PHYTOHORMONES

- Phytohormone is a substance which, being produced in any one part of a plant, is transferred to another part and there influences a specific physiological process."

- Growth in plants is regulated by a variety of plant hormones, including auxins, gibberellins, cytokinins and growth inhibitors, primarily abscisic acid and ethylene

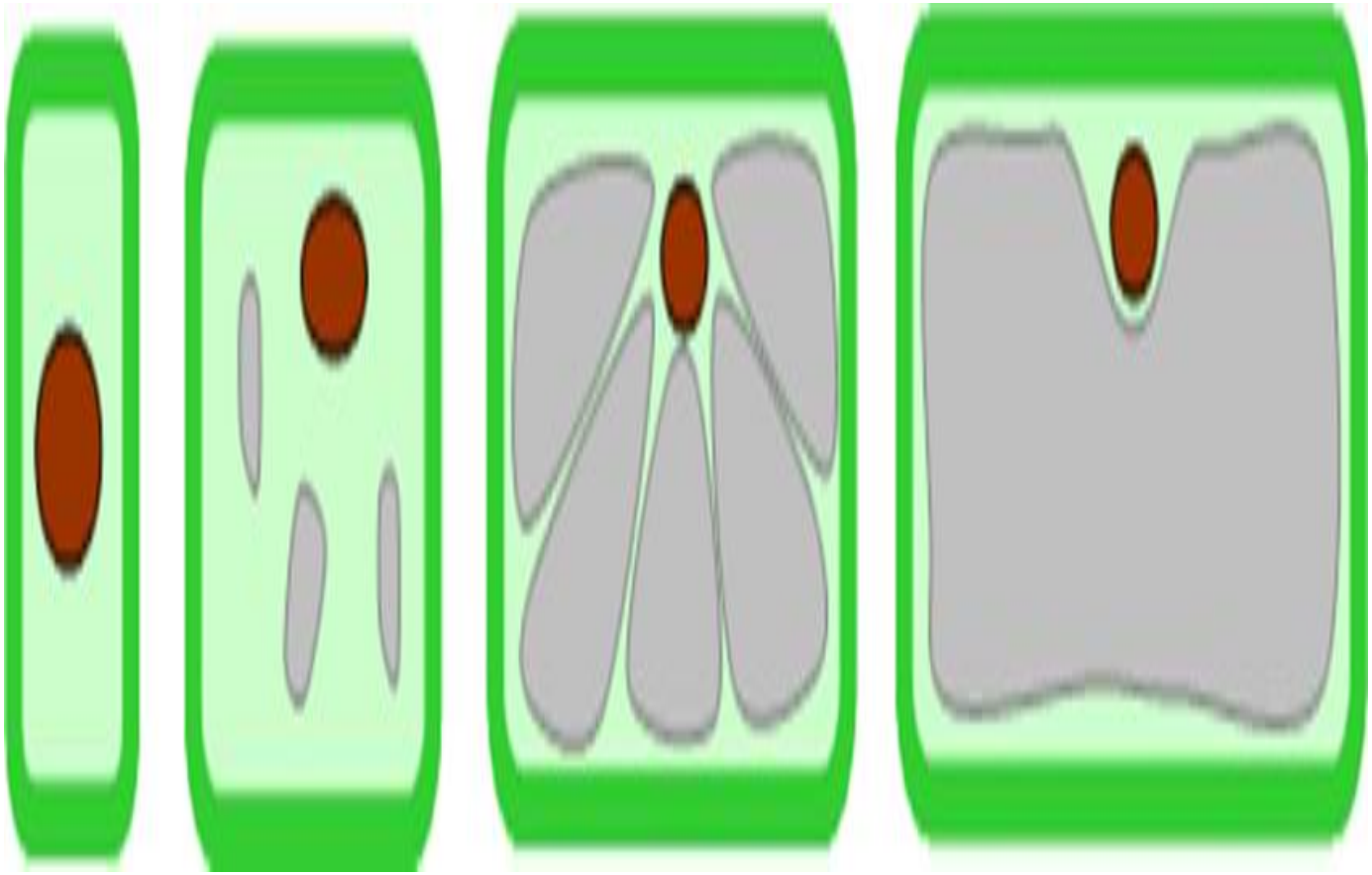
CYTOKININS

- Cytokinins are compounds derived from a nitrogen-containing compound (adenine)
- Skoog dicovered it.
- The name cytokinin is derived from its ability to induce cytokinesis during cell divisions
- Cytokinins are synthesized in roots, from which, like the gibberellins, they move upward in the xylem and pass into the leaves and the fruit

EFFECTS OF CYTOKININS

- Cell enlargement
- Nucleic acid synthesis
- Protein synthesis
- Cell division
- Effect on dormancy
- Delays senescence
- Cytokinins prevent yellowing by stabilizing the content of protein and chlorophyll in the leaf and the structure of chloroplasts

CELL ENLARGEMENT



ABSCISIC ACID

- Abscisic acid (ABA) is often referred to as an inhibitory rather than stimulatory hormone.
- F.T. Addicott and his associates discovered abscisic acid in the early 1960s
- It is found in leaves, where it is partially synthesized

EFFECTS OF ABSCISIC ACID

- **Closure of Stomata:** Large amounts of abscisic acid in the leaves causes the stomata to close which helps the plant conserve water during droughts.

- **Bud dormancy:** ABA mediates the conversion of the apical meristem into a dormant bud.

- The newly developing leaves growing above the meristem become converted into stiff bud scales that wrap the meristem closely and protects it from mechanical damage and drying out during the winter.

EFFECTS OF ABSCISIC ACID…CONTD

- **Seed Dormancy**: It delays seed germination in many plants. Has some effect on induction and maintenance of dormancy in general
  - Induces seeds to synthesize storage proteins
  - Inhibits the affect of gibberellins on stimulating de novo synthesis of a-amylase
- **Counteracts Stimulatory Effects**: it inhibits stimulatory effects of other hormones.

EFFECTS OF ABSCISIC ACID…CONTD

- **Inhibits shoot growth** but does not have as much affect on roots or may even promote growth of roots.
- It inhibits cell division in the vascular cambium
- **Induces gene transcription** especially for proteinase inhibitors in response to wounding

EFFECTS OF ABSCISIC ACID…CONTD

- **Root growth:** ABA can stimulate root growth in plants that need to increase their ability to extract water from the soil

- **Abscission:** ABA also promotes abscission of leaves and fruits

GIBBERELLINS

- **Gibberellins** (GAs) are plant hormones that regulate growth and influence various developmental processes
- GA synthesis occurs at their site of action in growing organs in plants.
- During flower development, the tapetum of anthers is believed to a primary site of GA biosynthesis

GIBBERELLINS…….CONTD

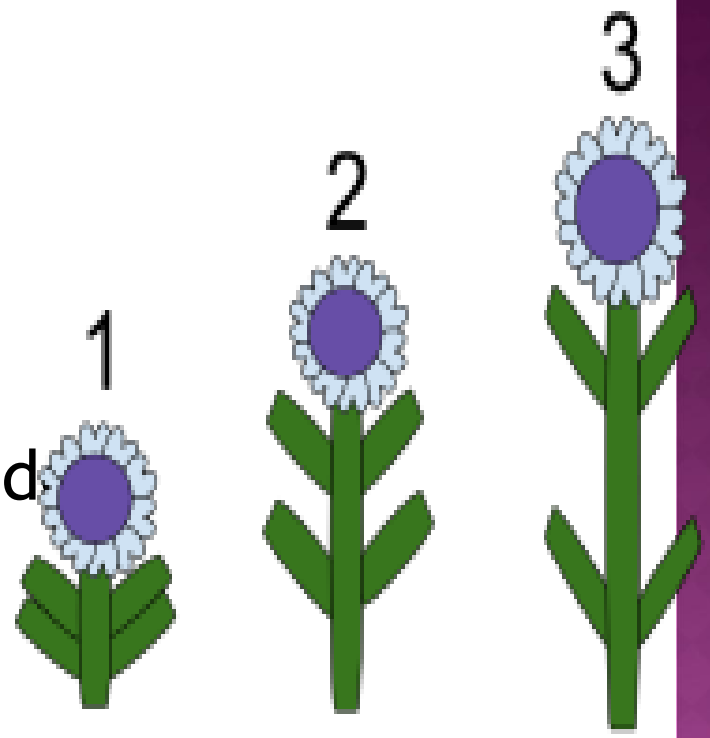
- Gibberellin was first recognized in 1926 by a Japanese scientist, Eiichi Kurosawa, studying bakanae, the "foolish seedling" disease in rice.

- It was first isolated in 1935 by Teijiro Yabuta and Sumuki from fungal strains (*Giberella fujikuroi*) provided by Kurosawa.

- Yabuta named the isolate as gibberellin.

EFFECTS OF GIBERELLINS

- It breaks dormancy
- Signals starch hydrolysis through inducing the synthesis of the enzyme α-amylase in the aleurone cells
- They stimulate cell elongation
- A major effect of gibberellins is the degradation of DELLA proteins
- Shoot growth is increased, internode extension, increased leaf-growth and enhanced apical dominance.
- Gibberellin tends to inhibit abscission by promoting growth



1. Shows a plant lacking gibberellins and has a internod Length of "0"
2. Shows your average plant with a moderate amount of Gibberellins and an average internode length.
3. Shows a plant with a large amount of gibberellins and so has a much longer internode length because gibberellins promotes cell division in the stem.

EFFECTS OF GIBERELLINS….CONTD

- GA induces flowering of long-short-day plants kept permanently in short-day photoperiods.
- It inhibits flowering of short-day plants in inductive short-day photoperiods.

ETHYLENE

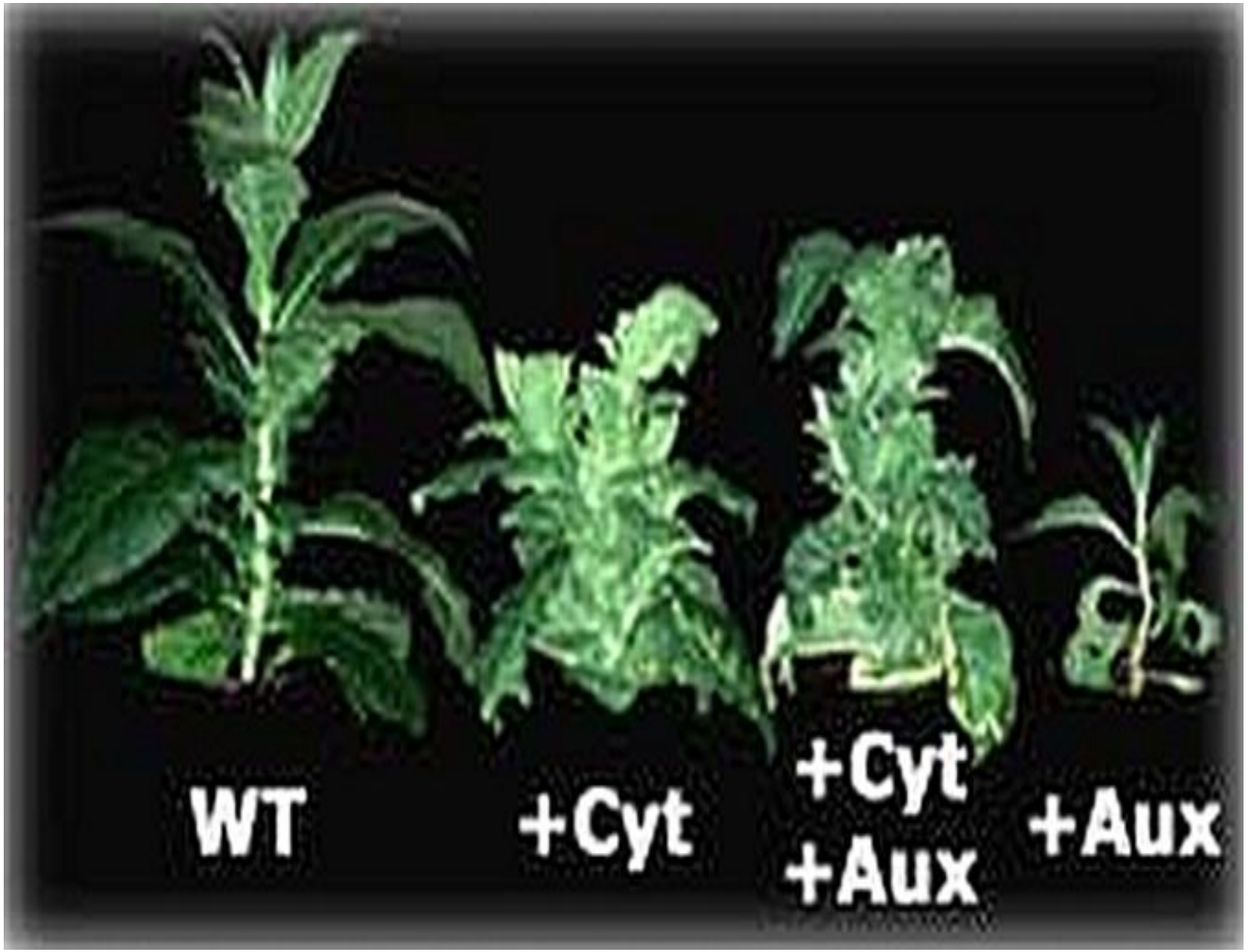
- Ethylene is a growth inhibitor which is a natural product of plants formed possibly from linolenic acid (a fatty acid) or from methionine
- Ethylene is produced from essentially all parts of higher plants including leaves, stems, roots, flowers, fruits, tubers and seeds
- Ethylene production can also be induced by a variety of external aspects such as mechanical wounding, environmental stresses and certain chemicals including auxin and other regulators

EFFECTS OF ETHYLENE

- Stimulates leaf and flower senescence
- Stimulates epinasty.
- Induces root hair growth
- Ethylene is a ripening hormone in fruits.
- the opening of flowers
- Inhibits stem growth
- Stimulates stem and cell broadening and lateral branch growth outside of seedling stage
- Ethylene promotes the triple response which involves apical hook formation and inhibition of hypocotyl and root growth

INTERACTION BETWEEN HORMONES

- **Apical dominance**
- ABA moving up from the roots to the stem synergizes with auxin, moving down from the apical meristem to the stem in suppressing the development of lateral buds.
- The result is inhibition of branching or apical dominance.


WT
+Cyt
+Cyt
+Aux
+Aux

INTERACTION BETWEEN HORMONES….CONTD

- Cytokinins act in conjunction with auxins to promote cell division and to retard senescence
- At the shoot apex, auxin promotes lateral organ initiation, whereas CK maintains the cells in an undifferentiated, proliferating stem cell state.
- At the root apex, auxin maintains the stem cell population and CK induces differentiation.

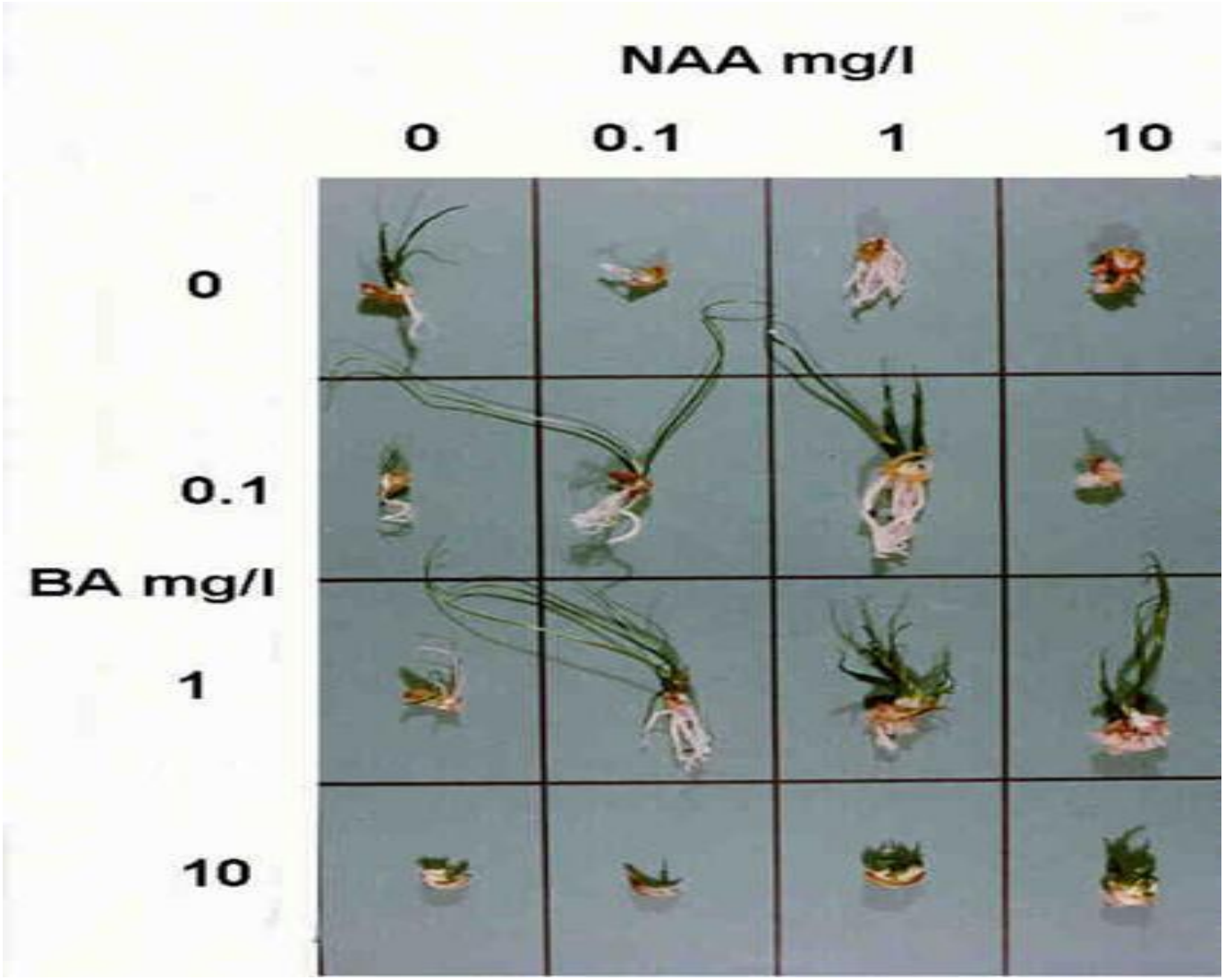
INTERACTION BETWEEN HORMONES….CONTD

- During germination, the embryo is first activated by uptake of water which enables it to produce gibberellin.
- Gibberellin acts on the living cells surrounding the endosperm which induces the aleurone cells to produce enzymes that break down starch to sugars and release tryptophan from the protein of the endosperm.
- The tryptophan migrates to the coleoptile tip and is transformed into indole acetic acid, which in turn moves to the growth zone and weakens the cell walls, thus permitting water uptake.

INTERACTION BETWEEN HORMONES….CONTD

- The root nodule development in legumes and its metabolic activity is subtly regulated by the interaction between auxins and cytokinins.
- Although cytokinin is known to stimulate cell division, it does not induce DNA synthesis as a prelude to cell division but in the presence of auxin, it promotes DNA synthesis.
- So it is suggested that cytokinin stimulates and auxin promotes DNA synthesis.

INTERACTION OF CYTOKININS WITH AUXINS IN MORPHOGENESIS:



INTERACTION BETWEEN HORMONES….CONTD

- **Seedling growth:** ABA inhibits stem elongation probably by its inhibitory effect on gibberellic acid.

- Ethylene stimulates the synthesis of the enzymes and abscisic acid accelerates the associated senescence

WORD OF CAUTION

- Read more on the phytohormones because this is not enough.

BEST WISHES

- All the best in your exams, my brothers, sisters, aunties, uncles, mothers, fathers, wives, daughters and sons.

THE END