General Biology 103
Plant Development
Prepared for LBCC
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Factors that Influence Germination
Age of the seeds
Availability of water
Temperature
Light (day length)
Depth in the soil
Presence of toxins or inhibitors

Amylase
Enzyme that digests the starch of the endosperm and liberates the energy to fuel the growth of the young seedling.

In the Beginning......
Germination - the process by which a mature embryo sporophyte resumes growth after a period of dormancy in the seed.

Growth – an increase in the cell number and size.
Occurs primarily at the meristems.
- Elongation: lengthening
- Differentiation: specialization of tissues e.g. buds that make flowers or buds that make leaves.

Parts of an Embryonic Plant
Plumule – embryonic leaves
Epicotyl – Embryonic stem
Hypocotyl – Embryonic stem
Embryonic Root - root

As in other grains, the seed coat has fused with tissues of the fruit.
Endosperm cells that store food for the forthcoming seedling’s growth
Cotyledon (one)
Colopectile
First leaf forming
Apical meristems of primary shoot
Apical meristems of primary root

Fig. 31-2, p.524
Malting
Germination in grains seeds.
Involves a digestive enzyme called amylase. Breaks down the starch in the endosperm. Converts:
- Starch $\rightarrow$ Maltose $\rightarrow$ Sucrose $\rightarrow$ Glucose
Fuels the energy for embryo growth.
How humans benefit: Alcoholic beverages

What about potatoes?
- Starch is a complex carbohydrate.
- Made as an end product of photosynthesis.
- In the case of potatoes the starch is not in the “seeds” or “roots” but rather in the modified stems.
- The “eye” of a potato is the embryonic sprout.
- The sprout grows from the potato section and when placed into soil.
- The growth of the sprout is regulated by hormones.

Plant Hormones
What is a hormone?
- A chemical signal.
These chemicals are produced by cells in one location that influence other cells.
Example: Growth in another region of the organism.
Typically they are proteins
OR steroids $\leftarrow$ which are lipid based.

Time to take out your plant hormone Learning Table
Table 32-1 Major Classes of Plant Hormones and Their Main Effects

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Source and Mode of Transport</th>
<th>Stimulatory or Inhibitory Effects</th>
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| Gibberellins| Young leaves of shoots, seeds, 
|             | mature shoots, ripe petals, 
|             | cilia of young leaves toward 
|             | base of root. Nerve cells of 
|             | young shoots. Increases cell 
|             | division, elongation. Affects 
|             | shoot growth, flowering, 
|             | fruit development, delay in 
|             | flower senescence. Mitigates 
|             | stress conditions. |
| Auxins      | Apical meristem of shoots, 
|             | cilia, mature shoots, 
|             | cilia, mature leaves, 
|             | mature leaves. Translocates 
|             | from shoot to root. Affects 
|             | cell elongation, 
|             | phototropism, plant 
|             | growth, flowering, 
|             | fruit development, 
|             | senescence. |
| Cytokinins  | Meristematic tissues, 
|             | mature leaves, cilia, 
|             | mature leaves, cilia, 
|             | mature leaves. Translocates 
|             | from shoot to root. Affects 
|             | root growth, 
|             | flowering, 
|             | fruit development, 
|             | senescence. |
| Abscisic Acid| Produced in petiole (stalk of the leaf) | Affects: 
|             | Dropping of leaves 
|             | Growth inhibition – blocks protein synthesis 
|             | Induces dormancy in buds 
|             | Closing of stomata (in leaves) 

**Gibberellins**

- Working on your seedlings right now!
- Affects:
  - Germination
  - Sprouting of buds
  - Elongation of stems & leaves
  - Stimulation of flowering
  - Affects the development of fruit
- Commercial applications – increases fruit size, delays citrus fruit ripening.

**Auxins**

- Made in: Apical meristem of shoot system.
  - Move from tip downward.
- Affects:
  - Cell elongation
  - Phototropism
  - Development of vascular tissue
  - Fruit development
  - Retards senescence in leaves & fruits

**Cytokinins**

- Produced in root – moves to shoot
- Affects:
  - Stimulates embryo development
  - Promotion of sprouting of lateral buds.
  - Stimulation of the onset of fruits
  - Stimulate plant metabolism
  - Delays the aging of plant parts especially leaves

**Abscisic Acid**

- Produced in petiole (stalk of the leaf)
- Affects:
  - Dropping of leaves
  - Growth inhibition – blocks protein synthesis
  - Induces dormancy in buds
  - Closing of stomata (in leaves)
Ethylene

*Produced by ripening fruits*

Affects:
- Ripening of other fruits
- Abscission (dropping) of fruits
- Maturation of flowers

This is why bananas can be picked green and sent to market from Central America to the U.S. to ripen. Tomatoes, grapes and strawberries don't respond to artificial ethylene exposure.

How do Plants Respond to External Stimuli?

- Tropisms – movement towards
- Nastic responses
- Phytochromes
- Temperature
- Photoperiod