Plant hormones on plant growth and development

by Dr. Pawan Kumar Goutam

Plant Growth and Development

Hormones diffuse throughout the plant to promote growth and development.

What is a Plant Hormone?

A naturally-occurring compound which regulates change in physiology, *growth* or development of the plant.

5 Types of Plant Hormones

I. Auxin

II. Cytokinin

III. Gibberellin

IV. Abscisic Acid

V. Ethylene

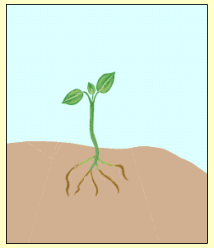
Auxin

Role of Hormone	Cell elongation *(increase cell size)*
Site of Production	Shoot Tips
Effect of Hormone	Growth of plant in response to the environment, production of roots.

Tropism: a plant's response to environment

Phototropism- response to *light*

Geotropism-response to *gravity*



Thigmotropism-response to *touch*

Auxin Growth Effects

Stimulates Adventitious <u>Root</u> Formation.

Adventitious roots grow from stems or leaves rather than from the original root system of the plants.

This is especially useful when cutting and transplanting plants.

Auxin Growth Effects

Tropisms-How a plant grows in response to the environment

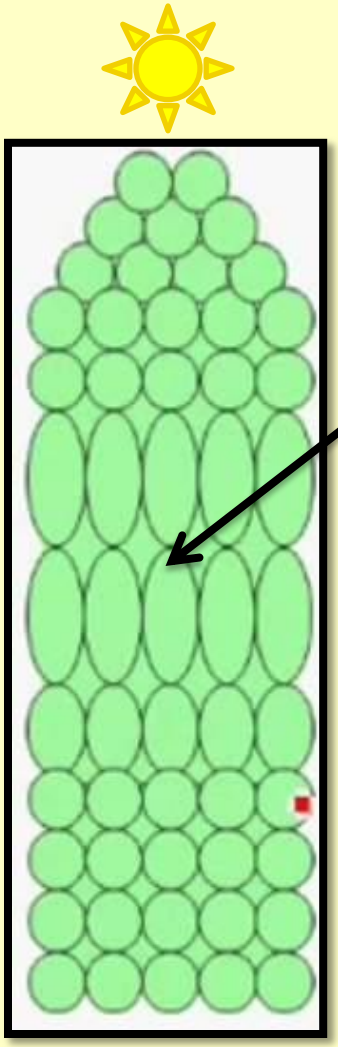
Geotropism-gravity

Phototropism-light

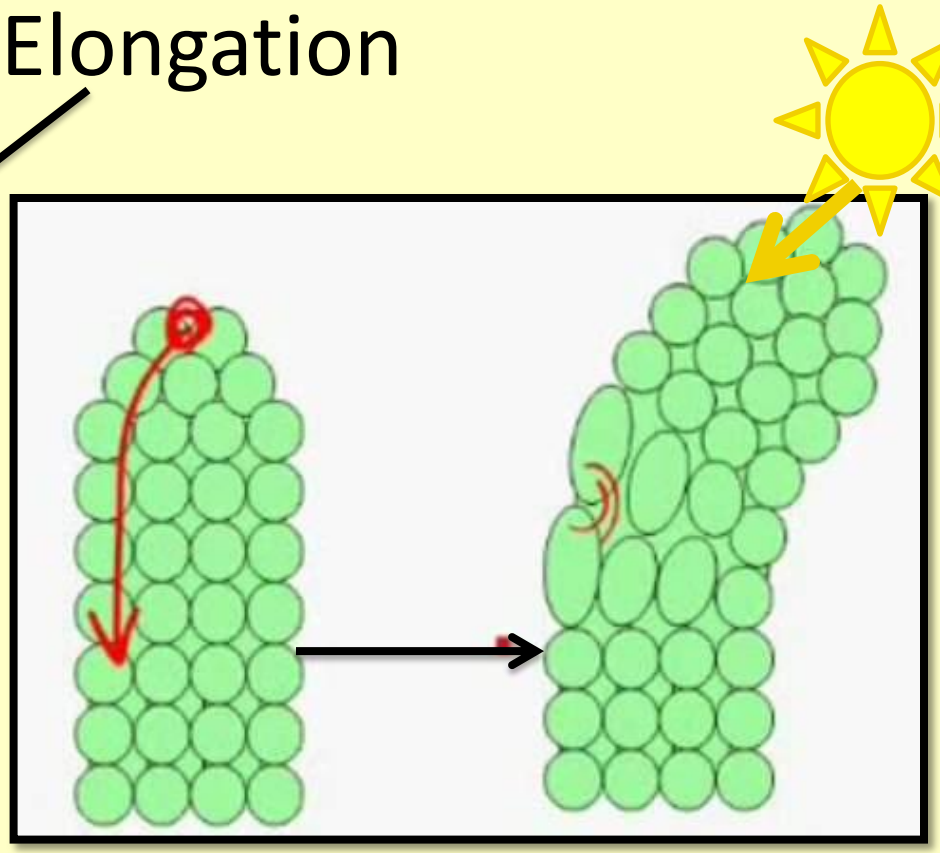
Thigmotropism-touch

Auxin

How does this hormone stimulate tropism?



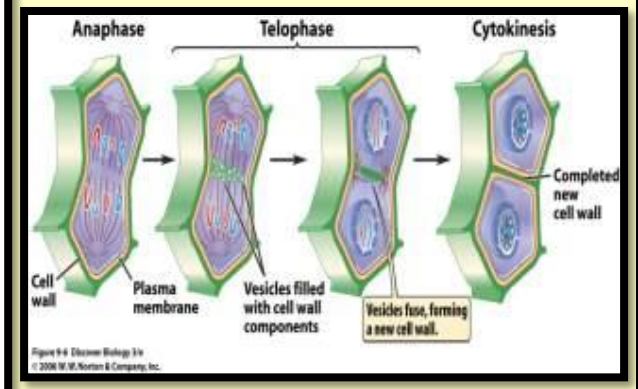
Cell Elongation

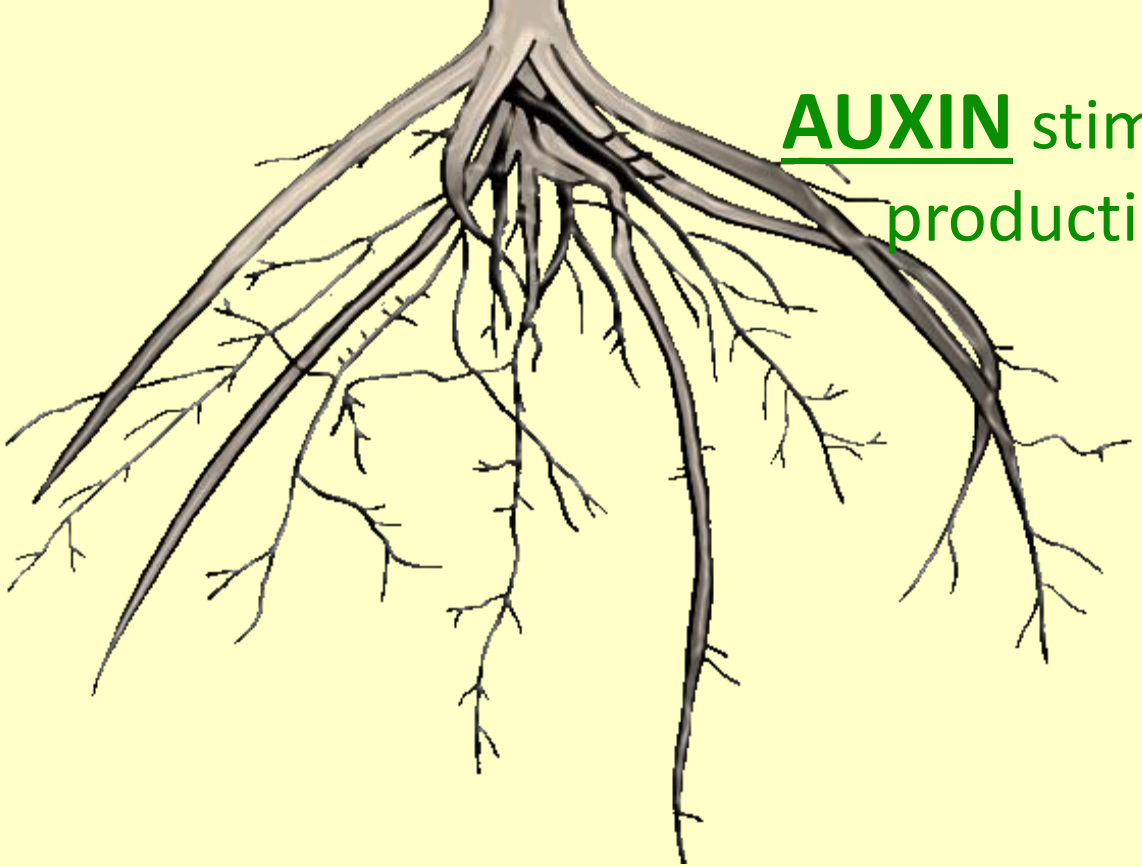


Auxin travels away from the sunlight and expands the cells

Cytokinin

Role of Hormone	Cell division *(increase number of cells)*
Site of Production	Root Tips
Effect of Hormone	Mitosis of new cells; Stimulates seed germination and new shoot growth





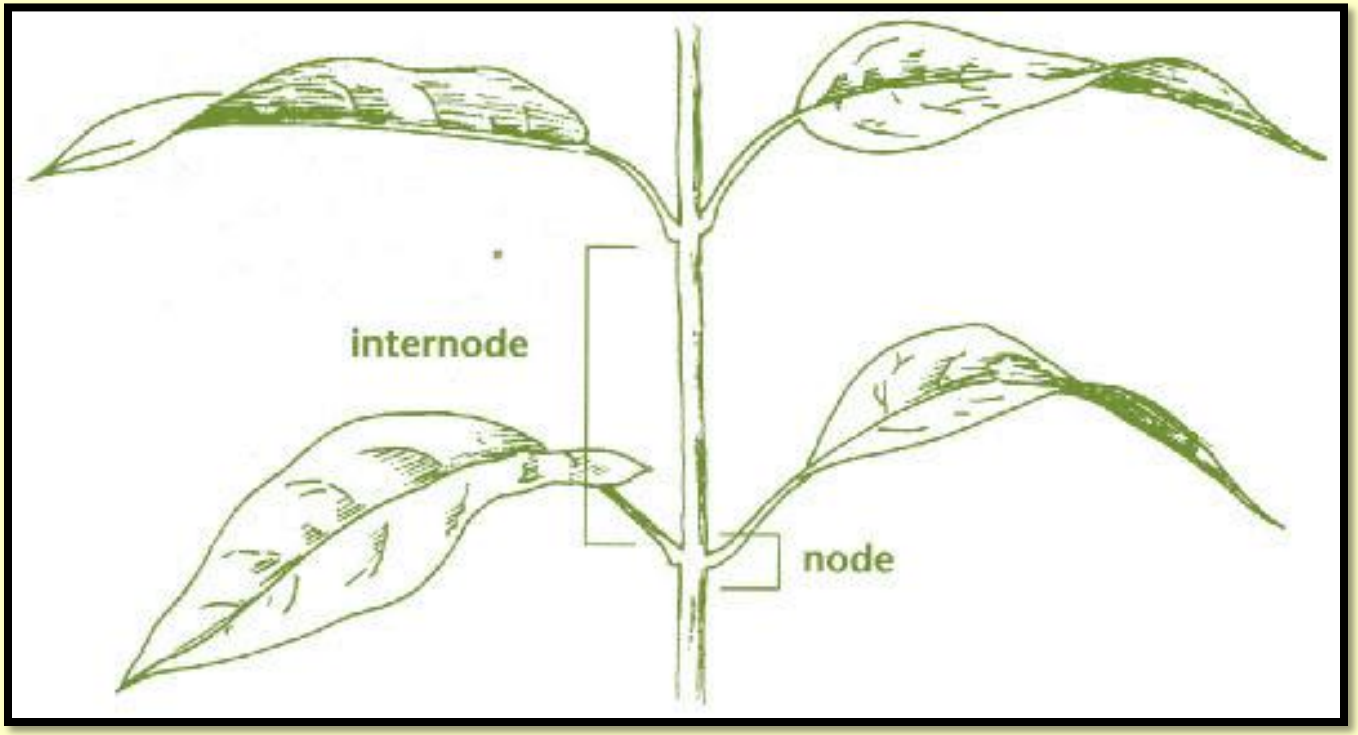
AUXIN stimulates the production of **roots**.

CYTOKININ stimulates the production of **shoots**.

Gibberellin

Role of Hormone	Internode Elongation (height)
Site of Production	Root and Shoot Tips
Effect of Hormone	Controls yearly cycles *(flowering/bolting, seeding and dormancy exiting)* Rapid growth of stems and seeds.

Internode Elongation



Internode: the part of the plant between two nodes or joints.

Node: the part of the stem where stems leaves and buds emerge; point at which stems intersect and branch.




Gibberellin and Cycle Control

How gibberellin in a plant recognizes seasonal changes

Photoperiod: a plant's recognition of daylight length in a 24 hour period.

As daylight increases in the spring, the plant recognizes a longer photoperiod. ***Gibberellin*** triggers the plant to exit dormancy.

Why is it called Gibberellin?

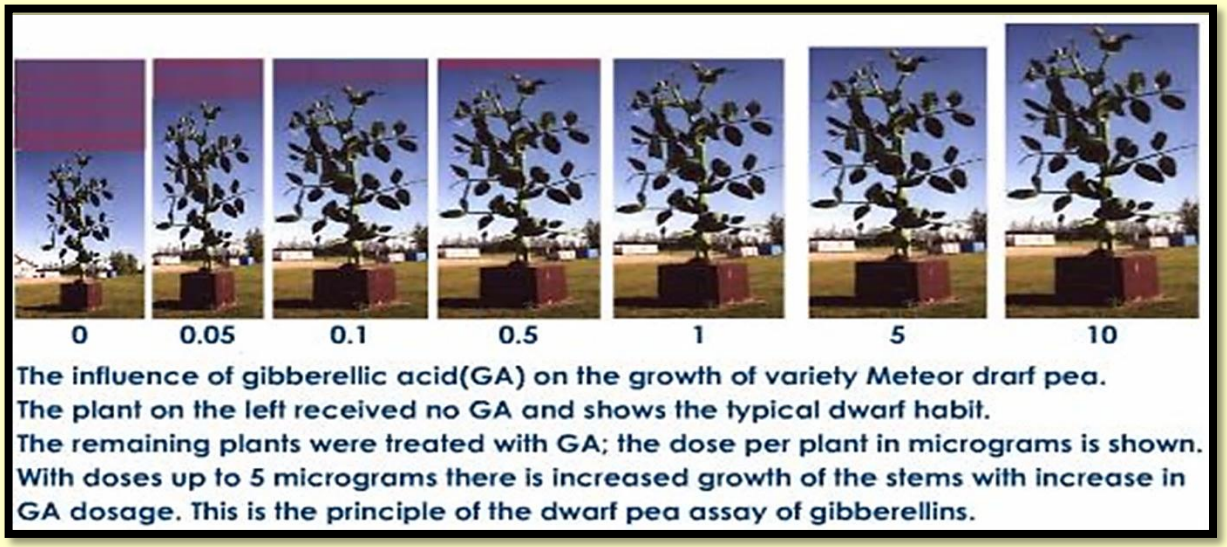
Japanese rice farmers discovered a fungus (*Gibberella fujikuroi*) that caused an increase in this hormone.

From this, they learned that plants have a hormone that causes shoot and seed growth.

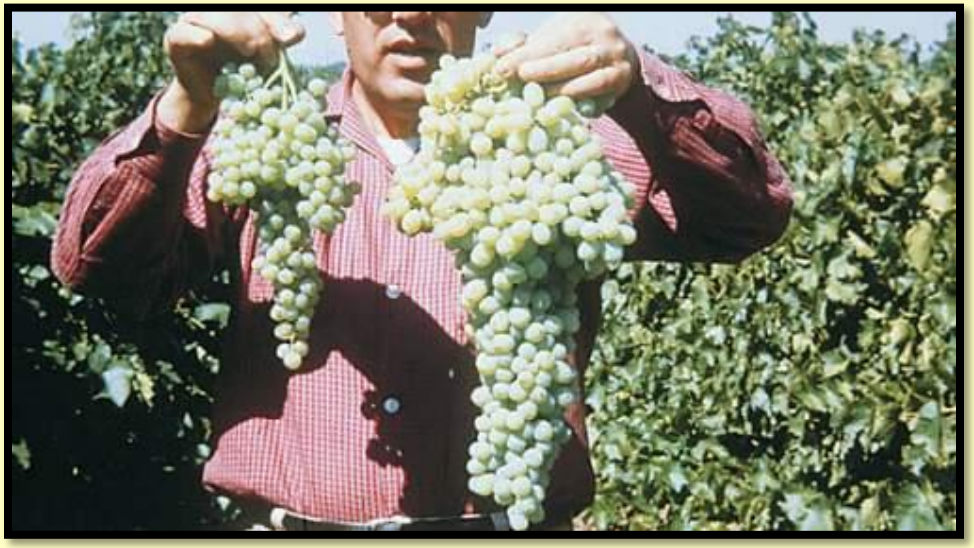
They named this hormone, "Gibberellin", after the fungus.

Gibberellin Growth Effects

Increases plant height



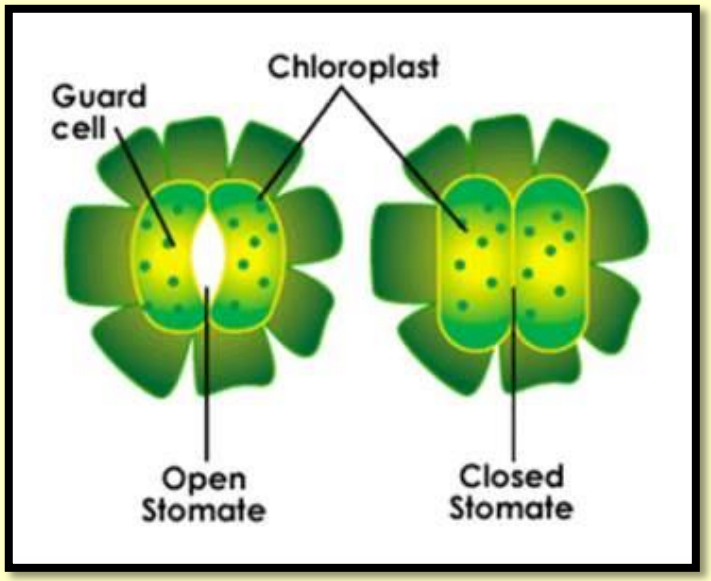
The influence of gibberellic acid(GA) on the growth of variety Meteor drarf pea.
The plant on the left received no GA and shows the typical dwarf habit.
The remaining plants were treated with GA; the dose per plant in micrograms is shown.
With doses up to 5 micrograms there is increased growth of the stems with increase in GA dosage. This is the principle of the dwarf pea assay of gibberellins.



Increases fruit size

Abscisic Acid

Role of Hormone	Dormancy
Site of Production	Chloroplasts
Effect of Hormone	Enters dormancy: (leaves drop off trees, seeds fall, the stomata close to reduce water loss during drought stress)



Abscisic Acid

Abscisic Acid in a plant recognizes seasonal changes

Dormancy: a period of no growth

As daylight decreases in the winter, the chloroplasts in the plant recognize a shorter photoperiod.

Abscisic Acid triggers the plant to enter dormancy.

The flowers, seeds and leaves fall from the trees

Ethylene

Role of Hormone	Ripening and Death
Site of Production	Ripening fruits, aging flowers, germinating seeds and wounded tissues
Effect of Hormone	Stimulates fruits to ripen, flowers to enter senescence (to grow old and die)

What causes my fruits and veggies to go bad?

The answer is ETHYLENE!

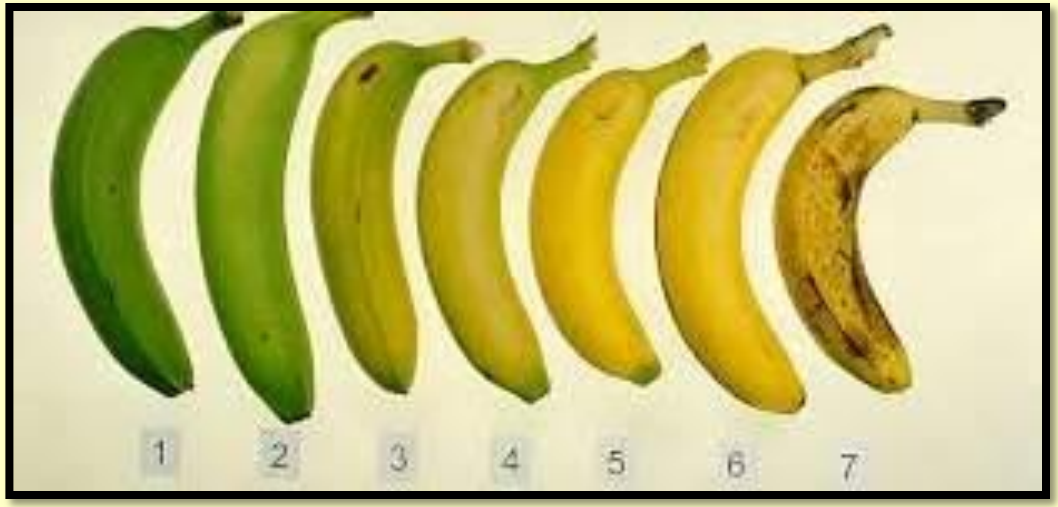
Ethylene is the only plant hormone that exists in a **gas** form.

It can be synthesized from anywhere in the plant. It can even diffuse outside the origin plant and affect another plant nearby.

Is Ethylene good or bad?

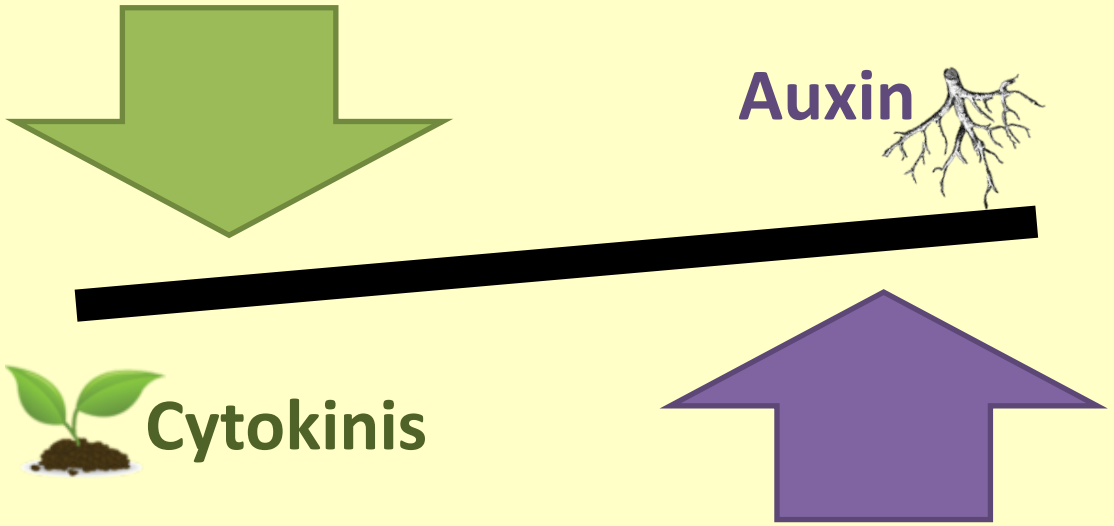
A gas that speeds up plant death?!!
How is this good news?!

Examples: flowers or fruit that are not "ripe" need ethylene to reach their peak



How do these Hormones Work Together?

If the amount of Auxin is greater than Cytokinins…



Shoots grow less rapidly,
while root growth is dramatically increased

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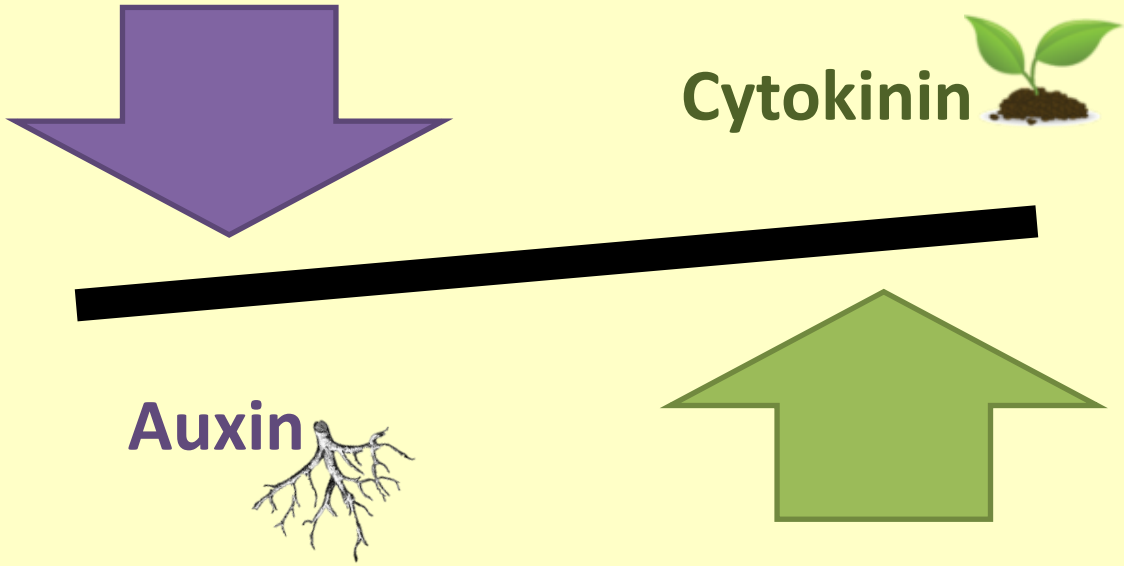

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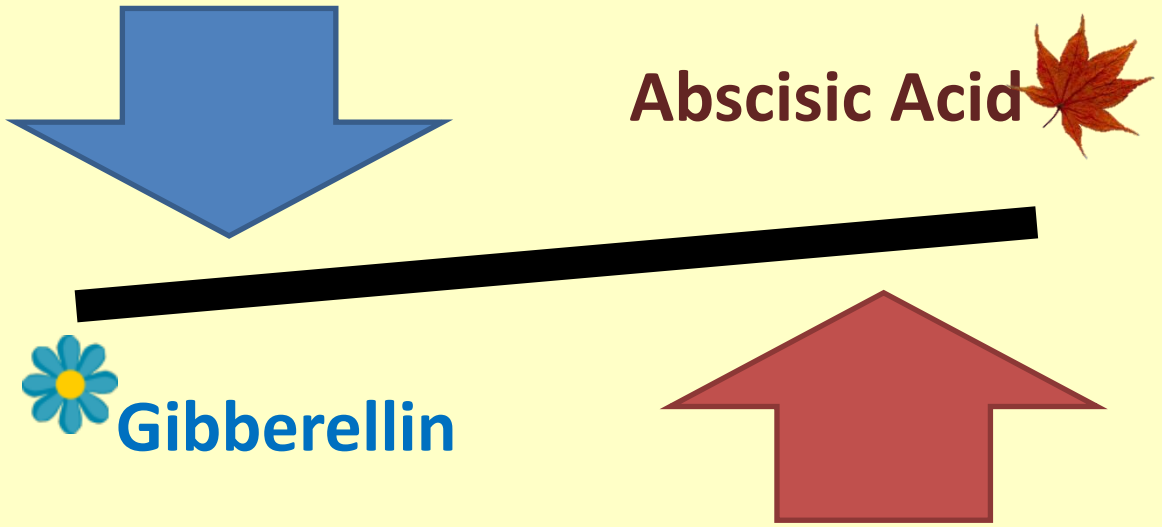

Flowers are no longer blooming and leaves begin to fall from the trees.

How do these Hormones Work Together?

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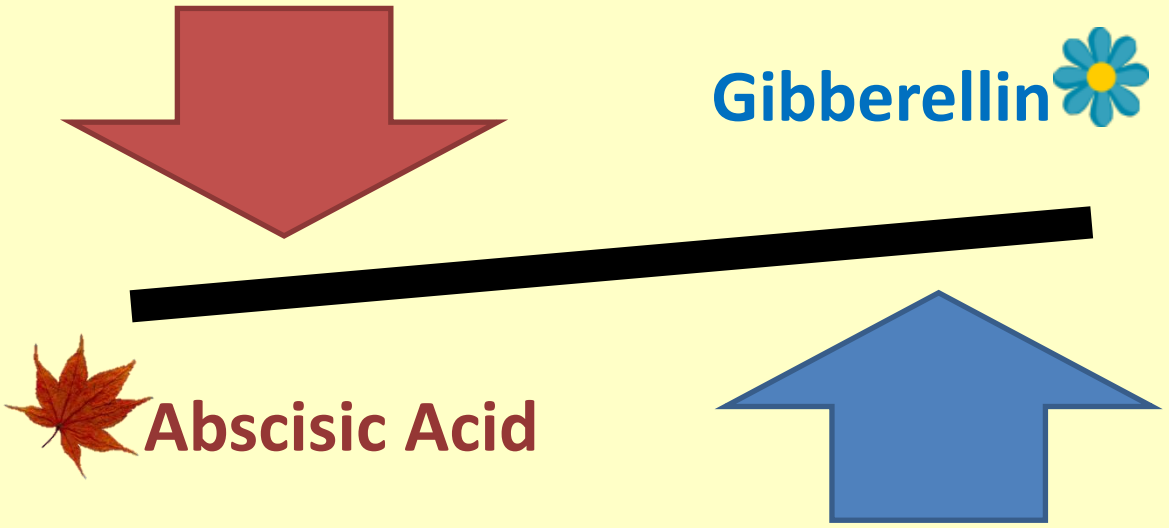

Green leaves and flowers begin to regrow.
This usually occurs in the spring time.

In summary…

Auxin	• Produces Roots • Cell elongation • Acts through tropism responses
Cytokinin	• Produces new Shoots • Mitosis of new cells • Seed Germination
Gibberellin	• Promotes Internode elongation • Controls yearly cycles
Abscisic Acid	• “Dormancy hormone” • Causes leaves to drop and stomatas to close
Ethylene	• “Death Hormone” • Speeds up ripening and senescence

Thank you