# Ratna Sagar

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**Education, Our Mission**

As per the latest ICSE syllabus 2022

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Revised and Updated

# LIVING SCIENCE BIOLOGY

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EDUCATION, OUR MISSION

# ICSE
# Living Science
# Biology

## Class 10

## Chapter 7 Chemical Coordination in Plants

## LEARNING OBJECTIVES

**Stimuli and Receptors**

**Tropic Movements or Tropism**

- **Types of tropical movements in plants**
- **1. Phototropism – Movement in response to light**
- **2. Geotropism – Movement in response to gravity**

**3. Hydrotropism – Movement in response to water**

**4. Chemotropism – Movement in response to chemicals**

**5. Thigmotropism – Movement in response to touch**

**Nastic movements or Nasties**

**Plant growth regulators**

- **Types of plant growth regulators**

**What are the functions of hormones in plants?**

Since plants do not have nervous system, they use hormones for coordination and response. Therefore, the function of control and coordination in plants is performed by chemical substances called hormones or plant growth regulators.

## Stimuli and Receptors

Any change in the environment to which an organism responds and reacts is called a **stimulus**. Stimuli are detected by group of cells called **receptors**. For example, our skin, eyes, ears, nose and tongue contain different receptors.

Touch-me-not plant (*Mimosa pudica*)

Plants and animals respond to stimuli in a different way. Animals respond to stimuli in many ways because they have a nervous system. However, plants react to stimuli in a very limited way because they do not have a nervous system. Thus, response to stimuli is a characteristic property of each living organism.

## Tropic Movements or Tropism

Plant movements in response to stimuli can be of two types:

- ❖ Tropic movements
- ❖ Nastic movements

A growth response that results in the movement of plant part towards or away from stimuli is called **tropism.** In simpler terms, the movement of a plant in the direction of stimulus is known as **tropism**. It is of two types – positive tropism and negative tropism.

- When the growth movement of the plant part is towards the stimulus, it is called **positive tropism**.
- When the growth movement of the plant part is against or away from the stimulus, it is called **negative tropism**.

## Types of tropical movements in plants

There are five types of tropical movements in the plants – phototropism, geotropism, hydrotropism, chemotropism and thigmotropism.

### 1. Phototropism – Movement in response to light

The growth and movement (orientation) of a plant part in response to the light is called phototropism. If the plant part (like shoot/stem) orients towards the light then it shows **positive phototropism**. If the plant part (like its root) moves away from light then it shows **negative phototropism.**

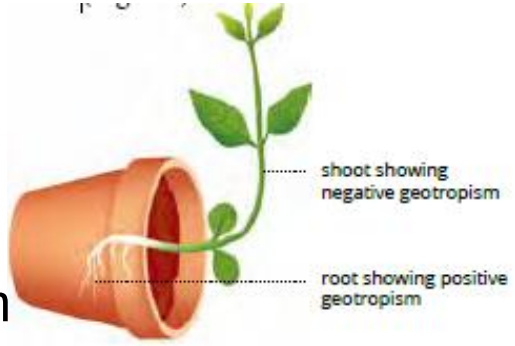
Positive phototropism


Negative phototropism

## 2. Geotropism – Movement in response to gravity

The growth movement of plant part in response to gravitational force of the earth is called geotropism. Roots show positive geotropism (grows in the direction of gravity) **while shoots show negative geotropism** (grows against force of gravity).

This can be observed if you plant a seedling upside down, the roots tend to grow downwards while the shoot will grow upwards




Positive and negative geotropism


Positive hydrotropism

## 3. Hydrotropism – Movement in response to water

The growth movement of plant parts towards water or moisture is called **hydrotropism.** The roots always grow towards water, therefore roots are **positively hydrotropic**. For example, the roots of plant growing in humid air bend towards a higher relative humidity level.

## 4. Chemotropism – Movement in response to chemicals

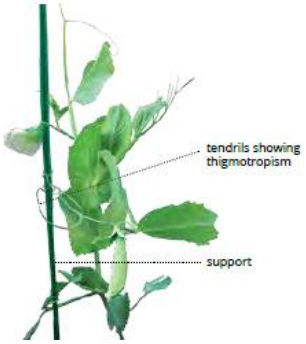
The growth movement of a plant part due to chemical stimuli is called chemotropism.

For example, pollen tube grows through the style towards ovules in response to certain chemical secretions from stigma.When the plant part grows towards chemical stimulus, it is positive chemotropism. If it grows away from chemicals, it is negative chemotropism.

## 5. Thigmotropism – Movement in response to touch

The growth movement of a plant part in response to the touch of an object is called **thigmotropism.**

When the plant organ touches a support, it results in a coiling response to catch hold the object and tighten its hold. For example, the tendrils of a plant (such as sweet pea and vines) grow towards a support, touch it and wind around that support.




Roots have a negative touch response, which means that when they feel an object they move and grow away from it. This property allows the root to go through the soil with minimum resistance.

## Nastic movements or Nasties

The movement of a plant part in response to an external stimulus when the direction of response is not oriented with respect to the direction of stimulus is called **nastic movement**.

Nastic movements are temporary movements and plant organs revert back after removal of stimulus.

❖ When the non-directional movement of a plant part is in response to touch, it is called thigmonasty. For example, movement in touch-me-not plant (*Mimosa pudica*).

❖ When the non-directional movement of a plant part (usually petals) is in response to light, it is called photonasty. For example, opening and closing of dandelion flower in response to light intensity. The main difference between tropic and nastic movements is that a tropic movement is directional while a nastic movement is non-directional.

## Plant growth regulators

Plants produce certain chemical substances in their cells which regulate their growth and development. These chemicals are secreted in very minute quantity but have a substantial effect on physiological processes in a plant.

Some of these chemicals stimulate plant growth while others retard the rate of growth of plants. Therefore, these chemicals are known as **plant growth regulators** or **plant hormones** or **phytohormones**. They coordinate the activities of the plants by controlling one or the other aspect of growth of the plants.

## Types of plant growth regulators

There are five main types of naturally occurring plant hormones or plant growth regulators.

1. Auxins 2. Gibberellins 3. Cytokinins 4. Ethylene 5. Abscisic acid (ABA)

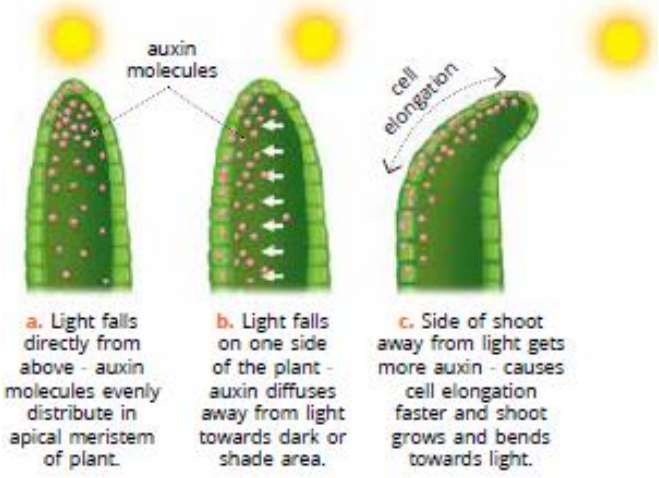
**1.Auxins:** Auxins are a group of **plant growth regulators** which are synthesized in meristematic tissues at the shoot and root tips. Auxins promote cell enlargement and cell differentiation. The most common naturally occurring auxin is indole-3-acetic acid (IAA).

**Functions**

**1. Influence plant growth:** Auxin is a **growth hormone** and helps the cells to grow longer.

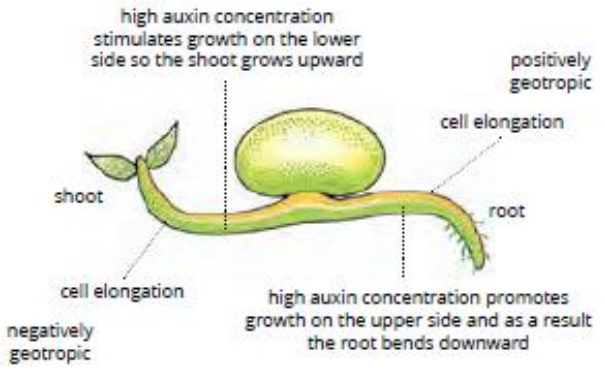
**2. Counter balances root and shoot growth:** It has opposite effect on the growth of the stem and roots. It promotes cell growth in shoots and inhibits cell growth in roots.

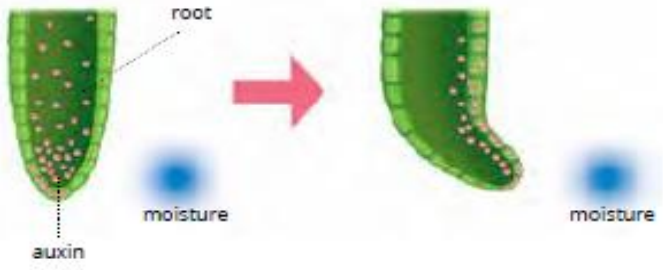
**3. Control the phototropic behaviour of a plant**: When light comes from one side of the plant, auxin diffuses away from the light towards shady side of the shoot.



The higher concentration of auxin towards shady area stimulates the cells to grow longer and faster and the plant appears to bend towards light.

**4. Control the geotropic behaviour of a plant:** In a root, extra auxin inhibits growth. In a root, which is growing sideways, more auxin gets accumulated on its lower side. Therefore, the cells on the upper side grow and elongate faster. As a result, the root bends downwards.




**5. Control the hypotropic behaviour of a plant:** In a root, more auxin gets produced on the side with more moisture. This inhibits the growth on that side and as a result the root bends towards the moisture.

**6. Induces the formation of seedless fruits** without fertilization (known as parthenocarpy) in number of plants. For example in tomatoes.

**7. Helps in lengthening of internodes** and suppresses growth of lateral buds.

**2. Gibberellins :** Gibberellins are another class of plant growth regulators which produce a variety of physiological responses in plants. These are formed in plastids of leaves of buds, developing embryos and root tips.

**Functions**

1. Gibberellin promotes cell enlargement in the presence of auxins.
2. It delays leaf senescence in a few species of plants.
3. It promotes cell division and stimulates stem elongation.
4. It stimulates seed germination by breaking seed dormancy.
5. It also helps in seed germination, flowering and fruit ripening.
6. It is used in the brewing industry to speed up the malting process.

**3. Cytokinins:** Cytokinins are a kind of plant hormones that play a central role during cell cycle and influence many developmental processes. Natural cytokinins are synthesized in regions where rapid cell division occurs, for example, root apices, developing shoot buds, young fruits, etc. It also helps to produce new leaves, chloroplasts and lateral shoot growth.

**Functions**

**1.** Cytokinin **promotes cell division**. Therefore, it is present in high concentration in areas of rapid cell division like fruits and seeds.

**2.** It **controls cell enlargement** and **cell differentiation**.

**3.** Like gibberellins, it also **helps in breaking seed dormancy**.

**4. Ethylene:** Ethylene is a growth regulatory **gaseous hormone**. It is formed in all parts of plants but its synthesis occurs maximum during ripening of some fruits.

**Functions**

**1.** Ethylene is a gaseous hormone that has **inhibitory effect on growth**.

**2.** It stimulates abscission in flowers and fruits.

**3.** It strongly promotes the formation of female flowers in monoecious plants like pumpkin and melon.

**4.** It induces ripening of fruits and flowering in mango.

**5.** It causes downward curvature of leaves (known as epinasty).

**6.** It breaks seed and bud dormancy. It initiates sprouting of potato tubers and germination in peanut seeds.

**5. Abscisic acid (ABA):** It is a weak acid that was first identified in the early 1960s as a growth inhibitor and originally believed to be involved in abscission. It is also called a **stress hormone** as it acts as a mediator in controlling plant responses to environmental stresses. It is produced in mature green leaves and in fruits.

**Functions**

**1.** Abscisic acid is a **growth inhibiting hormone** and **inhibitor of plant metabolism**.

**2.** It **promotes wilting of leaves**.

**3.** It **promotes dormancy of seeds and buds**. It acts as an inhibitor of seed germination.

**4.** It **prevents loss of water** by causing stomatal closure.

## SUMMARY...

- ❖ Plants do not have nervous system but they still respond to internal and external changes in the environment around them.
- ❖ The function of control and coordination in plants is performed by chemical substances called hormones or plant growth regulators.
- ❖ Any change in the environment to which an organism responds and reacts is called a stimulus. Response to stimuli is a characteristic property of each living organism.
- ❖ Plant movements in response to stimuli can be of two types: tropic movements and nastic movements.
- ❖ A growth response that results in the movement of plant part towards or away from stimuli is called tropism.
- ❖ When the growth movement of the plant part is towards the stimulus, it is called positive tropism. When the growth movement of the plant part is against or away from the stimulus, it is called negative tropism.
- ❖ There are five types of tropisms found in the plants – phototropism, geotropism, hydrotropism, chemotropism and thigmotropism.
- ❖The growth and movement of a plant part in response to the light is called phototropism.
- ❖ The growth movement of plant part in response to gravitational force of the earth is called geotropism.

❖ The growth movement of plant part towards water or moisture is called hydrotropism.

❖ The growth movement of a plant part due to chemical stimuli is called chemotropism.

❖ The growth movement of a plant part in response to the touch of an object is called thigmotropism.

❖ The movement of a plant part in response to an external stimulus when the direction of response is not based on the direction of stimulus is called nastic movement.

❖ Plants produce certain chemical substances in their cells which regulate their growth and development. These chemicals are known as plant growth regulators or plant hormones or phytohormones.

❖ Auxin is a growth hormone and helps the cells to grow longer, controls the phototrophic behaviour and the geotropic behaviour of a plant.

❖ Gibberellin promotes cell enlargement, promotes cell division and stimulates stem elongation.

❖ Cytokinins play central role during cell cycle and influence numerous developmental programmes.

❖ Ethylene is a gaseous hormone that has inhibitory effect on growth and induces ripening of fruits.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