

Chapter 16

Reproduction in plants

Germination

- ***Germination*** means sprouting, growing of a plant embryo in a seed into a mature plant.
- ***Flowering plants are of 2 groups:***
 - Monocotyledons have one cotyledon in the seed. Food is stored outside the cotyledon in tissue called endosperm.
 - Dicotyledons have 2 cotyledons in the seed. The cotyledons store food.
- ***A cotyledon is a modified seed in a leaf.***
 - Function: it digests, absorbs and transfers the stored food to the growing part of the embryo.

Structure of a broad bean-a dicot. seed

An embryo: a miniature plant in a seed.

Two cotyledons: they store food.

Testa: a tough, protective seed coat, which encloses the embryo and cotyledons.

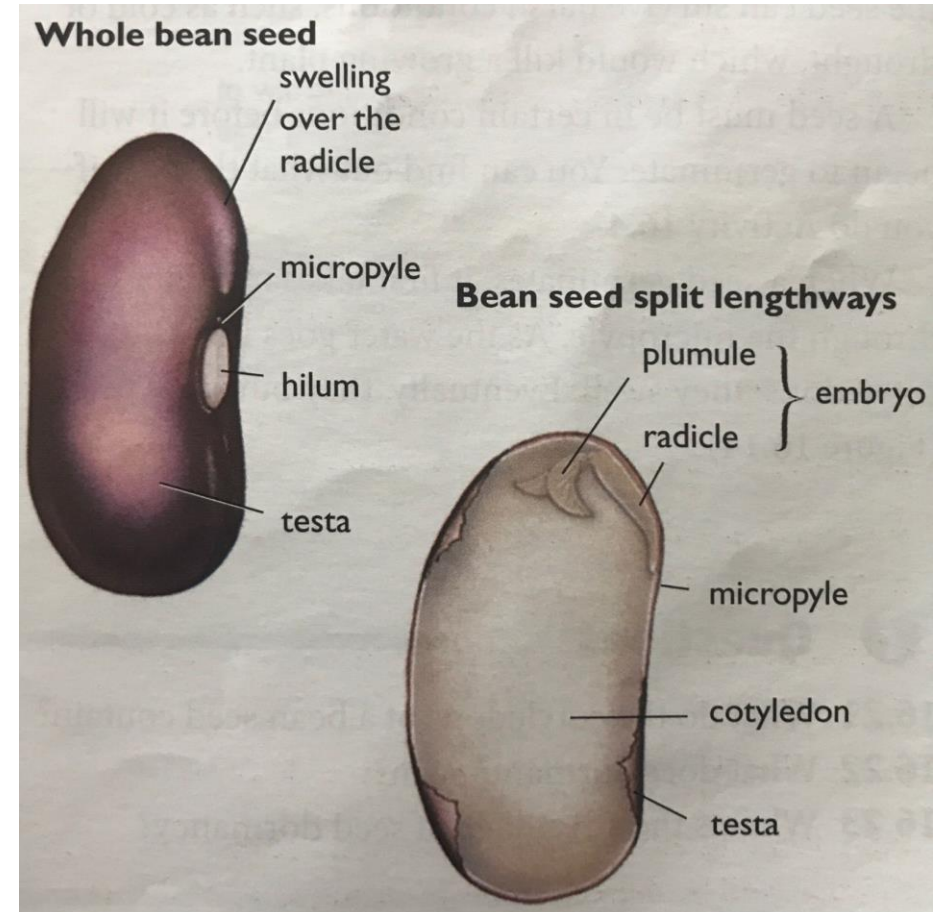
Micropyle: a small hole in the testa, has two functions:

One during fertilization, through which the pollen tube enters the ovule.

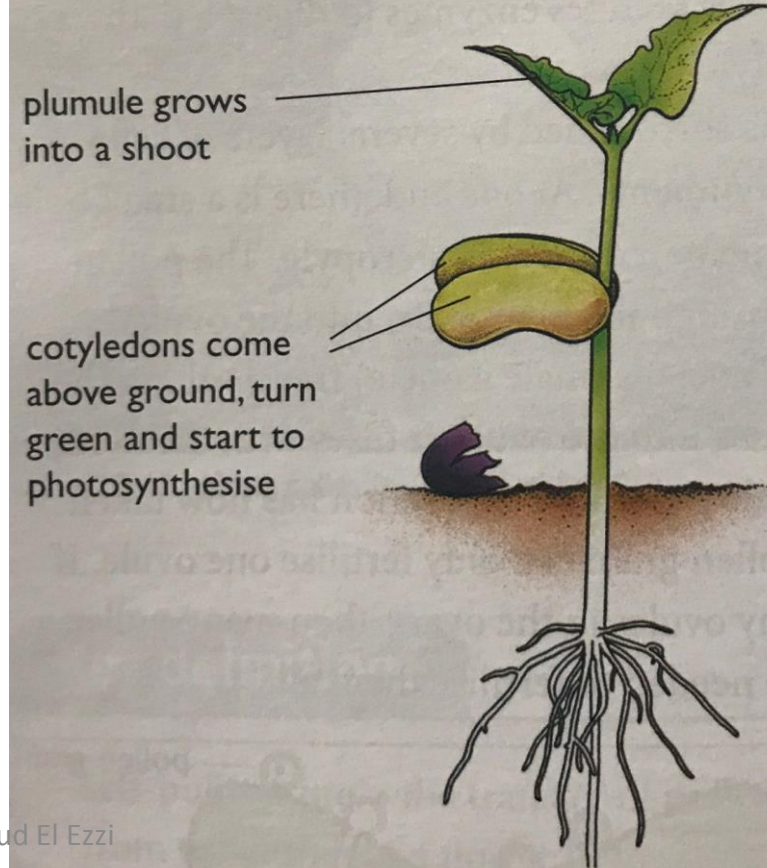
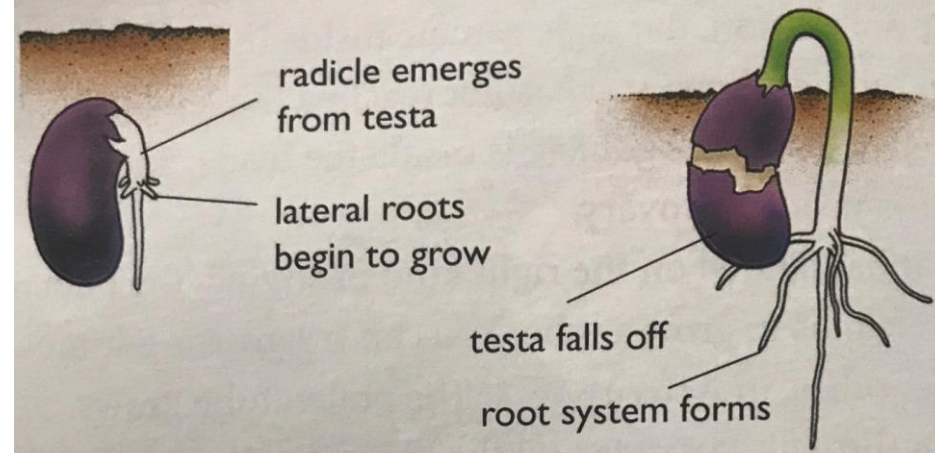
The second during germination, the micropyle is an important route for the water.

Hilum: the scar left where the seed was attached to the pod.

- Once the ovule have been fertilized, a zygote is formed, which divides by mitosis to form an embryo plant.
- The embryo consists of a radicle (tiny root), which will grow into a root, and a plumule (tiny shoot), which will grow into a shoot.



Seed germination



- When seeds germinate, it first absorbs water through the micropyle.
- As cotyledons swell with water, they burst the testa;
- Water activates the enzymes in the cotyledons;
- Amylase begins to break down starch molecules to maltose;
- Proteases break down proteins molecules to amino acids.
- Maltose and amino acids are soluble, so they dissolve in the water; they diffuse to the embryo plant, which uses these in energy production and for growth.

- ***What are the three conditions needed for germination?***

- Water,
- Oxygen,
- and a suited temperature.

Uses of water in seedlings

- ✓ Activates the enzyme in the seed.
- ✓ In hydrolysis of stored starch to sugar and proteins to amino acids.
- ✓ Transports sugar and amino acids.
- ✓ Expands the leaves and keeps the shoot upright because water maintains the turgor of the cell.
- ✓ Transports salts from root to shoot.
- ✓ As green leaves appear, water is needed for photosynthesis

Experiment 1 The need of water

Label 3 containers: A,B and C

Put dry cotton wool in A.

Put wet cotton wool in B and C.

Place equal number of soaked seeds in the 3 containers, seeds of the same type.

Add water to C until all the seeds are completely covered.

Cover the containers by using lids.

Place the three containers in same conditions of temperature and light;

Leave them for the same period of time.

Results

- In B, seeds will germinate normally. In A, seeds will not germinate (due to lack of water).

Explanation

- Seeds in container B prove that water is necessary for germination.
- Seeds in container C show that much water may prevent germination by cutting down the oxygen supply to the seed

Experiment 2 The need of oxygen

Roll two moist cotton wools in a dish containing cress seed (small seeds such as sesame);

- A thread holds each cotton wool is attached to a bung;
- Label two flasks A and B;
- To flask A, sodium hydroxide and pyrogalllic acid solutions are added.
- To flask B, sodium hydroxide is added.
- A bung closes each flask; in such a way the moist cotton wool with cress seeds don't touch the solution.

Special property for:

- Sodium hydroxide: absorbs CO_2 from the air in the flask;
- Pyrogalllic acid: absorbs O_2 ;

So, flask A contains no CO_2 or O_2 .

Results

In flask B seeds will germinate. In flask A, no germination of seeds.

Explanation

Pyrogalllic acid in flask A, absorbs O_2 and so no germination occurs. Flask B shows that O_2 is needed in germination.

Experiment 3

The need of temperature and germination

- Label four containers A,B,C,D.
- Put wet cottons in all containers.
- Put same numbers of soaked seeds in all containers.
- Place container A in a refrigerator (at about 4 degree Celsius).
- Place container B in a room (about 20 degrees Celsius).
- Place container C in a warm place, such as in an incubator (30 Celsius).
- Place a container D in a beaker of boiling water.

Results

- Seeds in A may not germinate. Seeds in D will not germinate.
- Seeds in C at 30 C will germinate and will be more advanced than those in B at room temperature.

Explanation

- At very low temperature enzymes are inactive. So germination may not start.
- At high temperature 50 C and above, enzymes are denatured and seeds are killed.
- The higher the temperature , the faster the germination at least up to 40 C.