CYTOKININS

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1. Discovery:

They are plant growth hormones which are basic in nature, either amino purine or phenyl urea derivatives, that promote cytokinesis (= cell division) either alone or in conjunction with auxin. Skoog and co- workers found that callus from intermodal segments of Tobacco proliferate only when in addition to auxin, the nutrient medium is provided with extract of yeast, vascular tissues, coconut milk or DNA.

They were analysed to find out the growth promoting chemical. The first cytokinin was discovered from degraded autoclaved Herring sperm DNA by Miller 1955.

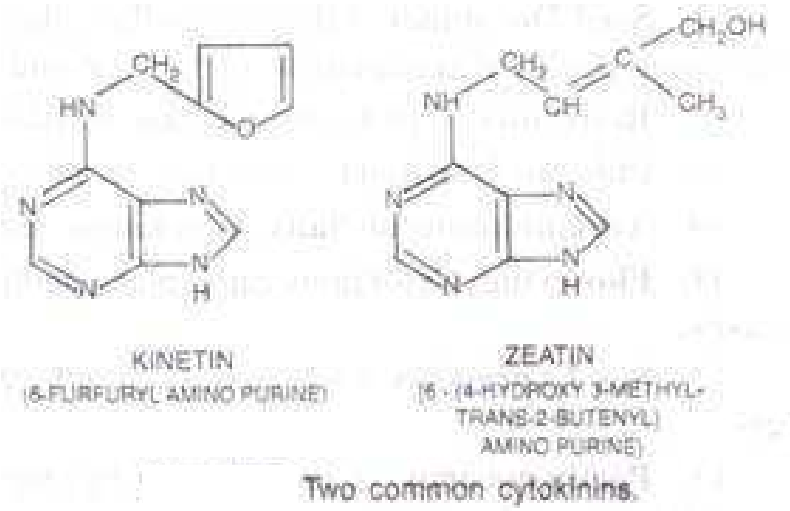
2. Chemical nature:

It is called kinetin (6-furfuryl amino-purine). Kinetin does not occur naturally. It is a synthetic hormone. The first natural cytokinin was obtained from unripe maize grains or kernels by Letham (1964). It is known as zeatin (6-hydroxy 3-methyl trans 2-butenyl amino-purine).

It also occurs in coconut milk. Up to now 18 types of cytokinins have been discovered. Some of them are constituents of transfer RNAs.

Roots seem to be the major source of cytokinin synthesis. From roots the cytokinins pass upwardly through xylem.

Some cytokinin synthesis also takes place in other areas where cell divisions are occurring like endosperm region of seeds, growing embryos and developing seeds, young fruits, developing shoots buds, etc. Coconut milk is a rich source of cytokinin.



Two common cytokinins.

3. Bioassay:

A. Tobacco Pith Culture:

Out of two tobacco pith cultures, one is supplied with cytokinin while the other is not. Increase in fresh weight of the tissue over the control is a measure of stimulation of cell divisions and hence cytokinin activity. The test can measure cytokinin concentration between 0.001- 10 mg/litre. It takes 3-5 weeks.

B. Retardation of Leaf Senescence:

It is a rapid bioassay technique. Leaf discs are taken in two lots. In one lot cytokinin is provided. After 48-72 hours, the leaf discs are compared for chlorophyll content. Cytokinin retards

the process of chlorophyll degradation. The test is sensitive in concentration of 1 pg/litre.

C. Excised Radish Cotyledon Expansion:

The test was developed by Letham. Excised Radish cotyledons are measured and placed in test solution as well as ordinary water (as control). Enlargement of cotyledons is an indication of cytokinin activity.

4. Physiological roles:

1. Cell Division:

Cytokinins are essential for cytokinesis though chromosome doubling can occur in their absence. In the presence of auxin, cytokinins bring about division even in permanent cells. Cell division in callus (unorganised, undifferentiated irregular mass of dividing cells in tissue culture) is found to require both the hormones.

2. Cell Elongation:

Like auxin and gibberellins, cytokinins also cause cell elongation.

3. Morphogenesis:

Both auxin and cytokinins are essential for morphogenesis or dif- ferentiation of tissues and organs. Buds develop when cytokinins are in excess while roots are formed when their ratios are reversed (Skoog and Miller, 1957).

4. Differentiation:

Cytokinins induce formation of new leaves, chloroplasts in leaves, lateral shoot formation and adventitious shoot formation. They also bring about lignification and differentiation of inter-fascicular cambium.

5. Senescence (Richmond-Lang Effect):

Cytokinins delay the senescence of leaves and other organs by mobilisation of nutrients.

6. Apical Dominance:

Presence of cytokinin in an area causes preferential movement of nutrients towards it. When applied to lateral buds, they help in their growth despite the presence of apical bud. They thus act antagonistically to auxin which promotes apical dominance.

7. Seed Dormancy:

Like gibberellins, they overcome seed dormancy of various types, including red light requirement of Lettuce and Tobacco seeds.

8. Resistance:

Cytokinins increase resistance to high or low temperature and disease.

9. Phloem Transport:

They help in phloem transport.

10. Accumulation of Salts:

Cytokinins induce accumulation of salts inside the cells.

11. Flowering:

Cytokinins can replace photoperiodic requirement of flowering in certain cases.

12. Sex Expression:

Like auxins and ethylene, cytokinins promote femaleness in flowers.

13. Parthenocarpy:

Crane (1965) has reported induction of parthenocarpy through cytokinin treatment.

5. Uses of Cytokinins:

1. Tissue Culture:

Cytokinins are essential for tissue culture because besides cell division they are also involved in morphogenesis. Instead of direct addition of cytokinins, the latter may be provided to tissue culture through the addition of coconut milk or yeast extract.

2. Shelf Life:

Application of cytokinins to marketed vegetables can keep them fresh for several days. Shelf life of cut shoots and flowers is prolonged by employing the hormones.

3. Resistance:

Cytokinin application is helpful to plants in developing resistance to pathogens and extremes of temperature.

4. Overcoming Senescence:

Cytokinins delay senescence of intact plant parts.

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This information, including the figures, are collected from the above references and will be used solely for academic purpose.