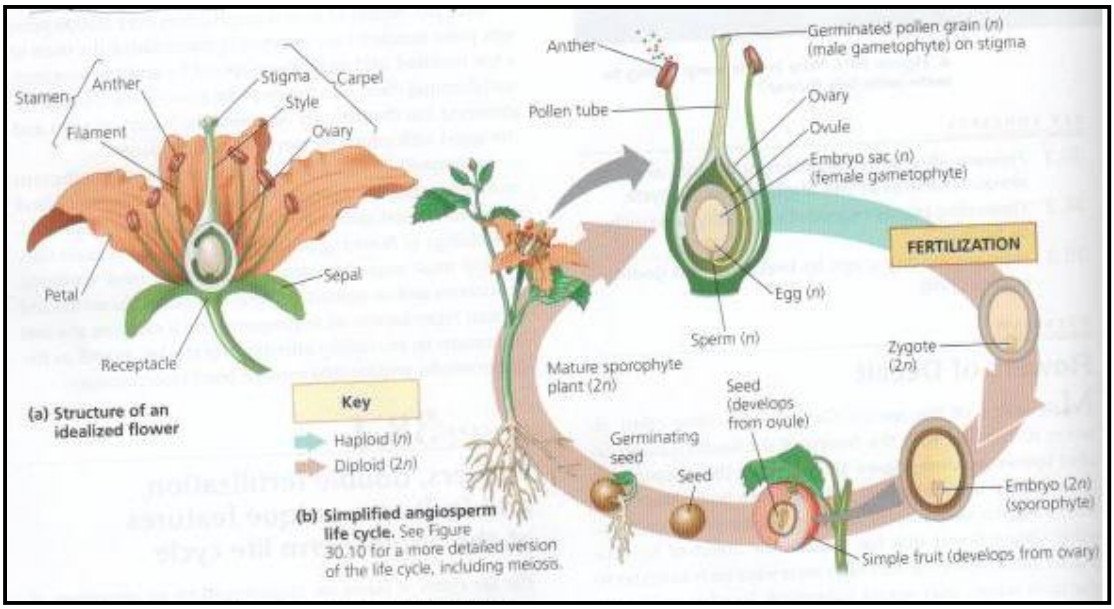
Study unit 6

Thanks for your involvement in making this group an interactive one. If you are yet to participate, Please do.

As it has been mentioned in my welcome address that all the tutorials will be based on what the Lecturer has designed. Even though, I tried (and will try in subsequent ones) to simplify the module for the purpose of your understanding, I would like to say that IT IS NOT EXHAUSTIVE IN ITSELF. Hence, onus lies on you to study and study to ensure maximum achievement. To this effect, only highlight excerpt are presented here. This also will cut across all tutorials that I would be pasting on myunisa.

The figure below represents the simplified life cycle of angiosperm and the structure of floral part of the plant



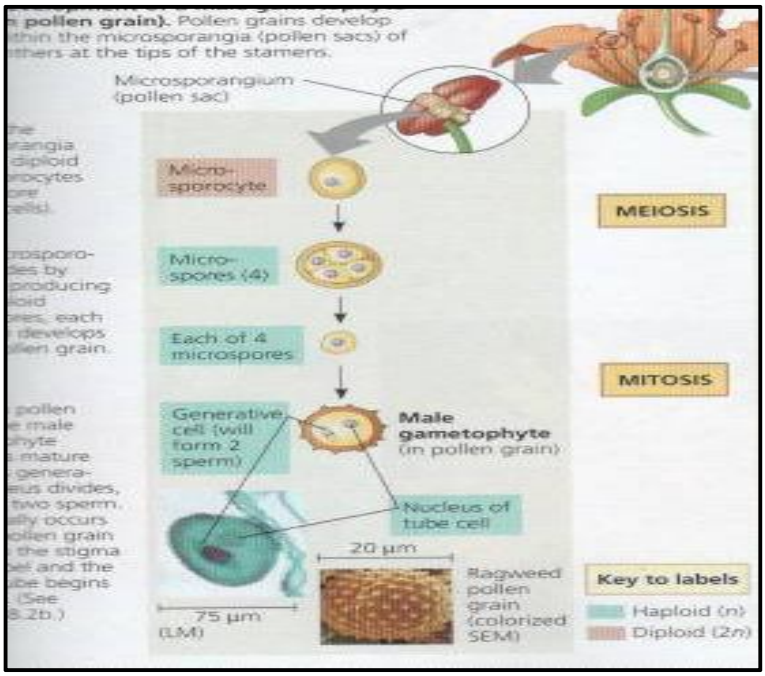
Development of male gametophyte

Anther consists of four microsporangia called pollen sacs. Within the microsporangia are many cells called microsporocytes or microspore mother cells. Microsporocytes undergo meiosis to form four haploid male gametophyte. Each microspore then undergo mitosis, producing a male gametophyte consisting of only two cells: generative cell and tube cell

The generative cell and tube cell and the spore cell wall is called the pollen grain

As the male gametophyte matures, the generative cell passes into the tube cell and the spore wall is completed. When the microsporangia break open, the pollen grain is released and may be transferred into the sticky surface of the receptive stigma. On the stigma, the tube cell produces pollen tube a long protuberance that delivers the sperm to the female gametophyte. The pollen tube elongate through the style and the generative cell usually divides and produce

two sperm cells and remains in the pollen tube. The pollen tube grows through the style into the ovary where it releases the sperm cells into the female gametophyte.

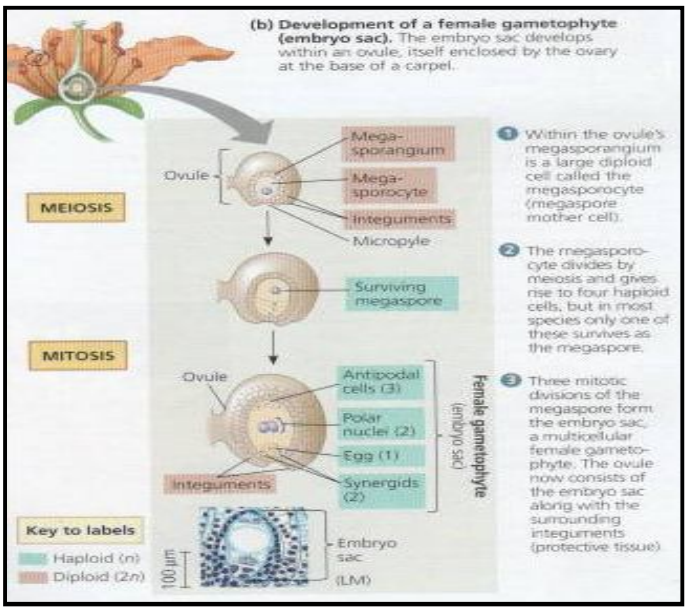


Male gametophyte development

Female gametophyte

The female gametophyte is also called the embryo sac. Two integuments (the layer protecting the sporophytic tissue) surround the **megasporangium** leaving the gap called the **micropyle**. The megasporocyte in the megasporangium of the ovule enlarges and undergoes meiosis to produce four haploid (*2n*) megaspores; one survives and the other three degenerates. The nucleus of the surviving megaspore divides by mitosis three times without cytokinesis, resulting in one large cell with eight haploid nuclei. The multinucleated mass (the cell containing the eight nuclei) is partitioned by the membrane into multicellular female gametophyte (embryo sac). At the micropylar end, two cells called synergids is

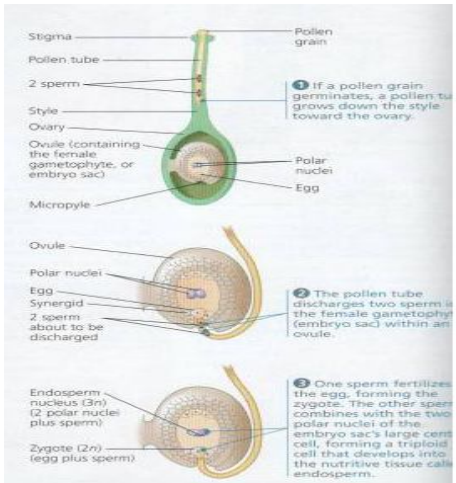
positioned at both sides of the egg and their function is to help attract and guide the pollen tube to the embryo sac.



Process of development of the embryo sac (female gametophyte)

Double fertilization

Pollen grain which consists of the tube cell and the generative cell absorbs water and germinates into the pollen tube which grows through the style towards the ovary. The nucleus of the generative cell divides by mitosis and forms two sperm cells. The synergid in the female gametophyte produces chemical that attracts the pollen tube towards the micropyle. On getting there, one of the two synergids dies providing passage for the pollen tube into the embryo sac for the discharge of the two sperm cells. Upon reaching the female gametophyte, one sperm fertilizes the egg, forming the zygote. The other sperm combines with the two polar nuclei, forming triploid (3n) nucleus in the center of the large cell of the female gametophyte. This large cell will give rise to the endosperm, a food storing tissue of the seed. The union of the two sperm cells to with different nuclei of the female gametophyte is called **DOUBLE FERTILISATION.**



Double ferlilsation

Seed development

After double fertilization, each ovule develops into seed and the ovary develops into fruit. The embryo develops from the zygote. The nutrients are stored in the endosperm but the function may be taken over by the cotyledon (seed leaves) depending on the species.

Endosperm Development

Endosperm usually develops before embryo does. The triploid nucleus at the ovule's central cell after fertilization divides. It forms multinucleated "super cell" that has a milky consistency. This liquid mass is called the endosperm. Membranes are formed in between the nuclei causing partition through cytokinesis to form the "naked cells". These naked cells- the cell with only the membranes, produce cell walls and the endosperms becomes solid. Endosperm store the food that can be used by the seed for germination

Embryo development

The first mitotic division of the zygote splits the fertilized egg into basal cell and terminal cell. The terminal cell eventually gives rise to most of the embryo. The basal continues to divide, producing thread cell called suspensor. This help to transfer nutrients to the embryo from the parent plants. As the suspensor elongates, it pushes the embryo farther into the nutritive and protected tissue. Alongside this process, the terminal cell divided several times and forms a spherical proembryo (early embryo) attached to the suspensor. The cotyledon begins to form as bumps on the proembryo. The embryo elongates as the cotyledon appears. In between two cotyledons is the embryonic shoot apex. The embryonic root apex forms at the opposite end of the embryo's axis where the suspensor attaches

Structure

- Hypocotyl embryonic axis where the cotyledon are attached. It terminates in the radicle
- Epicotyl: portion of the embryonic axis above where The cotyledon are attached andbelow the first pair of miniature leaves
- Plumule is the epicotyl, young leaves and shoot apical meristem combined together

Monocotyledonous embryo has single cotyledon e.g maize, grass. The embryo of grass seed hides between two protective sheaths

- **Coleoptile:** covers the young shoot
- **Coleorhiza:** covers and protect the young root

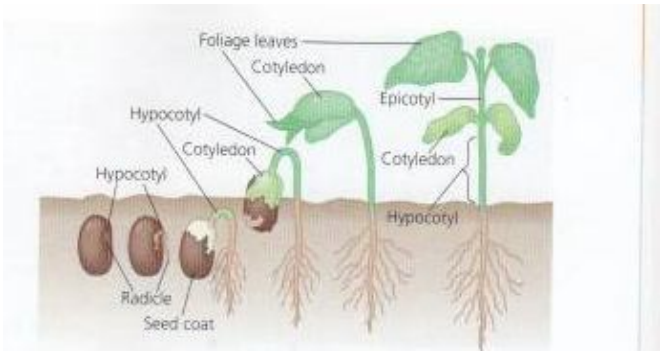
TYPES OF S EED GERMINATION

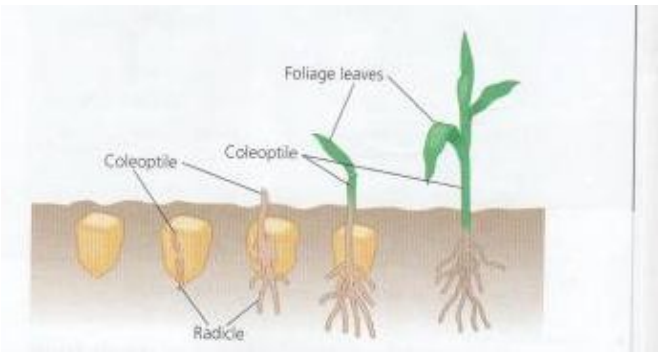
There are three types of germination

1 The radicle or embryonic root emerges first. After, the shoot starts to grow breaking the soil surface. A hook forms in the hypocotyl and the growth pushes the hook above the ground and the hypocotyl straightens as it responds to the sunlight. Cotyledon separates and the delicate epicotyl emerges and spreads its first true leaves. The leaf expands, becomes green and starts to make food by photosynthesis. The cotyledon (seed leaves) shrivels and fall away for lack of food supplies

2 In this type of germination, the coleoptile which is the sheath enclosing and protecting the embryonic shoot pushes upward through the soil into the air. The shoot tip grows through the coleoptile breaking through the its tip. The cotyledon stays inside the soil.

3 The third type of germination is that which the shoot comes from the parent plant directly.

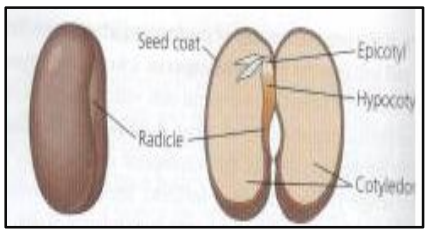


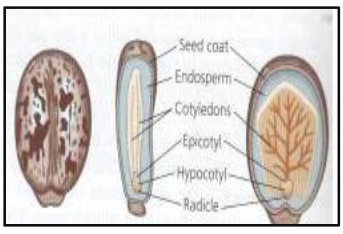


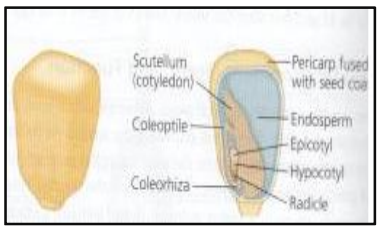
Epigeal in cowpea: cotyledon goes above the soil

Hypogeal in grass: the cotyledon stays within the soil

Structure of a Seed







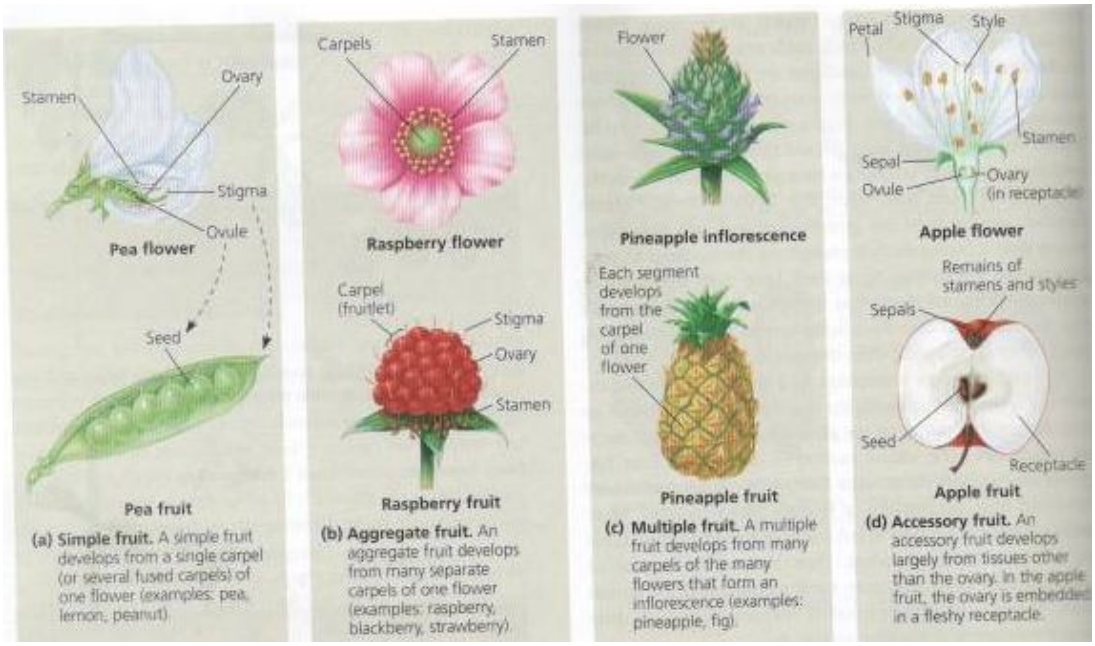
a. Garden beans with thick cotyledon b. castor with thin cotyledon c. maize with one cotyledon

Development of fruit

The fruit develops from the ovary. At fertilization, the plant hormones are triggered. The ovary walls thicken and become the pericarp of the fruit

- Simple fruit is derived from a single carpet or several carpels fusing together
- Aggregate fruit is derived from a single flower but several carpels or ovaries

- Multiple fruit: these are fruit derived from an inflorescence i.e. a group of flower tightly clustered together. When the walls of these ovaries starts to thickens, they fuse together and become incorporated into one fruit e.g. pineapple



Vegetative reproduction in plants

- **Cutting:** shoot cutting or the stem. The shoot forms callus and the adventitious root develops from it. Example are some woody plants, and potatoes is propagated through its specialized stem
- **Grafting:** in this type of vegetative reproduction the stem, bud from one plant will be grafted into a plant of closely related specie or different variety of the same species.

The **stock** is the part that provides the root system and the **scion** is the one grafted to the root system.