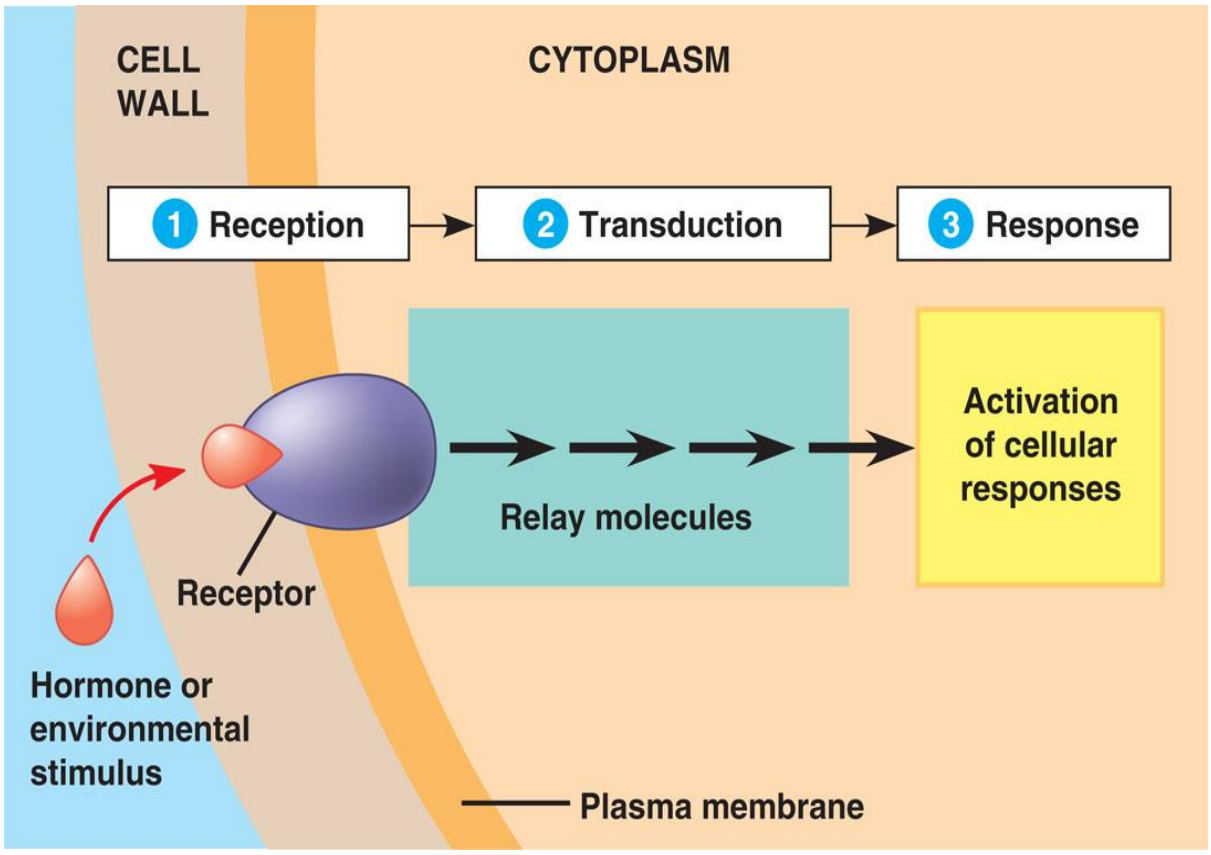
Plant Hormones

Plant hormones – a natural substance (produced by plant) that acts to control plant activities. Also called PGRs (plant growth regulators, because it controls start growth, stop growth, modify growth & development. Plant growth regulators – include plant **hormones** (natural & synthetic), but also include **non-nutrient chemicals not found naturally in plants** that when applied to plants, influence their **growth and development.**

In plants, **many behavioral patterns** and functions are controlled by **hormones**. These are "**chemical messengers**" influencing many patterns of **plant development.**

They are **produced in one part** of a plant and then transported to **other parts**, where they initiate a response.

They are stored in regions where **stimulus** are and then **released** for transport through either phloem or mesophyll when the appropriate stimulus occurs.



Types of growth regulators

1. **Auxins** (IAA, NAA, 2,4-D, 2,4,5-T)
2. **Cytokinins** (kinetin)

3. **Abscisic acid** (ABA)
4. **Gibberellins** (GAx)
5. **Ethylene** (C_2H_4)
6. Also: New emerging PGRs include brassinosteroids and jasmonic acid

Auxins

They are control stem elongation. Produced in **tips of stems**. Migrate from cell to cell in stems.

1. Auxins responsible for plants bending towards light **(Phototropism).**
2. Auxins responsible for plant response to **gravity** (**Gravitropism**). Move to lowest side and cause stem tissue to elongate – stem curves upwards.
3. Auxins **controls apical dominance,** move down the stem from the terminal bud and inhibit growth of side shoots.

Pinching = removing the terminal bud or breaking the apical dominance. Pinching - stops flow of auxins down the stem and allows side shoots to develop, produces bushy, well-branched crops

4. Auxins **encourage root development in cuttings.** Some plants produce plenty of auxins to make rooting cuttings easy. Other plants need synthetic auxins such as IBA.

Gibberellins

Produced in **stem and root apical meristems**, seed embryos, young leaves. It controls:

1. **Cell elongation and cell division**
2. Stimulate **development of flowers**
3. Cause **internodes to stretch**.

High light intensity = no stretch

Low light intensity = long internodes. Leaves are raised to capture light.

Greenhouse problem – plants spaced too closely to one another. Plants shade one another – results in stretching, less compact plants, weaker stems, loss in value. **B-Nine** is a growth regulator that **inhibits gibberellin** and controls plant height in bedding plants.

4. Break seed dormancy and **enhance germination.**

Cytokinins

Produced in **roots**, transported through xylem. They control:

1. **Cell division** (used in tissue culture)
2. Cell **differentiation** (used in tissue culture for plant organ formation)
3. **Formation of callus tissue**
4. **Delay aging process** in plants

- **Cytokinins vs. Auxins:**

Work together to control **cell differentiation and cell division**

- **In stems**

a. Auxins inhibit lateral shoots,
b. cytokinins promote lateral shoots

- **In roots**

a. Auxins promote root branching,
b. cytokinins inhibit root branching

Ethylene Gas

Colorless gas. Produced in:

a. **nodes of stems,**
b. **ripening fruits,**
c. **dying leaves**

Ethylene exposure

1. **Thickens stems**
2. **Breaks down chlorophyll**
3. **Weakens cell membranes**
4. **Softens cell walls**

Abscisic Acid – The Plant Stress Hormone

Widespread in plant body – moves readily through plant. ABA appears to be synthesized (made) by the leaves. Interact with other hormones in the plant, counteracting the growth – promoting the effects of auxins & gibberellins. It controls:

1. Involved with leaf and **fruit abscission** (fall),
2. **Onset of dormancy** in seeds and onset of dormancy (rest period) in **perennial flowers** and shrubs.

3. ABA is effective in inducing **closure of stomata in leaves**, indicating a role in the **stress physiology** in plants. (ex: increases in ABA following water, heat and high salinity stress to the plant)

Florigen

A hormone called florigen both stimulates and inhibits flowering. Since flowering is sometimes a function of day length**.** Pigments called phytochromes are involved in "measuring" day length. The ratio of different forms of this pigments change as a function sunlight exposure and can thus be used by the plants to set their "internal biological clocks".