

# The Integral Role of Plant Hormones in their Growth and Development

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Hormones are the tools in the tool chest of a living body. They produce and control certain feelings and emotions. Plants are no exception to hormones, as well. Plants get their senses due to the presence of hormones being produced and utilized properly in their bodies. The recognized classes of plant hormones include auxins, cytokinins, gibberellins, ethylene, and abscisic acid. All of them play important roles in the development and growth of plant cells. However, auxins and cytokinins are the most important plant hormones. Along with them, some non-traditional hormones such as jasmonates and oligosaccharides work in the plant bodies.

Auxins make an integral part of the plant's nutrient media. It promotes the growth of organs, cell suspensions, and calli. It is also responsible for regulating the direction of morphogenesis. It also controls basic processes such as cell elongation and cell division at the cellular level. Since they initiate cell division, they are also involved in giving rise to either defined organs or unorganized tissues due to the formation of meristems. They mediate tropisms and maintain apical dominance in whole plants whereas in the organized tissues, they establish and maintain polarity (Friml, 2003). Indole-3-acetic acid (IAA) is the most common form of auxins. They are particularly important for fruit setting and dropping in plants such as seedless cucumbers.

Gibberellin comes into existence as a metabolic product of a fungus. Gibberellin A<sub>2</sub> (C<sub>19</sub>H<sub>26</sub>O<sub>6</sub>), gibberellin A<sub>1</sub> (C<sub>19</sub>H<sub>24</sub>O<sub>6</sub>) and gibberellic acid (C<sub>19</sub>H<sub>22</sub>O<sub>6</sub>) are three famously known gibberellins. It creates nearly the same changes in a plant as auxins do. It influences seed and pericarp growth, anther development, flower induction, stem elongation, and seed germination. They are also responsible for modifying the flux through the GA-biosynthetic pathway which is primarily essential for the development and adaptation of the plant to its environment. This is why gibberellins mediate environmental stimuli (Bartley et al., 1994). Its effect on some species of plants is greater than others. However, not all plants positively respond to gibberellin, especially the dwarf plants. Maturing grapes are treated with it to induce looser bunches and larger fruit sizes.

Cytokinin is the fountain of youth for plants. It interacts in a complex manner and controls differentiation, development, and growth in the plants. It delays the natural aging process of a plant. The same concentration of cytokinin and auxin results in normal cell division. If auxin is greater in amount, then roots are developed. It is responsible for seed germination, the breaking of bud dormancy, floral development (Faiss et al., 1997), the activity of shoot apical meristem, apical dominance, nutrient mobilization, and leaf senescence. Its deficiency results in increased root growth and reduced shoot length.

Ethylene is another major plant hormone. It inhibits growth in the meristems of axillary buds, roots,

and shoots, DNA synthesis, and cell division without influencing RNA synthesis. It inhibits cell expansion within fifteen minutes. It also delays differentiation. For this reason, plants grow to enormous sizes (Apelbaum & Burg, 1972). Pea seedlings regularly use this hormone. It inhibits the root length to 60% and the stems never get elongated. Also, the roots deflect apogeotropically in the gravitational field. It also helps develop root hair proliferation and swollen zones behind the root tips.

Another important plant hormone is abscisic acid. It is the thirst signal of the plants. It is responsible for regulating the respiration process during drought. Also, it is the natural time of the Mother Nature. It enables the seed to break its dormancy when it falls on the ground, and the environment around it is favorable. It is particularly important in cold weather and frozen climates because the seeds are required to germinate too early in such weather if it wants to set roots and begin to grow. Pines are particularly rich in abscisic acid because they are stratified before germination. It is used to modify sodium and potassium levels in the guard cells as well. It is for this reason that plants close their stomata and save water.

The non-traditional hormones come after the big five hormones in the bodies of plants. They are compounds that influence the growth and development of plants. They have recently been discovered, and more research is required to understand their role completely. Jasmonates is one of such recent discoveries. They induce defense mechanisms in the plants. Their levels increase as a predator attacks the plant body. It is for this reason that toxic secondary metabolism increases in a plant body. For instance, if caterpillars attack a tomato plant, the fruits' jasmonate levels will increase. It triggers the release of another compound that is responsible for attracting predators that feed on the caterpillars.

## Works Cited

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