Al-Mustaqbal University

College of Science

General biology-Botany

Professions Theoretical Lecture 9

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**plant movements**

Plant movements are complex processes that help plants respond to their environment. They allow plants to optimize growth, reproduce effectively, and survive adverse conditions. These movements are often categorized into **tropic**, **nastic**, and **automatic** movements. Let's break each one down in more detail:

### 1. Tropic Movements

Tropic movements are **directional** movements in response to an environmental stimulus. The direction of the growth is determined by the stimulus source. Tropic movements are largely governed by plant hormones, especially auxins.

#### a. ****Phototropism**** (Movement in response to light)

* **Positive phototropism**: Plant parts, like stems and leaves, grow toward light, which helps them maximize photosynthesis.
* **Negative phototropism**: Roots typically grow away from light, as they seek out nutrients and moisture in the soil.
* **Mechanism**: Auxins accumulate on the shaded side of the plant, causing cells to elongate and the plant to bend toward the light.
* **Examples**:
	+ Sunflower stems bending toward the sun.
	+ Houseplants leaning toward the window for more light.

#### b. ****Gravitropism**** (Movement in response to gravity)

* **Positive gravitropism**: Roots grow downward, toward the gravitational pull, helping plants anchor and absorb water and nutrients from the soil.
* **Negative gravitropism**: Stems and shoots grow upward, away from gravity, to reach sunlight for photosynthesis.
* **Mechanism**: Gravity causes auxins to redistribute within the plant, with more auxin accumulating on the lower side, promoting cell elongation and growth in the opposite direction of gravity.
* **Examples**:
	+ Roots of plants like corn grow downward.
	+ The stems of trees grow upward, defying gravity.

#### c. ****Hydrotropism**** (Movement in response to water)

* **Positive hydrotropism**: Roots grow toward areas with higher moisture concentrations to find water.
* **Negative hydrotropism**: Some roots may grow away from waterlogged soil to avoid damage.
* **Mechanism**: Plant roots can sense moisture gradients in the soil and grow toward regions where water is available.
* **Examples**:
	+ Roots of desert plants growing toward deeper water sources.
	+ Roots of crops like rice seeking out moisture in flooded soils.

#### d. ****Thigmotropism**** (Movement in response to touch)

* **Positive thigmotropism**: Plants like climbing vines or tendrils grow toward and wrap around support structures.
* **Negative thigmotropism**: Some roots grow away from obstacles or physical barriers in the soil.
* **Mechanism**: Physical touch causes changes in the distribution of auxins, leading to differential growth and coiling or bending toward the touch stimulus.
* **Examples**:
	+ Vine tendrils wrapping around a trellis.
	+ Sensitive plants like Mimosa pudica closing their leaves upon touch.

### 2. Nastic Movements

Nastic movements are **non-directional**, meaning they occur in response to stimuli, but not in a fixed direction relative to the stimulus. These movements are usually caused by changes in turgor pressure (the internal pressure of a plant cell), rather than growth.

#### a. ****Photonasty**** (Movement in response to light)

* **Photonastic movements** are typically observed in flowers or leaves that open and close in response to light cycles, but not necessarily toward or away from the light source.
* **Examples**:
	+ The opening and closing of tulip flowers in the morning and evening.
	+ The closing of sunflower petals when light diminishes.

#### b. ****Thigmonasty**** (Movement in response to touch)

* **Rapid movement**: Plants that exhibit thigmonasty react to mechanical stimuli like touch, temperature changes, or vibrations.
* **Examples**:
	+ Mimosa pudica, also known as the sensitive plant, where the leaves fold up when touched.
	+ The Venus flytrap closing its lobes when prey touches its trigger hairs.
	+ The rapid closing of certain flower petals when touched.

#### c. ****Nyctinasty**** (Movement in response to darkness)

* **Circadian rhythm**: Some plants exhibit daily movements in response to the absence of light.
* **Examples**:
	+ The folding of leaves at night, as seen in Oxalis or Mimosa species.
	+ The closing of flowers in the evening, such as the evening primrose.

### 3. Automatic Movements (also known as Growth Movements)

These are slow, directional movements that do not involve the plant responding to an external stimulus but rather occur due to the inherent growth patterns of the plant.

#### a. ****Turgor Movement****

* **Turgor pressure** plays a significant role in plant movements such as the opening and closing of stomata, the movement of water through vascular tissue, and leaf unfolding.
* **Example**:
	+ The opening of guard cells around stomata when they fill with water, allowing gas exchange.

#### b. ****Nutation****

* **Nutation** is a **rotational movement** often seen in plant stems and tendrils. It involves a slow, spiral movement that allows the plant to seek out support or grow toward more favorable conditions.
* **Example**: The spiraling of climbing plants like morning glories.

#### c. ****Circumnutation****

* The plant undergoes a slow circular motion as it searches for support or favorable growth conditions. This is a type of movement seen in some growing stems, especially in climbing plants.
* **Example**: The tendrils of certain vines may move in circular patterns to locate a surface to climb.

### Hormonal Control in Plant Movements

Plant hormones, or **phytohormones**, play a key role in regulating plant movement, particularly tropic responses:

* **Auxins**: These hormones promote cell elongation and are crucial for phototropism, gravitropism, and thigmotropism. They often accumulate on the shaded or lower side of the plant, directing growth.
* **Gibberellins**: They also influence growth and elongation, particularly in stems and fruits.
* **Cytokinins**: Involved in cell division and growth, they often work in opposition to auxins.
* **Abscisic acid (ABA)**: Responsible for slowing growth and facilitating responses to stress, like drought.
* **Ethylene**: Influences fruit ripening and leaf abscission, and can play a role in responses to physical injury.