimulating shoot and root elongation and apical dominance :**

They increase plant length and the distance between nodes, spacing the branch points further apart.

The central stem is dominant over lateral branches, because the apical bud is dominant over lateral buds. The key actor here is auxin. Auxin is produced in the tip and moves down a stem. It inhibits the development of lateral buds. The result is taller stem and fewer branches

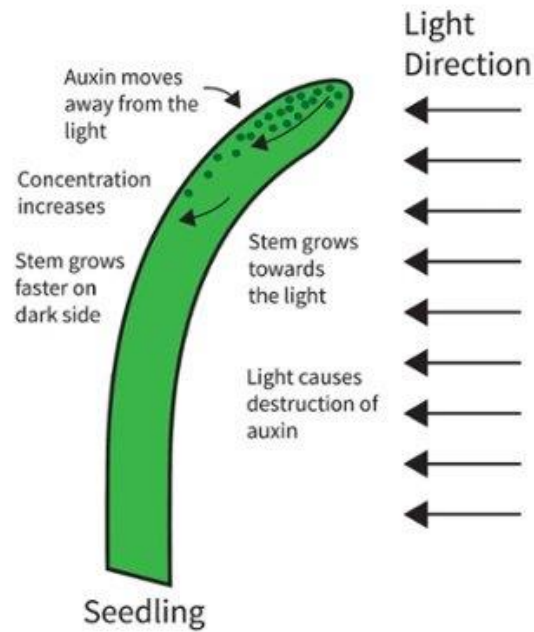


- **Controlling seedling orientation:**

It was the infamous Charles Darwin and his son Francis who first noticed that **seedlings bend toward the light**. However, whether a new shoot grows into the soil or towards light, **depends on where auxins are located** and how they influence cells within the plant.

Auxins will move downward due to gravity and laterally, away from light. Cells grow more in areas of the plant where auxins are highly concentrated.

Movement of Auxin



- **Stimulating root branching:**

When an auxin is applied to a cut stem, the stem will initiate roots at the cut.

- **Promoting fruit development:**

Auxins in the flower promote maturation of the ovary wall and promote steps in the full development of the fruit.

2. Cytokinins

Cytokinins are a group of hormones that promote cell division in the plant roots and shoots and the growth of buds. These hormones have been found in all complex plants as well as mosses, fungi, and bacteria.

Location: Most cytokinins are produced in the meristem of the roots.

Once the cytokinin has been produced in the roots, **it travels up the xylem**, or vascular tissue, to other parts of the plant where continued growth takes place (such as young leaves, developing fruits, and seeds).

Function:

They increase cell division by stimulating the production of proteins needed for mitosis.

3. Gibberellins (GA)

Definition - What does Gibberellins (GA) mean?

Gibberellins are the plant hormones that promote germination, stem elongation, and leaf development.

Location: they are found everywhere in the Plant.

Function:

They are instrumental in determining dormancy, sexual reproduction, and flowering.

Triggered by soil temperature, moisture, and season, gibberellins are stimulated and released, and then guide the plant through the entire life cycle process. They act as the chemical messengers that trigger and control germination and growth.

A plant without gibberellin hormones would grow uncontrollably, not knowing when to form additional buds, leaves, blooms, or seeds.

4. Abscisic Acid (ABA)

Abscisic acid is a single compound unlike the auxins, gibberellins, and cytokinin.

Location: ABA is mainly produced in root tips, and move to other parts of plant.

Functions of Abscisic Acid

- Stimulates the closure of stomata (water stress brings about an increase in ABA synthesis).
- Inhibits shoot growth but will not have as much affect on roots or may even promote growth of roots.
- Induces seeds to synthesise storage proteins.
- Has some effect on induction and maintanance of dormancy.

5. Ethylene

Ethylene, unlike the rest of the plant hormone compounds is a gaseous hormone. Like abscisic acid, it is the only member of its class. Of all the known plant growth substance, ethylene has the simplest structure. **It is produced in all higher plants and is usually associated with fruit ripening and the triple respons.**

Location: Ethylene is produced from essentially **all parts** of higher plants.

Function:

- It triggers fruit ripening (breakdown cell walls and convert strach into mono/disaccharides)
- It triggers falling leaves