Lab -8- **Alyaa Mohsin**

Plant hormones

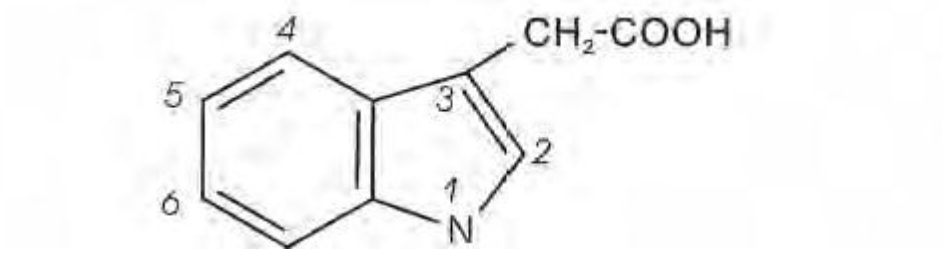
Plant hormones are *a group of naturally occurring, organic substances which influence physiological processes at low concentrations*. The processes influenced consist mainly of growth, differentiation and development. These hormones play an active role in every step of the plant's life cycle and are classified to:

- auxins
- cytokinins
- gibberellins
- ethylene
- abscisic acid

1-Auxin

Encourages plant growth increasing cell elongation and proliferation. The transport of auxins synthesized in meristematic tissues, such as leaves, top buds and flowers, is downward. Indole-3-acetic acid (IAA) is the only hormone naturally synthesized in plants. However, many synthetic materials were shown to have similar effects to IAA.

Auxins are a class of phytohormones that control numerous processes of plant growth and development . Auxins are known primarily for their ability to induce cell elongation. In addition, they stimulate cell division, vascular differentiation, and root initiation.
Indole-3-acetic acid (IAA) is an essential auxin in the plant, which is produced mainly in meristematic tissues of young leaves.



IAA (indole-3-acetic acid

Sites of biosynthesis of IAA is synthesized from tryptophan or indole primarily in leaf primordial and young leaves, and in developing seeds.

Action of Auxins

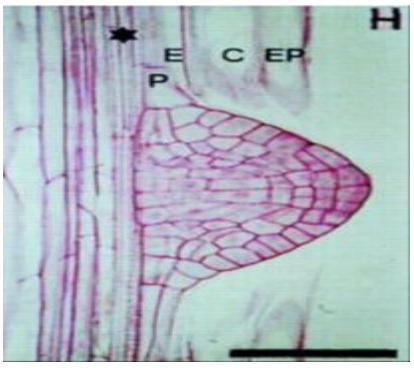
1- Cell enlargement - auxin stimulates cell enlargement and stem growth
2- Cell division - auxin stimulates cell division in the cambium and, in combination with cytokinin, in tissue culture
3- Vascular tissue differentiation - auxin stimulates differentiation of phloem and xylem
4- Root initiation - auxin stimulates root initiation on stem cuttings, and also the development of branch roots and the differentiation of roots in tissue culture .
5- Apical dominance - the auxin supply from the apical bud represses the growth of lateral buds .

Cytokinins (CKs)

Nature

CKs are adenine derivatives characterized by an ability to induce cell division in tissue culture (in the presence of auxin). The most common cytokinin base in plants is zeatin.

Shoot branches are promoted by CK and inhibited by auxin



Root branches, called lateral roots, are promoted by auxin and inhibited by CK

Cytokinin transport

Cytokinins are transported from roots to shoots via the xylem and from shoots to roots via the phloem

Effects

1- Cell division - exogenous applications of CKs induce cell division in tissue culture in the presence of auxin This also occurs endogenously in crown gall tumors on plants . The presence of CKs in tissues with actively dividing cells (e.g., fruits, shoot tips) indicates that CKs may naturally perform this function in the plant.

2- Morphogenesis - in tissue culture and crown gall . CKs promote shoot initiation. CKs induce bud formation .

3- Leaf expansion ,resulting solely from cell enlargement. This is probably the mechanism by which the total leaf area is adjusted to compensate for the extent of root growth, as the amount of CKs reaching the shoot will reflect the extent of the root system.

4- CKs delay leaf senescence

5- CKs may enhance stomatal opening in some species .

6- Chloroplast development - the application of CK leads to an accumulation of chlorophyll and promotes the conversion of etioplasts into chloroplasts .

Lab -9-

Gibberellins (GAs)

Gibberellins are also hormones that promote growth and development at low doses, such as auxins. The gibberellins were discovered in 1926 by a Japanese researcher from *Gibberella fujikuroi*, which caused a lot of overgrowth in the rice plant. This substance was then isolated and named gibberellic acid (GA3). GA3 is the most common form of gibberellins. Now, it is known that there are at least 126 forms of gibberellin. They are found in buds, embryos, roots, young leaves, flowers, fruits and cambium of plants

Sites of biosynthesis.

GAs are synthesized from glyceraldehyde-3-phosphate, via isopentenyl

diphosphate, in young tissues of the shoot and developing seed. Their

biosynthesis starts in the chloroplast and subsequently involves membrane

and cytoplasmic steps

Effects

-The most obvious effect of gibberellins is to increase the prolongation of the cells. Also, they are very effective in breaking down seed and bud dormancy, eliminating the dwarfism, and the need for chilling, encouraging parthenocarpic fruit bearing and germination. . GAs cause stem elongation in response to long days

- Enzyme production during germination - GA stimulates the production of numerous enzymes, notably α-amylase, in germinating cereal grains

Ethylene

Nature

The gas ethylene is synthesized from methionine in many tissues in response to stress, and is the fruit ripening hormone. It does not seem to be essential for normal mature vegetative growth, as ethylene deficient transgenic plants grow normally.

Sites of synthesis

Ethylene is synthesized by most tissues in response to stress. In particular, it is synthesized in tissues undergoing senescence or ripening .

Effects

Ethylene gas is used for the ripening and yellowing of fruit species such as banana, citrus, pear, tomato, melon and pineapple. Also in plants, ethylene has the effects of breaking the dormancy, promoting flowering, stimulating adventitious root formation, promoting female flower formation in monocious plants. Leaf and fruit abscission. Flower opening. Flower and leaf senescence. Fruit ripening

Abscisic Acid

In addition to natural growth promoting substances, there are also inhibitory natural substances moving in the reverse direction, and the most important is abscisic acid. ABA is a natural antagonist of auxin, gibberellins and cytokinins known as promoting hormones. ABA is present in all organs of plant but mostly found in green leaves, and synthesized in the cytoplasm of mesophyll cells.

The ABA concentration in plants varies depending on environmental conditions, and the effect on physiological events is also variable.

Sites of synthesis

ABA is synthesized from glyceraldehyde-3-phosphate via isopentenyl

diphosphate and carotenoids in roots and mature leaves, particularly in response to water stress.

Effects

1-Stomatal closure - water shortage brings about an increase in ABA

which leads to stomatal closure

2- ABA inhibits shoot growth

3- ABA induces storage protein synthesis in seeds.

4- ABA counteracts the effect of gibberellin on α-amylase synthesis in germinating cereal grains.

5- ABA affects the induction and maintenance of some aspects of dormancy in seeds .