Cytokinins

- Cytokinins Overview
- Chemical Structure
- Physiological Action
- Transport
History

- major use in tissue culture
- found in wound healing in vascular tissue and potato tubers
- Carlos Miller, yeast extract, herring sperm DNA,
- adenine derivative
Chemistry

- synthetic cytokinin: kinetin, aminopurine derivative
- natural cytokinin: zeatin from Zea mays
- zeatin riboside conjugated form; transport form
Transport/degradation

- synthesized in apical meristems, mostly roots
- transported via xylem
- shoot synthesis local
Biological roles

• Cell Division
• Cell expansion of cotyledons in radish
• Modifies apical dominance relations
• Inhibition of senescence
• Promotes chloroplast development/chlorophyll accumulation
Cell Division

- tissue culture ratios
- controls
- organogenesis
- auxin/cytokinin ratios
- control root and shoot formation
Root meristems

Wild type

overexpression of cytokinin oxidase
Tissue Culture

Kinetin concentration (mg/ml)

IAA concentration (mg/ml)
Modifies apical dominance relations

- Promotes lateral bud growth
Inhibition of senescence

- directed transport
- maintains chlorophyll levels
Promotes chloroplast development/chlorophyll accumulation
Cytokinin effects

**FIGURE 18.14.** Cytokinin stimulation of polyribosome formation in cultured soybean tissues. Cultured soybean cells were grown with or without zeatin for 3 h. The cells were then homogenized and their monoribosomes and polyribosomes were separated by centrifugation through a sucrose gradient. The relative distribution of monoribosomes and polyribosomes is shown by the solid line for the cytokinin-treated cells and the broken line for the control. The cytokinin-treated cells have fewer monoribosomes and more polyribosomes than the control. The effect can be detected within 15 min. Since polyribosomes represent ribosomes actively synthesizing proteins, the results suggest that cytokinins stimulate total protein synthesis in these cells. (From Tepfer and Poskett, 1978.)

**FIGURE 18.15.** Comparison of the effects of a cytokinin (benzyladenine) and dim red light on the transcription versus total abundance of LHCP mRNA in Lemma gibba. Transcription was determined by nuclear run-off experiments with isolated nuclei. Total abundance was measured by hybridizing H3-labeled cDNA probes to total RNA on Northern blots. In the dark, cytokinin (CK) caused a 5-fold increase in the total mRNA but only a 1.8-fold increase in transcription. In contrast, red light alone caused a 4-fold enhancement of transcription. The results indicate that red light alters transcription, whereas cytokinin affects a posttranscriptional step. The error bars represent the standard error. LHCP = chlorophyll a/b-binding polypeptide of light harvesting complex II. (Data from Flores and Tobin, 1986.)
Cell expansion

Dark control

Light control

+ Zeatin

+ Zeatin
Induction of ARR genes
Movement of AHP protein into nucleus