# Plant Growth Regulators: Cytokinin


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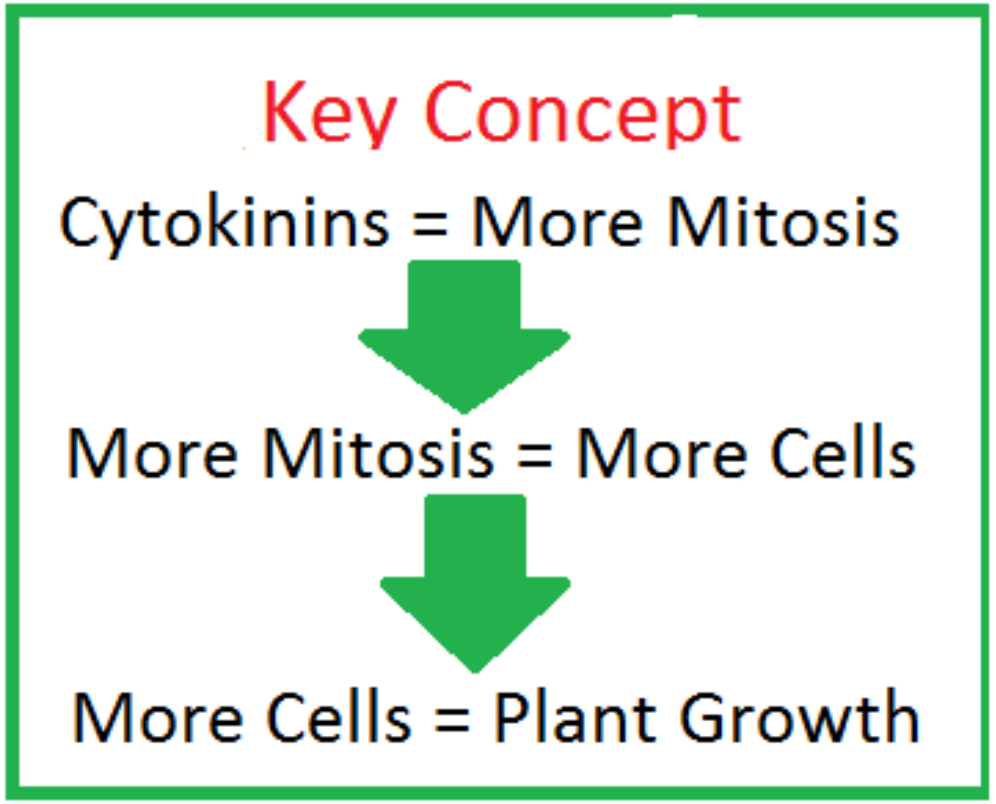
- B.Sc.(Life Sciences)
- DDU College(Department of Botany)

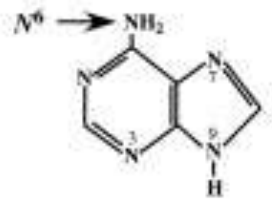


# Naturally occuring Cytokinins

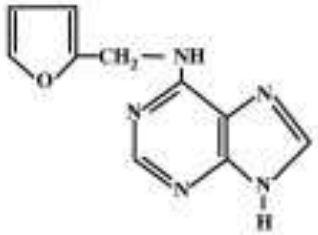
* Cytokinins extracted from coconut milk, Tomato juice
* Flowers and fruits of pear, plum
* Cambium tissues of *Eucalyptus, Nicotina*
* Immature fruits of *Zea Mays, Musa* sp.
* Root exudates of Sunflower

**Cytokinins found in plants**

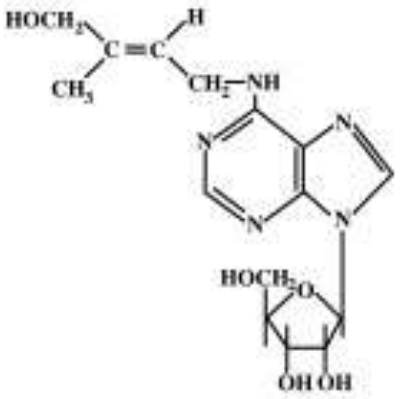
1. Ribosylzeatin,
2. Zeatin,
3. Dihydrozeatin.



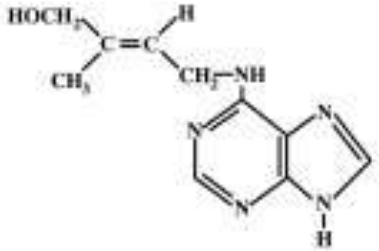
adenine



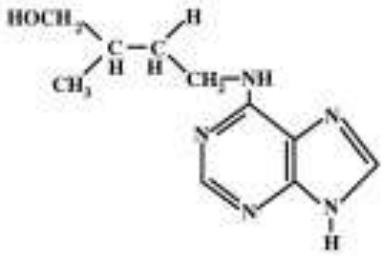
kinetin



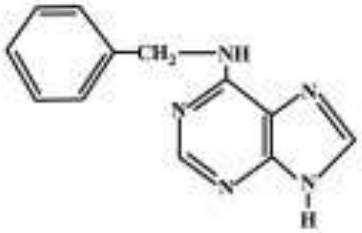
zeatin riboside



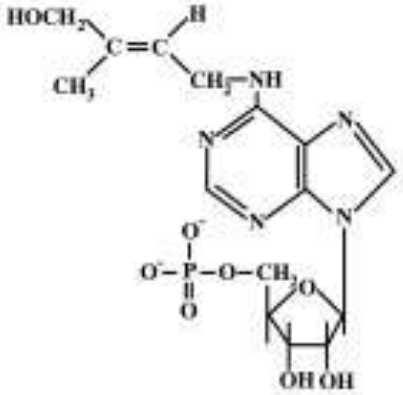
*trans*-zeatin



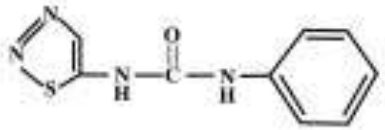
dihydrozeatin



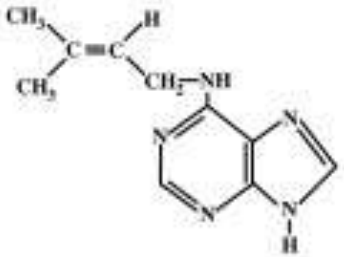
6-benzylamino purine (BA)



zeatin ribotide



thidiazuron



$N^6$-($\Delta^2$-isopentyl) adenine (iP)

Figure *1.*

Structures of cytokinins.

Adenine is the parent compound of naturally occurring cytokinins, though it does not activate cytokinin responses; the $N^6$ position is indicated with an arrow. *trans*-zeatin is the most abundant cytokinin in Arabidopsis, and the free base as well as the riboside and ribotide forms are shown. Kinetin is an artificial, aromatic cytokinin and benzyladenine is an example of a naturally occurring aromatic cytokinin. Thidiazuron is a diphenylurea-type cytokinin.

# Phytohormones and Their Functions in Growth and Development Under In Vitro Conditions

## Auxins

- Auxins are synthesized in young leaves and buds. They move mainly from apical to the basal end (basipetally) in excised coleoptile sections. Usually the transport is unidirectional, called polar transport, but recently it has been reported that it has been transported acropetally in phloem

- IAA, IBA are naturally occurring auxins

- 2-4-D, Dicamba and NAA are synthetic auxins

Functions under in vitro conditions(Auxins)

- Elongates cell
- Regulates apical dominance
- Forms lateral and adventitious roots
- Delays the onset of leaf abscission
- Regulates lateral floral bud development
- Promotes fruit development

| | |
|---|---|
| Cytokinins | •Cytokinins move to the leaves from roots, keeping root and shoot growth in balance<br>•Occur in both free and bound forms<br>•Zeatin is the most abundant naturally occurring free cytokinin; butdihydrozeatin (DZ) and isopentenyl adenine (iP) are found in higher plants and bacteria<br>•Root tip is important for its synthesis; however, cambial tissue and developing seed are also site synthesis |

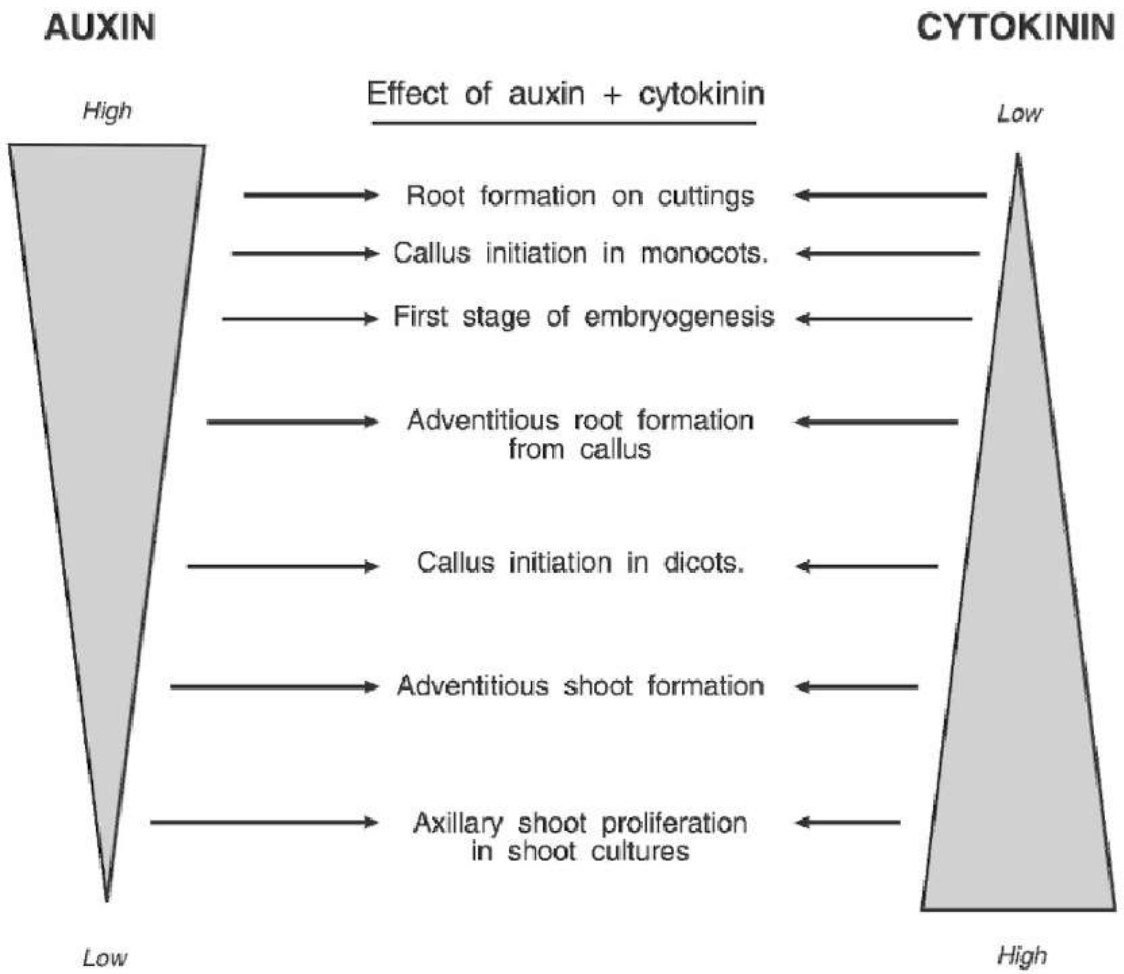
Functions under in vitro conditions

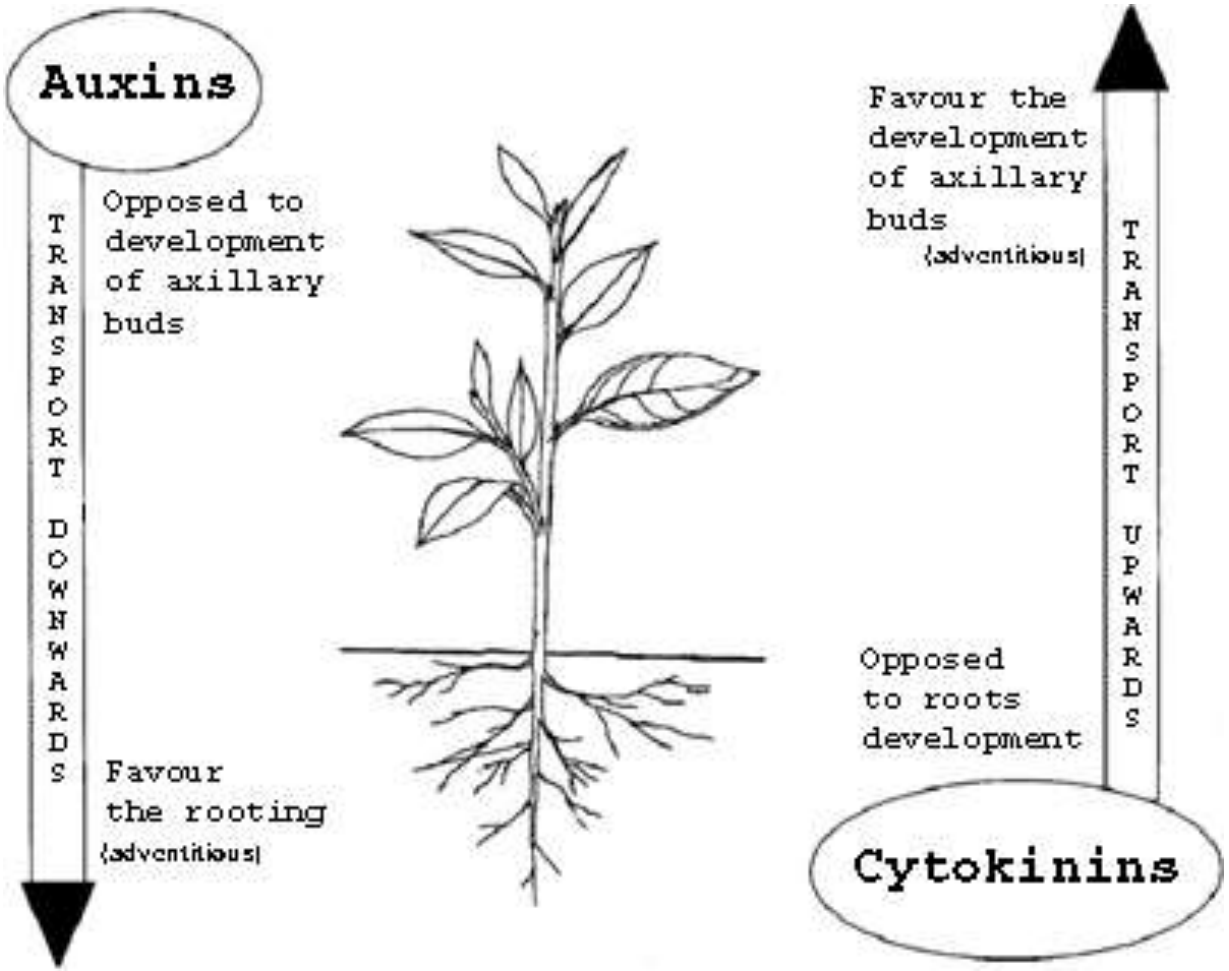
- Promotes chloroplast development
- Promotes cell division
- Promotes cell expansion in leaves and regulates growth of stem and roots
- Modifies apical dominance and promotes lateral bud growth

The auxin and cytokinin ratio regulates morphogenesis and callus formation under in vitro conditions.

cytokinin promotes plant cell division and growth, produce farmers use it to increase crops. One study found that applying cytokinin to cotton seedlings led to a 5–10% yield increase under drought conditions.[15]

**Cytokinins** have recently been found to play a role in plant pathogenesis. For example, cytokinins have been described to induce resistance against *Pseudomonas syringae* in *Arabidopsis thaliana*[16] and *Nicotiana tabacum*.[17] Also in context of biological control of plant diseases cytokinins seem to have potential functions. Production of cytokinins by *Pseudomonas fluorescens* G20-18 has been identified as a key determinant to efficiently control the infection of *A. thaliana* with *P. syringae.*.[18]


AUXIN
CYTOKININ
Effect of auxin + cytokinin
High
Low
Low
High
Root formation on cuttings
Callus initiation in monocots.
First stage of embryogenesis
Adventitious root formation from callus
Callus initiation in dicots.
Adventitious shoot formation
Axillary shoot proliferation in shoot cultures


Auxins
TRANSPORT DOWNWARDS
Opposed to development of axillary buds
Favour the rooting (adventitious)
Favour the development of axillary buds (adventitious)
TRANSPORT UPWARDS
Opposed to roots development
Cytokinins