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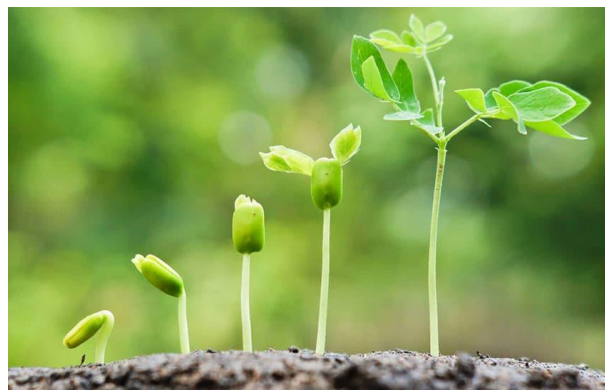
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Nurture your dreams

Theme: Growth and development in plants and animals

S3 New Curriculum Biology-Chapter 8– Growth in plants and animals



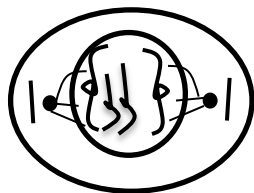
Growth refers to the increase in size, mass, or number of cells in an organism over time. It's a fundamental characteristic of living things and occurs through processes like cell division, enlargement, and differentiation. The type of cell division that results in growth is called mitosis and forms two genetically identical cells called daughter cells.

Mitosis

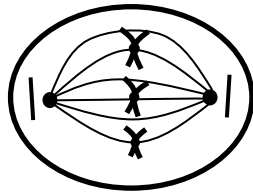
Mitosis is a type of cell division that produces two genetically identical daughter cells from a single parent cell.

Stages of mitosis

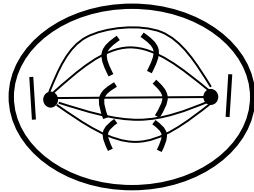
1. **Interphase** - During this stage, there is protein synthesis, formation of organelles and replication of DNA. It also builds up a sufficiently large store of energy to carry the cell through the remaining stage of mitosis. During interphase the chromosomes are not visible or distinct bodies either under light microscope or electron microscope. Just before mitosis begins the centrioles are among the most prominent organelles in the cell.
2. **Prophase** – Chromosomes condense and become visible. The nuclear membrane starts to break down.



3. **Metaphase** - Chromosomes arrange themselves on the equator of a spindle



4. **Anaphase** - Chromatid separate and migrate to opposite pole of the cell. The centromere leading



5. **Telophase** - Chromosomes unwind. Nuclear envelope and nucleoli form.

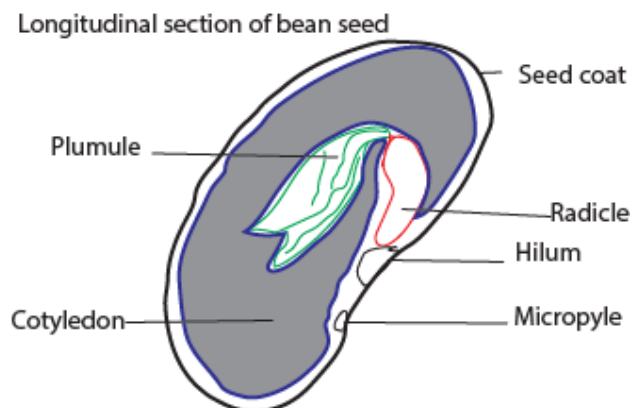


Importance of mitosis

- (i) **Genetic stability:** It ensures that the daughter cells carry the exact genetic material as the parent cells
- (ii) **Growth:** growth results in increase in the number of cells by mitosis.
- (iii) **Body repair:** worn out cells are replaced by the cells produced by mitosis
- (iv) **Asexual reproduction**

Seeds

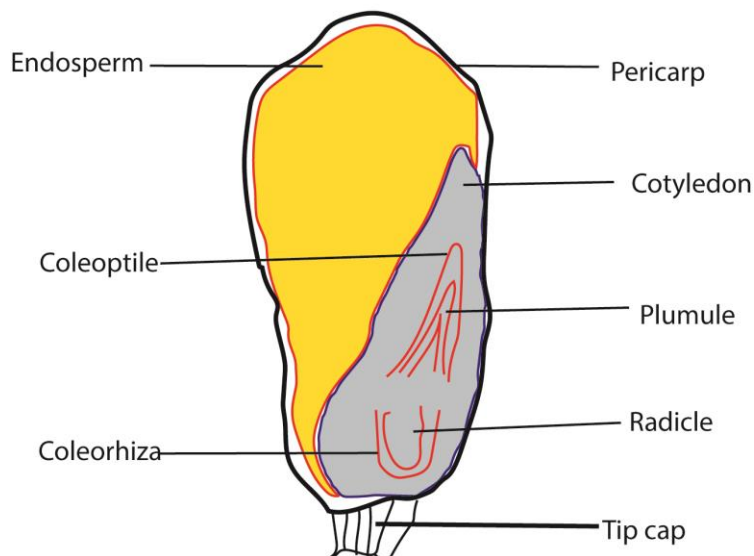
A seed is a fertilized ovule surrounded by a testis/seed. Internally the seed consists of food storage tissue called an endosperm, the plumule (embryonic shoot) and the radicle (embryonic roots) and the cotyledons (embryonic leaves).



Uses of parts of bean seed

- seed coat protects inner parts of the seed
- Plumule grows into shoot system
- Radicle grows into root system
- cotyledon stores food reserves and protects the embryo
- Micropyle allows in pollen nucleus during fertilization and water during germination
- Hilum attachment of to plant during development

Longitudinal section of maize fruit



- **Functions of parts of maize fruit**
- Pericarp protects the internal parts
- Endosperm stores food reserves
- Cotyledons protect and nourishes the embryo
- Coleoptile protects the plumule
- Plumule grows into shoot system
- coleorhiza protects the radicle
- Radicle grows into root system

Germination

It is the emergence and development of an embryo into a new young plant (seedling) which is capable of independent existence.

Conditions necessary for germination

1. Water: The role of water in seed germination may be
 - Dissolve and leak away germination inhibitors
 - Soften and rupture seed coat to allow in water and oxygen
 - hydrate vital activities of protoplasm
 - converts the insoluble food into soluble form for its translocation to the embryo

- Oxygen is necessary for aerobic respiration
- Temperature; moderate temperature (25 – 30°C) activates enzymes.

Experiment to demonstrate conditions necessary germination

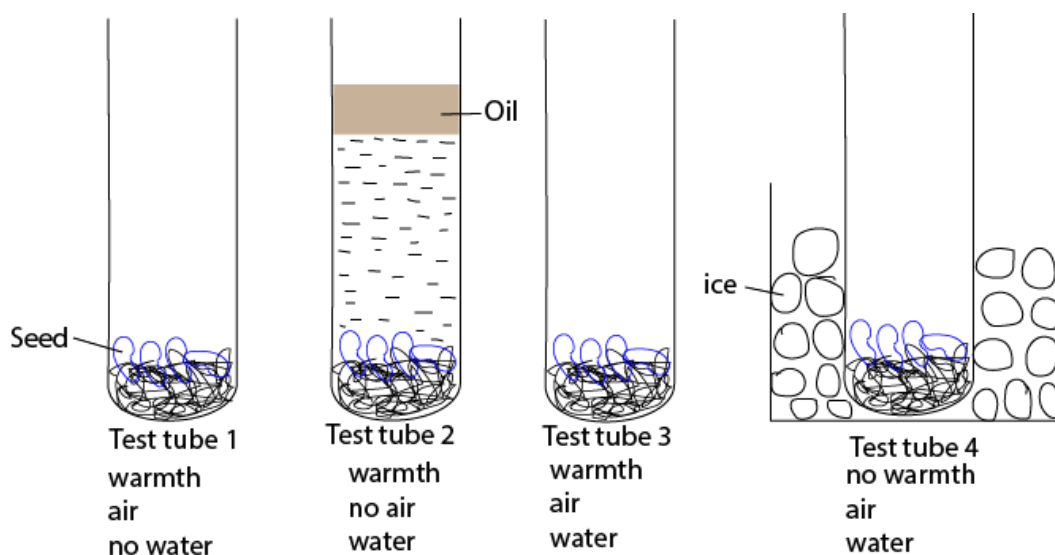
Prepare 4 test tubes as follow

Test tube 1: place dry seeds on cotton and place in a test tube in a warm place such that seed are provided with air and warmth but no water

Test tube 2: seeds on a cotton wool are placed in a test tube full of freshly boiled and cooled water and then covered with oil to prevent entry of air.

Test tube 3: seeds in soaked cotton wool are placed in an open test tube and placed in a warm place. These seed have warmth, oxygen and water

Test tube 4: seeds in soaked cotton wool are placed in an open test tube and test tube placed in a a beaker of ice



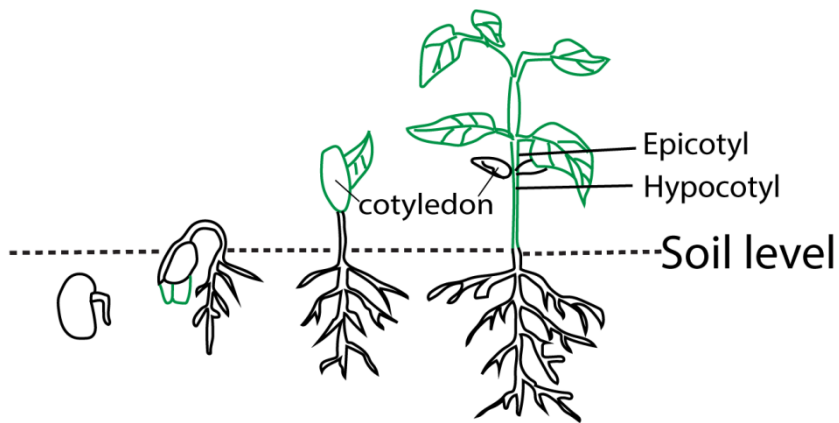
The setup is left for a few days

Observations

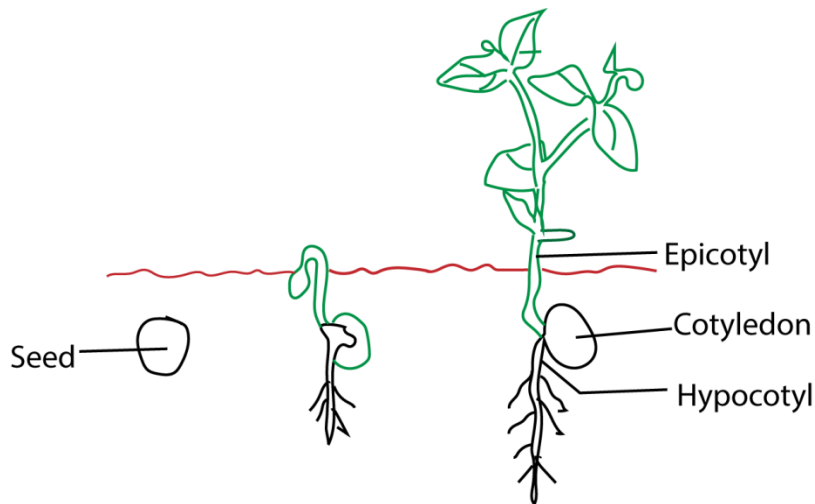
Seeds in test tube 3 germinated because they were provided with warmth, oxygen and water while in the rest of the test tube germination did not occur.

Types of germination

- Epigeal germination:** Here hypocotyl grows faster than epicotyl causing the cotyledon to grow above ground



2. **Hypogeal germination:** Here epicotyl grows faster than hypocotyl that the cotyledons remain under the soil.



Advantages of epigeal germination over hypogeal germination

Epigeal germination has advantage over hypogeal germination because the cotyledon may acquire chlorophyll and photosynthesize for the plant.

Seed dormancy

Seed dormancy is a condition in which seeds remain inactive and do not germinate, even when environmental conditions seem favourable.

Causes of seed dormancy

Seed dormancy can be caused by several factors that prevent seeds from germinating immediately, even under favorable conditions. Here are the main causes:

- (i) **Hard Seed Coat (Physical Dormancy):** Some seeds have a tough, impermeable seed coat that blocks water and oxygen from entering. Examples: Pea, bean, and lotus seeds.
- (ii) **Immature Embryo (Morphological Dormancy):** Some seeds contain an underdeveloped embryo that needs further growth before germination. Example: Some orchids and certain tree species.
- (iii) **Chemical Inhibitors (Physiological Dormancy):** Some seeds produce natural growth inhibitors that prevent germination until they are broken down or washed away. Example: Fruits like apples contain abscisic acid, which keeps seeds dormant until conditions change.
- (iv) **Lack of Proper Environmental Conditions:** Some seeds require specific light, temperature, or moisture conditions to trigger germination. Example: Desert plants may need heavy rainfall to break dormancy.
- (v) **Seed Age and Internal Factors:** Some seeds naturally take longer to germinate due to genetic or biological factors. Example: Some pine and oak seeds remain dormant for years.

Importance of seed dormancy

Seed dormancy plays a crucial role in plant survival and adaptation. It ensures that seeds do not germinate under unfavorable conditions, increasing their chances of thriving when the environment is optimal. Here are some key reasons why seed dormancy is important:

- (i) **Survival in Harsh Conditions:** Dormancy prevents seeds from sprouting during extreme weather, such as droughts or freezing temperatures. It allows seeds to wait until conditions are suitable for successful growth.
- (ii) **Seed Dispersal Over Time:** Seeds can remain dormant and spread gradually, reducing competition among offspring. This helps plants colonize new areas.
- (iii) **Protection against Premature Germination:** If seeds germinate too soon, they may die due to lack of water or nutrients. Dormancy ensures germination only occurs when resources are sufficient.
- (iv) **Long-Term Seed Storage:** Some seeds can remain dormant for years and germinate later when conditions improve. Example: Seeds found in ancient soils have germinated after centuries.
- (v) **Helps Maintain Genetic Diversity:** Dormancy allows seeds to sprout at different times, leading to genetic variation among plants. This improves resilience against diseases and environmental changes.

Measurement of growth in plants

Growth in plants is measured using several methods, depending on the type of growth being observed. Since plants grow in both height and mass, scientists use various techniques to track these changes. Here are some common ways to measure plant growth:

(i) Measuring Height

- Use a ruler or measuring tape to record the height of the plant at regular intervals.

- Measure from the base (soil level) to the tip of the tallest part.

(ii) Leaf Count and Size

- Count the number of new leaves over time.
- Measure leaf length and width to track expansion.

(iii) Stem Diameter

- Use a caliper or measuring tape to check the thickness of the stem.
- This is useful for tracking growth in trees and larger plants.

(iv) Dry and Fresh Weight

- Fresh weight: Weigh the plant immediately after harvesting.
- Dry weight: Dry the plant in an oven and weigh to determine biomass.

(v) Root Growth

- Carefully remove the plant and measure root length.

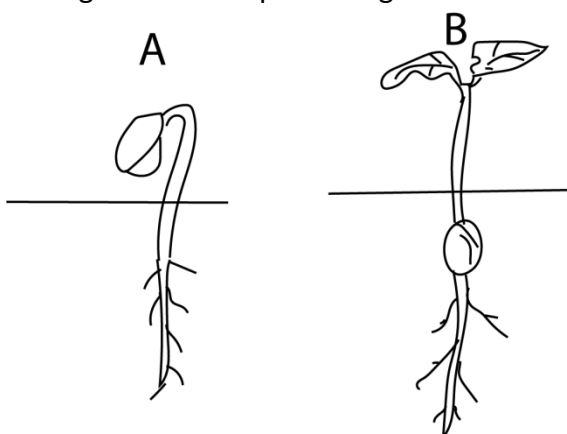
(vi) Chlorophyll Content and Photosynthesis Rate

- Scientists use special instruments to measure chlorophyll levels.
- Higher chlorophyll content often indicates better plant health and growth.

Each method gives insight into different aspects of plant development.

Revision exercise

1. The figure below represents germination in seed A and B



- (a) Giving reasons, identify the type of germination in each seed (04marks)
- (b) Explain how germination in seed A is brought about. (02marks)
- (c) Explain the advantage of the type of germination in seed A to the growing seedling (04marks)

2. (a) Explain the role of each of the conditions necessary for germination. (09marks)
- (b) Explain why germination may not occur in some seeds when the necessary conditions for germination are available (03marks)
- (c) Outline the importance of a seed remaining dormant during favorable conditions for germination. (03marks)

Suggested answers

1. (a) A – epigeal germination because the cotyledons are pushed above the ground
B – Hypogeal germination since cotyledons remain under ground during germination
- (b) Hypocotyl grows rapidly carrying the cotyledons with it
- (c) cotyledons may acquire chlorophyll for photosynthesis

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