Informational

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Auxins, Cytokinins and Gibberellins

Isolation of the first Cytokinin

Growing cells in a tissue culture medium composed in part of coconut milk led to the realization that some substance in coconut milk promotes cell division. The "milk' of the coconut is actually a liquid endosperm containing large numbers of nuclei. It was from kernels of corn, however, that the substance was first isolated in 1964, twenty years after its presence in coconut milk was known. The substance obtained from corn is called zeatin, and it is one of many cytokinins.

What is a Growth Regulator?

Plant Cell Growth regulators (e.g. Auxins, Cytokinins and Gibberellins) - Plant hormones play an important role in growth and differentiation of cultured cells and tissues. There are many classes of plant growth regulators used in culture media involves namely: Auxins, Cytokinins, Gibberellins, Abscisic acid, Ethylene, 6 BAP (6 Benzyladenine), IAA (Indole Acetic Acid), IBA (Indole-3-Butyric Acid), Zeatin and trans Zeatin Riboside.

The Auxins facilitate cell division and root differentiation. Auxins induce cell division, cell elongation, and formation of callus in cultures. For example, 2,4-dichlorophenoxy acetic acid is one of the most commonly added auxins in plant cell cultures.
The Cytokinins induce cell division and differentiation. Cytokinins promote RNA synthesis and stimulate protein and enzyme activities in tissues. Kinetin and benzyl-aminopurine are the most frequently used cytokinins in plant cell cultures.
The Gibberellins is mainly used to induce plantlet formation from adventive embryos formed in culture.

Abscisic acid (ABA) is used in plant tissue culture to promote distinct developmental pathways such as somatic embryogenesis. Abscisic acid inhibits cell division.
Ethylene is associated with controlling fruit ripening in climacteric fruits, and its use in plant tissue culture is not widespread. Some plant cell cultures produce ethylene which, if it builds up sufficiently, can inhibit the growth and development of the culture.
As in Plant tissue culture media, the ratio of auxins and cytokinins play an important role in the morphogenesis of culture systems. When the ratio of auxins to cytokinins is high, embryogenesis, callus initiation, and root initiation occur. For axillary proliferation and shoot proliferation, the ratio of auxins to cytokinins is kept low. GA3 enhances the callus growth and induces dwarf plantlets to elongate.

While cytokinin acts mainly to promote cell division, this hormone also serves other functions:

cell enlargement in young leaves, tissue differentiation, flowering, fruiting, and delay of aging in leaves. There are now known to be as many as 100 cytokinins, some of which occur naturally and others of which are manufactured. Zeatin is the most active of the natural cytokinins and less active than some of the synthetic ones.

When several living cells are isolated from a living plant and cultured in a medium containing both cytokinin and auxin, cell division proceeds, forming a mass of undifferentiated cells called a callus. The callus is then able to differentiate and produce both shoot and root, thus developing an entire new plant. Auxin favors root formation, and cytokinin favors the growth of the shoot. This means of vegetative propagation makes possible the perpetuation of superior forms.