Chapter 1: Biochemical Growth of Plants

**Plant Hormones**

Plants are all around us. Walking up and down the street one might pass one to twenty different plant species. Planet Earth would not be a place where humans and animals could live without all of these plants. They are present in all seasons and respond to their surrounding environment. When the weather is warm in spring and summer some plant germinate and others become dormant. In colder weather there are different plants that germinate and go into dormancy. Plants are capable of sensing not only the change of seasons, but also; where the sun shines, touch, and gravity (Harwood, 2016). The plant responding to the stimuli, the light source, shows how plants are capable of certain responses. In plant biology when growing plants one can observe how if the light shines brightest to the right of the plant the plant will grow in that direction.

 Hormones are a good explanation on why plants respond to certain stimuli. A hormone or ‘growth substance’ is complexes that act precisely to regulate the growth and development of plants at low concentrations (Lack, 2001). There are many diverse hormones that regulate an assortment of processes that happen throughout plants. Much like animals, who have hormones like; estrogen and testosterone that carry messages from one cell to the other plants also have hormones which function so. These hormones begin from the time the plant is an embryo to their full development to their death.

**The Various Plant Hormones**

In plants there are many hormones that are responsible for a various amount of responses. The five main types of plant hormones which will be discussed are; auxins, abscisic acid, cytokinins, ethylene, and gibberellin. Each hormone possesses their own function and can also work with another hormone.

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| Hormone | Function |
| Auxins | involved with growth and apical dominance |
| Abscisic Acid | close the stomata and maintains dormancy |
| Cytokinins | promotes cell division and prevents aging |
| Ethylene | ripening of fruit |
| Gibberellins | growth and breaking dormancy |

**Auxins**

The hormone that has various effects on elongation growth, cell division and differentiation, and apical dominance (Lack, 2001) is auxins. The prime effect of auxin is to regulate the stem growth in the plant to ensure the stem grows to be strong and bold. The hormone stimulates the growth of cells with elongating the cell, as in making a sunflower grow tall with a wide stem to be able to support the plant in its entirety. The cell division and differentiation with auxins helps the roots grow to support the plant. Apical dominance shows when the main central stem is growing dominantly alongside the other stem and branches that are associated with the plant (Harwood, 2016).

**Abscisic Acid**

Abscisic acid are hormones that regulates the dormancy and germination of seeds and of plant responses to stress (Lack, 2001). When the plant is stressed, due to lack of water, the hormone tells the stomata to close, preventing the loss of anymore water. The stomata are the tiny openings in leaves that allow different substances to enter and leave the plant (Harwood, 2016). When the seasons are changing the hormone, abscisic acid signals the plant it is time to dormant for a period. When the season changes back to the plants' germination period the hormone tells the plant to bud again, breaking its dormancy, releasing fewer hormones of abscisic acid and more of the gibberellin hormone.

**Cytokinins**

The hormone cytokinin are complexes that are able to regulate cell division in plants, they cause plant cells to divide. Cytokinins were first discovered when scientists were attempting to grow plant tissues in artificial environments (Harwood, 2016). The effects associated with this hormone is the promotion of growth and the delay of senescence, making the plant age slower. When the hormone is utilized in the leaves of plants, it capable of speeding up chloroplast maturation in etiolated (dark) tissue and promote cell growth in undeveloped leaves (Lack, 2001).

**Ethylene**

Ethylene is a gaseous hormone that has two functions; helps ripen fruits and involved in the process of abscission, which is the dropping of leaves, fruits, and flowers (Harwood, 2016). From the function of being able to ripen a fruit, ethylene is a very important hormone in the world of fruit marketing. Being a gaseous fruit means it can move through the air, when the season of germination comes into play this hormone is able to begin ripening all sorts of fruits. Fruits that can produce and respond to ethylene for ripening are called climacteric fruits such as; apples, oranges, bananas, etc., having this makes the fruits autocatalytic, stimulating their own production of ethylene (Lack, 2001).

**Gibberellins**

The most studied plant hormone can be acknowledged as gibberellin (GAs), there are over 100 different GAs that have been identified. The hormone gibberellin is a large group of complexes that are formed from isoprene units, they are stimulates of elongation in dwarf plants and mediate the transition from rosette form to flowering in response to seasonal changes (Lack, 2001). The hormone also plays a role in the processes in seed and bud dormancy. Gibberellin hormones are capable of helping the plant grow: enhancing the stem to be longer and stronger and increasing the number of plants in the environment. In many rosette plants the gibberellin levels are low, but the levels increase in response to the alteration in season, which prompts the growth response in plants. In response to the seasons altering, the hormone will break dormancy for the plant. Gibberellins are essential in the process of germination and increasing the activity with rehydrating the plant.

**The Importance of the Hormones**

The Kingdom Plantae ranges from the smallest nonvascular plants to the towering redwoods that people desire to see. Without plants, photosynthesis would be nonexistent, without photosynthesis life would be nonexistent. Plants are very complex. They have many different hormones that interact with each other in different ways. Plants hormones are influenced with both long-term processes, growth and development, and short-term responses, closing the stomata for dormancy of the season. Hormones alter the activity of enzymes or other cytoplasmic components directly, they can alter gene expression to make the genetic makeup stronger, and they help with the production of new/different cellular components (Lack, 2001).

Before this can happen there must be a cellular component the hormone interacts with, a receptor which alters in function or property in response to a hormone. Between the receptor and point of action there are many inter-linked series of chemical signals, intracellular messengers, in the cell that transmits and amplifies the initial signal (Lack, 2001). Though much research has been done on many plants and their hormones only a small amount of information has been discovered in the receptor area for hormones. The receptor for auxin (ABP1) and ethylene (ETR1) are two that have been identified and characterized by scientist (Lack, 2001). Much more research on plants is needed and is in the process of being done.

**Summary of Plant Hormones**

The importance of plants is becoming more relevant with time. People are paying more attention on how the function of a plant works. Research has been done to discover many hormones and their functions. Each hormone plays such an important role with the plants on how they produce and go into dormancy. Everyone hormone can respond to certain stimuli and most of the hormones work together to either make the plant grow, go into dormancy or out of dormancy, and producing ripen fruit for people to eat. The more scientist study plants the better off everyone will be. Without plants our existence as we know it would not exist.

Work Cited

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