➢ Growth Correlations in Plants

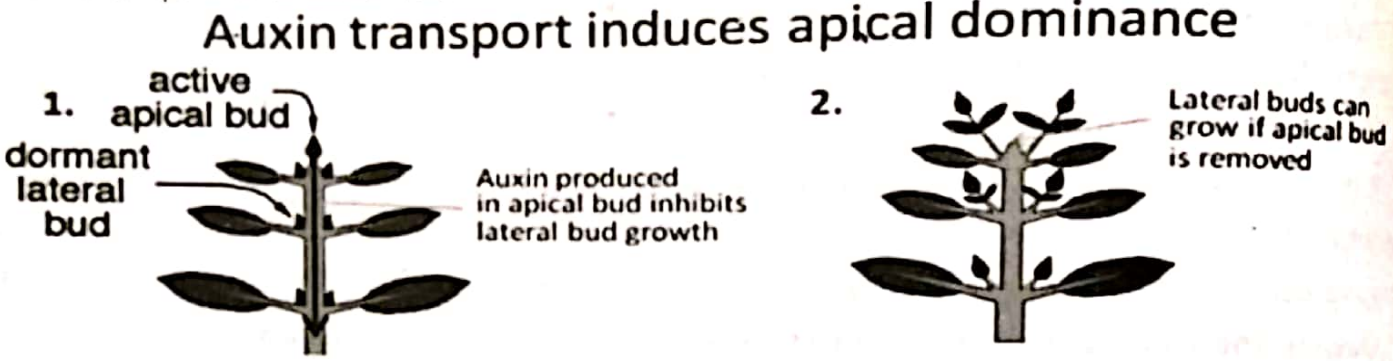
The relationship of growth among different organs of a plant is called growth correlation or the relationship between the parts of plant in which the activity of one part influence the growth of other part is called growth correlation. In plants the growth of various parts is correlated with each other.

Examples: Growth of vegetative part is sharply checked during fruiting. Similarly formation of flower may be controlled by the activity of leaves.

Types: There are two types of growth correlation in plant:

1. Inhibitory Correlation (Apical dominance)

When the activity of apical bud inhibits or control the growth of lateral buds (branches) is called inhibitory correlation. It is also called Apical dominance. In apical dominance the apical bud dominate and control the growth of lateral buds. Apical dominance depends upon the distance between apical and lateral buds.



Apical dominance is of two types

a. **Complete Apical Dominance:** When the apical bud completely inhibits the growth of lateral bud is called complete apical dominance. In this case only the main shoot grows and the growth of lateral bud is completely inhibited e.g. sunflower.

b. **Incompletely Apical Dominance:** When the apical bud cannot fully inhibit the growth of lateral buds is called incomplete apical dominance. In this case the apical bud is weak and lateral buds grow out. This results in bushy appearance of plants e.g. Tomato.

Inhibitory Factor

In 1934, Thiman and Skoog discovered that Auxin (IAA) causes apical dominance.

2. Compensatory Correlation

When the removal of one part enhances (increase) the growth of other part is called compensatory correlation. Example: Thinning of fruits can cause the remaining fruits to grow larger in size. In *Chrysanthemum* (Gul-e-Daude) removal of all buds except one results in the development of one large single flower.

➢ Plant Growth Hormones

- Plant hormones are usually referred as phytohormones or growth regulator or growth promoters.
- Phytohormones are organic compounds.
- They are active in extreme minute quantity.
- Their transportation occurs through Phloem.
- They are produced in one part of plant and target (act) in other part of plant.

Types: The following are the types of plant growth hormones.

1. Auxins **2.** Gibberellins **3.** Cytokinin **4.** Abscissic acid **5.** Ethylene

Auxins

Auxin is a Greek word which means "to increases".

Naturally occurring auxin: Indole acetic acid (IAA)

Occurrence: Auxins are produced in:

i. Apical meristem of shoots and roots

ii. Coleoptiles tips

Coleoptiles are membranous structure; protect plumule during early stage of seed germination.

Role: Auxin controls and regulates many physiological processes.

1. It promotes cell elongation by relaxing cellulose fibrils of the cell wall hence cells expand.
2. It causes differentiation of vascular tissues and initiates cell division in vascular cambium.
3. It causes inhibition of lateral buds or promotes apical dominance.
4. The same quantity of auxin that promotes growth in stem inhibits growth in main root system.

Gibberellins

Discovery: It was discovered by Kurosawa (1920)

In Japan, a disease of rice plant known as "Foolish seedling disease of rice" had body affected the rice plants. The diseased plants were longer than normal plants and were pale yellow. Kurosawa confirmed that it is caused by a fungus *Gibberella fujikurai* which contain certain chemicals substances; it was given the name gibberellins.

Occurrence: Gibberellin is produced in immature seeds, young leaves and stem.

Role:

1. Gibberellin causes stem elongation in dwarf plants.
2. Gibberellin breaks seed dormancy
3. Gibberellin causes bolting in dwarf plants (bolting: formation of elongated flowering stalk)
4. Gibberellin has role in seed germination in grasses e.g. Barley seed contain embryo which releases gibberellin, causes aleurone layer of endosperm to produce α-amylase which convert starch into glucose, it nourishes the embryo and promote seed germination.
5. Gibberellin promotes flowering in long day plants.
6. Exogenous application of gibberellin promotes more fruit formation e.g. in apple and grapes etc.
7. It helps in growing seedless grapes
8. Improve storage life of banana etc.

Cytokinin

Cytokinin is a Greek word: Cyto- Cell, Kinin= division

Discovery: It was discovered by Miller (1950) who was working in Prof. Skoog's Laboratory. He wanted to culture tobacco pith cells. He used different chemicals but failed. At last, he accidently added herring fish's sperm old DNA. It caused cell division. He concluded that the old DNA causes cell division and it was given the name of cytokinin i.e. it caused cell division.

Cytokinin is chemically related to certain components of nucleic acid. In the DNA, it was actually Purine bases which caused cell division of pith cells.

Role

1. Cytokinin induces cell division along with auxin in plant tissue culture.
2. It promotes root formation in tobacco pith culture.

3. It promotes growth of lateral buds or inhibits apical dominance working in opposition to the effects of auxin.
4. It prevents senescence/aging in leaves by stimulating protein synthesis.
5. In tobacco pith culture, a high concentration of auxin promotes root formation while a high concentration of cytokinins promotes bud formation.

➢ Abscissic Acid (ABA)

Discovery: After the discovery of auxins, plant physiologists suspected a dormancy causing chemical in plants.

Addicot (1963) isolated a growth inhibitor i.e. abscission causing agent in young cotton fruits and was called abscission II.

At the same time a substance was Isolated from *Betula pubescence* which caused bud dormancy and it was called dormin, similar to abscission II on chemical analysis.

Later on, abscission II was given the name of "Abscissic acid" due to its abscission character and acidic in nature.

Role

1. ABA causes bud and seed dormancy in plants.
2. ABA inhibits active growth of seedling and flowering in long day plants.
3. ABA promotes abscission/falling of leaves, flowers and fruits.
4. During stress conditions (water deficiency) concentration of ABA increases which cause closure of stomata and facilitates influx of water into the roots.

Therefore, ABA is also known as **stress hormone** that helps the plants to get rid of adverse conditions.

➢ Ethylene

Ethylene is a gaseous hormone found in leaves, flowers and fruits.

Role

1. It promotes fruit ripening.
2. It causes inhibition of root growth.
3. It promotes development of auxiliary buds.
4. It stimulates senescence and abscission of leaves.