Lecture-4 Pollination and Fertilization in flowering plants

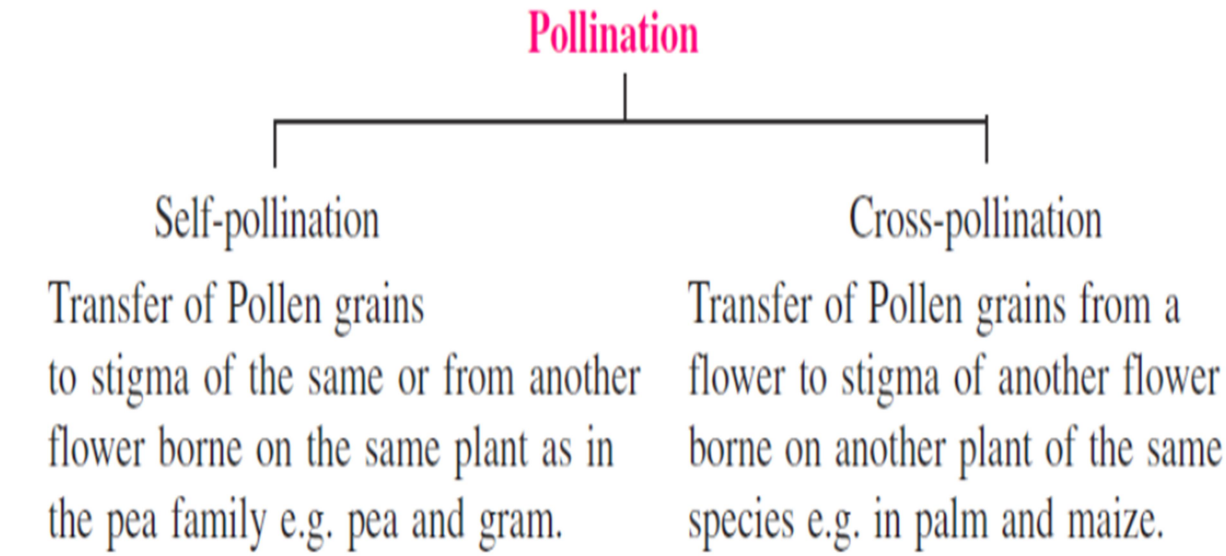
 Pollination refers to the process of transfer of pollen grains from anther and

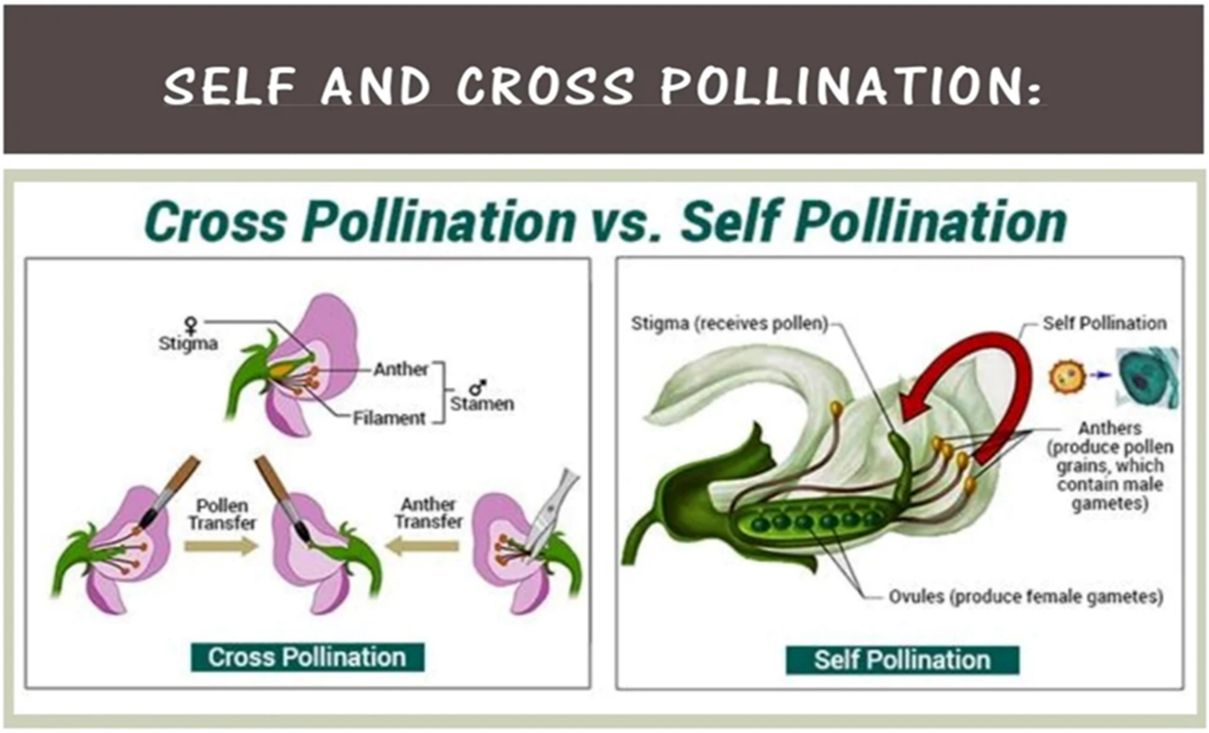
their deposition on stigmatic surface of the flower

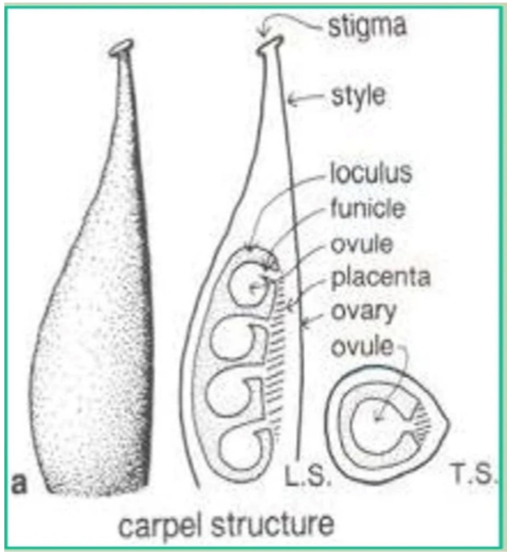
is the transfer of pollen grains from anthers to the stigma of same or genetically similar flower

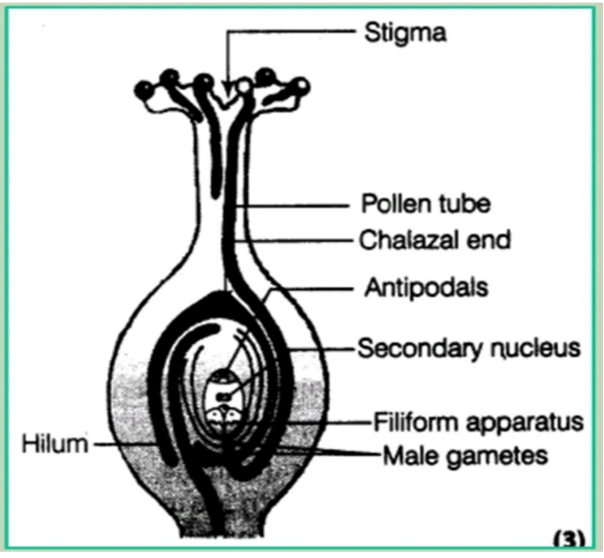
Pollination : Transfer of pollen grains from the anther to the stigma of a flower.

Pollination is of two types:









Self pollination

Self pollination is of two types : autogamy and geitonogamy

1. Autogamy:It is a self pollination which occurs between anther and stigma of the same flower.

a) Chasmogamous :

b) Cleistogamy

c) Bud pollination

importance of Pollination :

1. It results in fertilization and stimulates the ovule to get converted into seed.

2. New varieties of plants are formed through new combination of genes in case of cross pollination.

3. During pollination pollen tube produces growth hormones which stimulate ovary to develop into fruit.

Cross pollination is brought about by various external agencies such as, wind, insects, water, birds and other animals.

Characteristics in Flowers which favour Cross Pollination

1. Pollination by wind (Anemophily) : (Anemos : wind, Phile: to love)

(i) Flowers are small, without colour, nectar and scent.

(ii) Flowers produce a large number of pollen grains to allow for wastage when pollen-grains are carried by wind to another flower.

(iii) The pollen grains are small, light and sometimes provided with ‘Wings’.

(iv) The stigmas are comparatively large, protruding and some times hairy

2. Pollination by insects (Entomophily) : (entomo : insect, phile : to love)

(i) Flowers are usually large, coloured and showy to attract insects.

(ii) Some of these flowers secrete nectar to attract insects. Salvia flowers .(show special adaptations for pollination by bees. (Fig. 19.9a, b

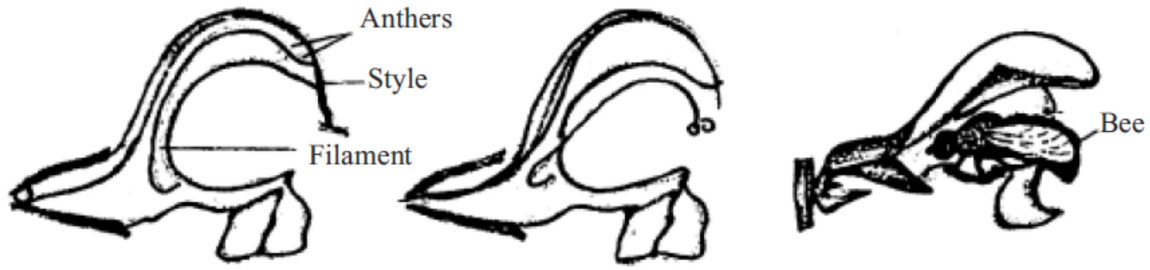


Fig. 19.9 Pollination in *Salvia* by bees

3. Pollination by Water (Hydrophily) (Hydros : water)

This takes place in aquatic plants.

(i) Pollen grains are produced in large numbers.

(ii) Pollen grains float on surface of water till they land on the stigma of female flowers e.g. Hydrilla, Vallisnaria

4. Pollination by Animals (Zoophily) (Zoon : animal)

Flowers of such plants attract animals by their bright colour, size, and scent for example sun bird, pollinates flowers of Canna, and gladioli, and Squirrels pollinate flowers of silk cotton tree

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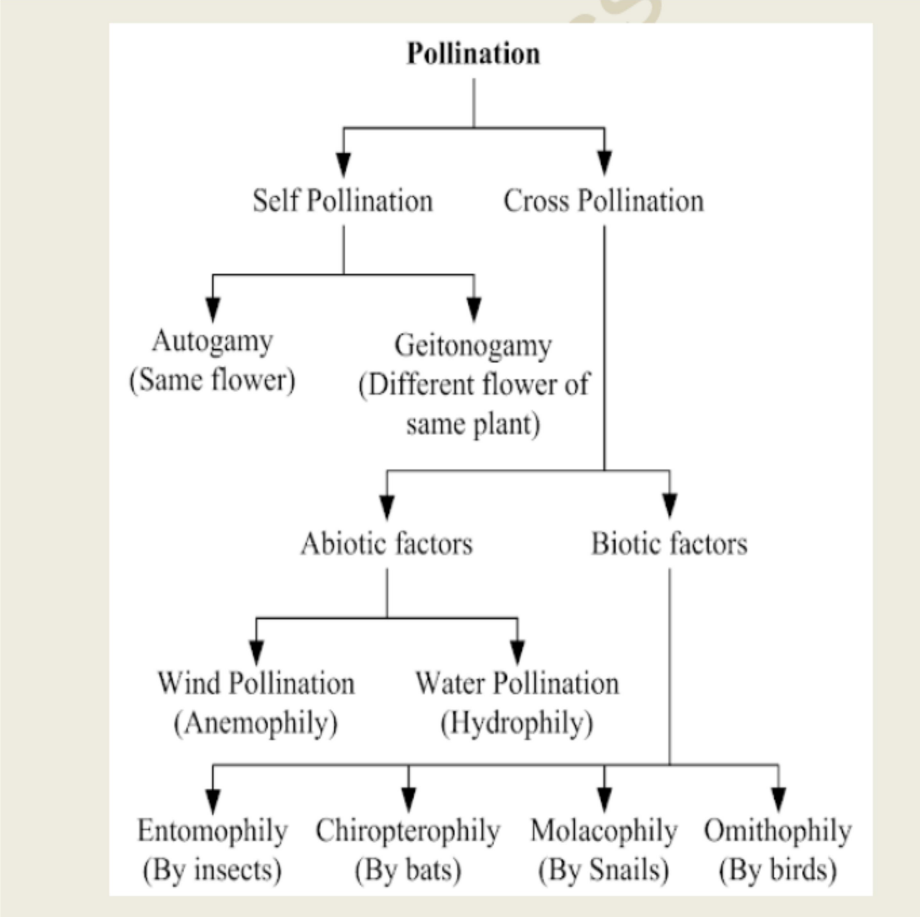
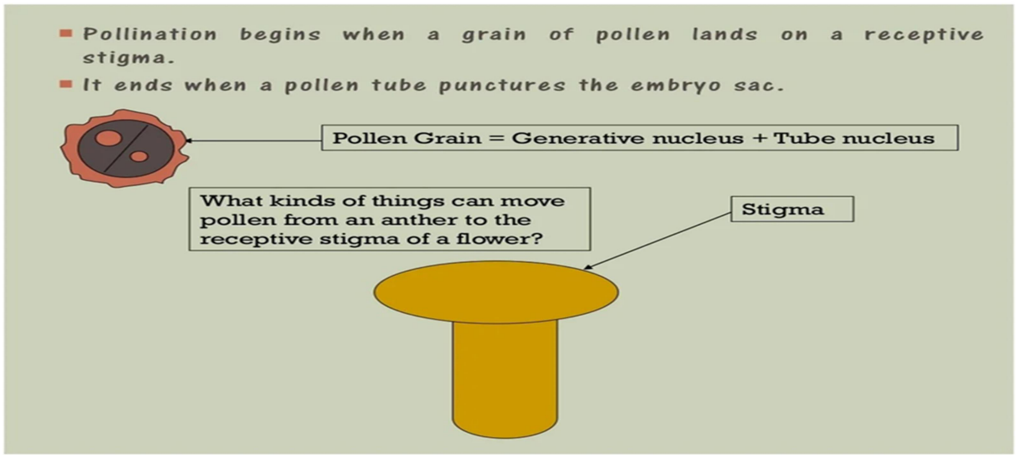
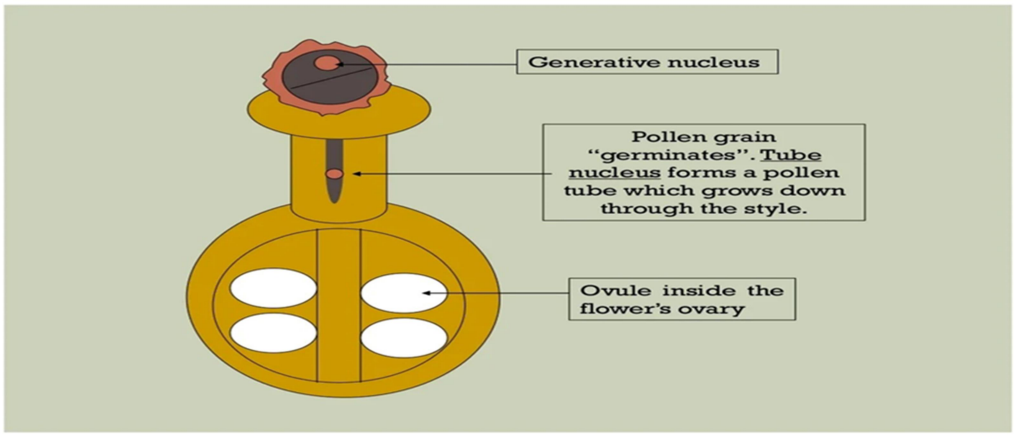
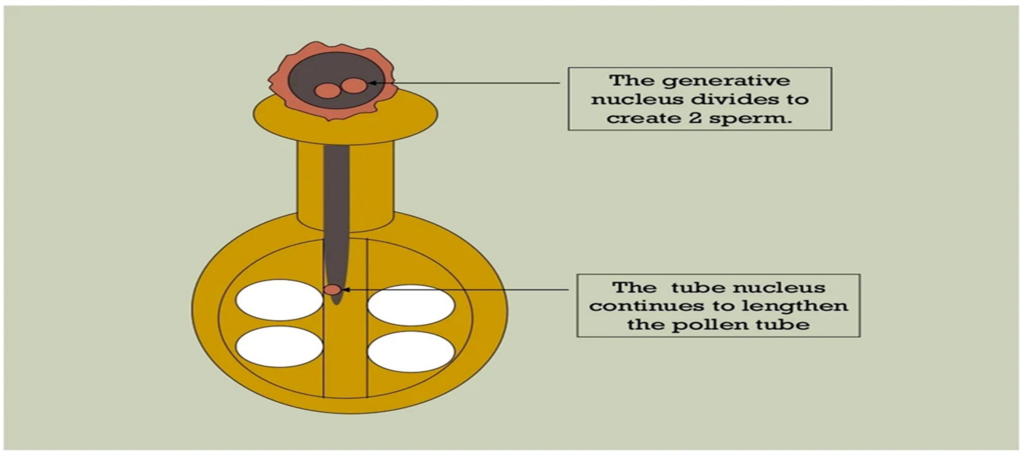
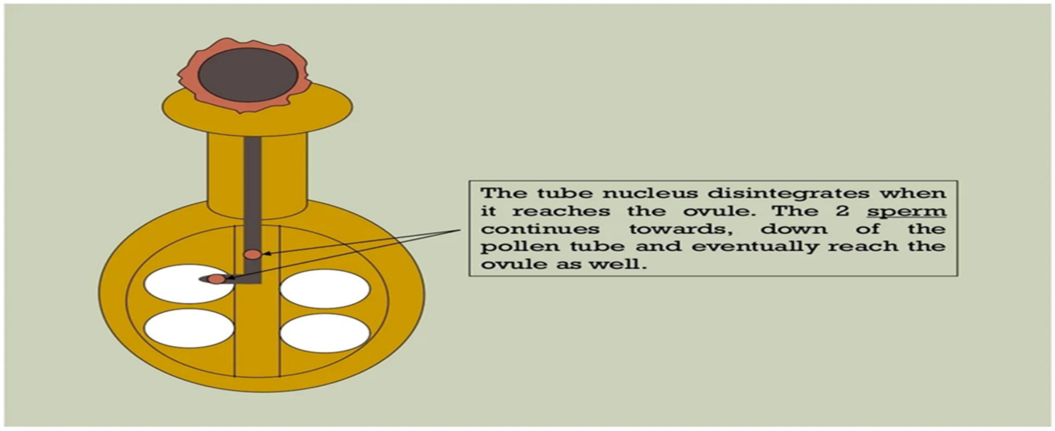
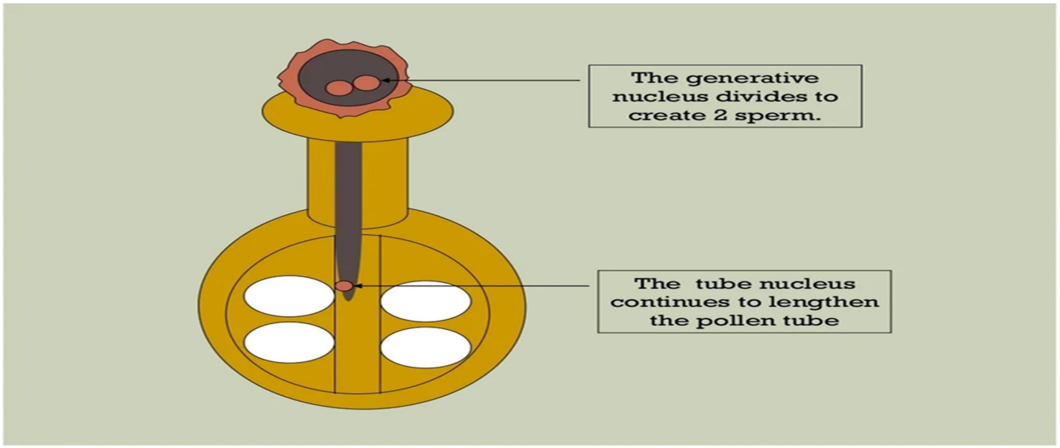


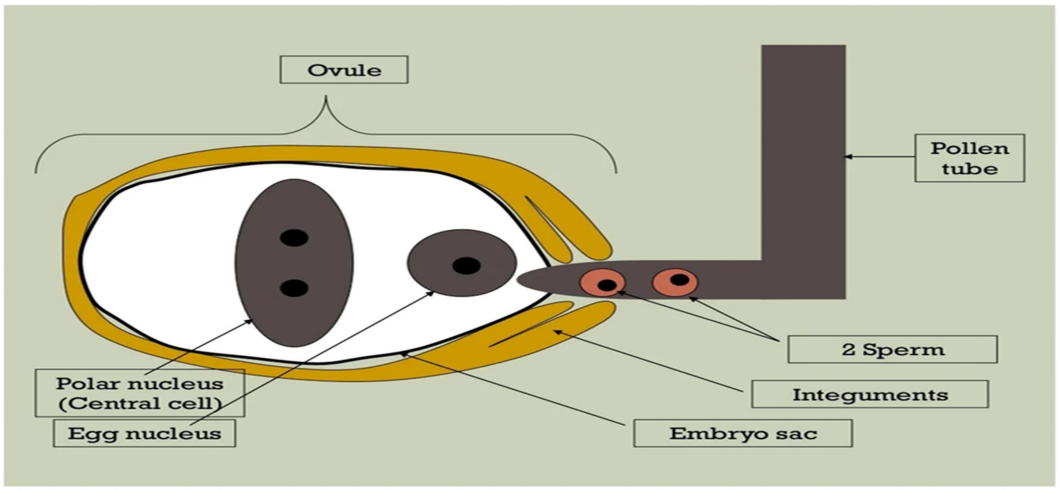



Generative nucleus
Pollen grain "germinates". Tube nucleus forms a pollen tube which grows down through the style.
Ovule inside the flower's ovary


The generative nucleus divides to create 2 sperm.
The tube nucleus continues to lengthen the pollen tube


The tube nucleus disintegrates when it reaches the ovule. The 2 sperm continues towards, down of the pollen tube and eventually reach the ovule as well.





Fertilization

- Pollen grains on reaching the right stigma become three-celled (if they are not

3-celled bearing two male garmetes and one tube cell or vegetative cell) and

begin to germinate.

- Each pollen grain forms a small tube like structure called pollen tube which

emerges through the germ pore. The contents of the pollen grain move into the

tube and the tube nucleus occupies the tip of the pollen tube.

- Pollen tube grows through the tissues of the stigma and style and finally enters

the ovule through the micropyle.

- Vegetative nucleus or the tube nucleus degenerates and the two sperms (or male gametes), now occupy the tip of the pollen tube.
- Tip of pollen tube passes through one of the synergids and bursts to release the two sperms into the embryo sac.
- One sperm fuses with the egg (syngamy) and forms a diploid zygote. The other

sperm fuses with the secondary nucleus to form the primary endosperm nucleus

which is triploid in nature. Since two types of fusion, syngamy and triple fusion

take place in an embryo sac, the process is termed as double fertilization.

- After triple fusion, the triploid primary endosperm cell develops into an

Endosperm

- Endosperm provides food to the developing embryo.
- The synergids and antipodal cells also degenerate to contribute nutrition to the young embryo.

Significance of Fertilisation

(i) Gives stimulus for the growth of ovary, leading to fruit formation.

(ii) Helps in recombination of characters as genes from two different individuals combine and form the zygote

Post fertilisation changes

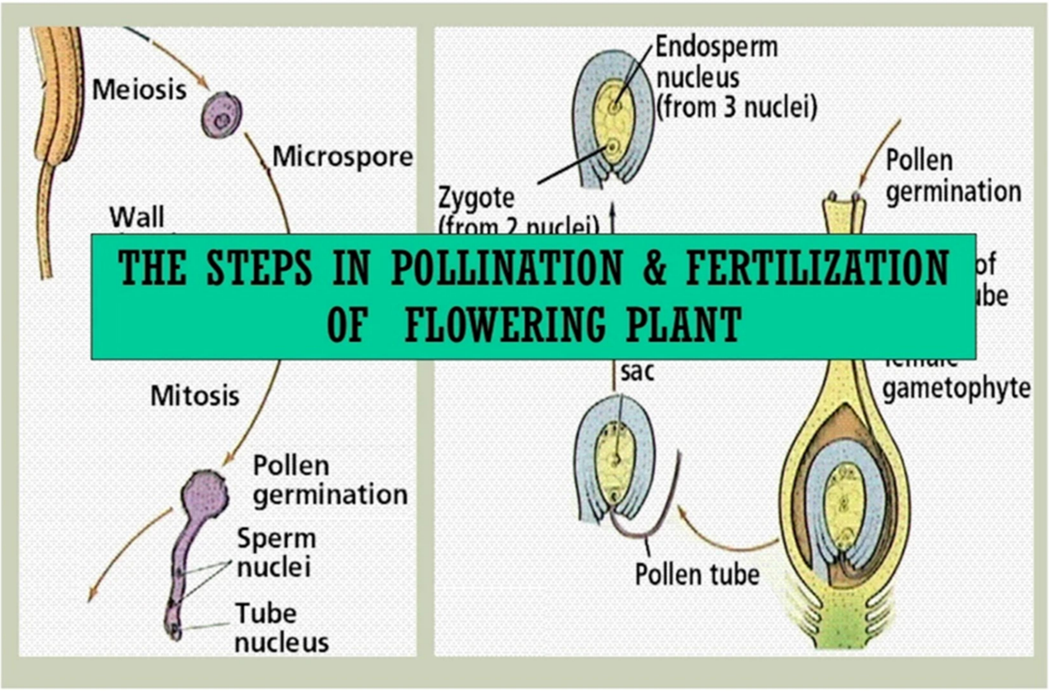
Events that follow double fertilisation are development of endosperm and embryo and maturation of the ovule into seed and ovary into fruit.

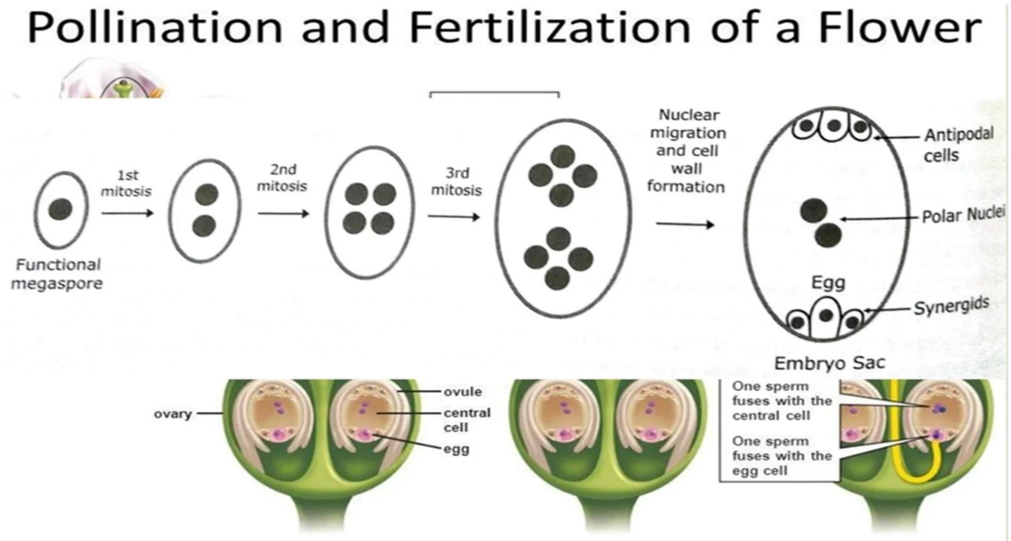
(a) Endosperm : The endosperm development begins before embryo development.This is needed to provide the nutritive tissue for the growth of the zygote into an embryo. The primary endosperm cell divides repeatedly and forms an endosperm tissue. There are three ways in which the endosperm may develop.

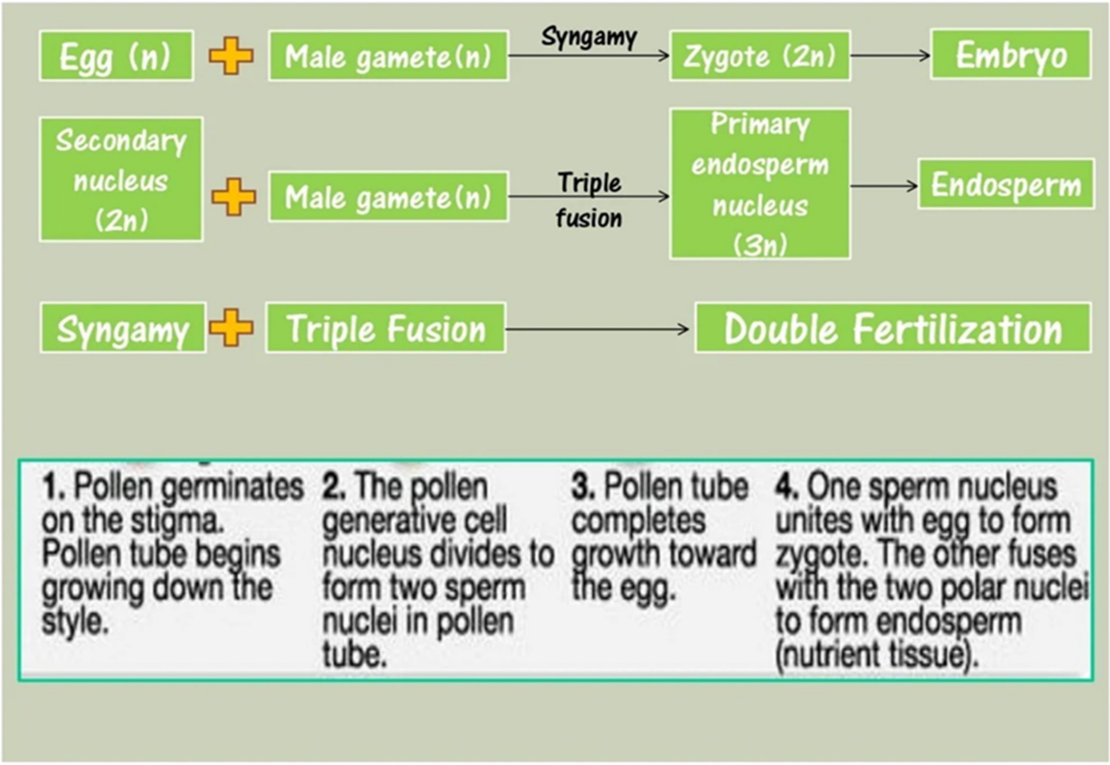
Nuclear type : The primary endosperm nucleus undergoes repeated mitotic divisions to give rise to free nuclei which arrange themselves at the periphery leaving a large central space. Cell wall formation starts subsequently from periphery towards the centre and endosperm becomes cellular at maturity. This is the most common type of endosperm development and is seen in maize, wheat,and rice.

(b) In Cellular type, each nuclear division of primary endosperm nucleus is followed by cytokinesis, making the endosperm cellular from the beginning

(c) In Helobial endosperm, the first mitosis of primary endosperm nucleus is followed by cytokinesis and it gives rise to two unequal cells. Subsequently, mitotic divisions in both the cells are free nuclear but ultimately, mature endosperm becomes cellular after cytokinesis. Endosperm may be completely consumed by the developing embryo before seed maturation as in many dicot seeds like pea, and beans or it may persist in the mature seeds or may even be massive considerably as in cereals, and coconut.


Meiosis
Microspore
Wall
Mitosis
Pollen germination
Sperm nuclei
Tube nucleus
Endosperm nucleus (from 3 nuclei)
Zygote
Pollen germination
sac
gametophyte
Pollen tube
THE STEPS IN POLLINATION & FERTILIZATION OF FLOWERING PLANT


Pollination and Fertilization of a Flower
1st mitosis
2nd mitosis
3rd mitosis
Functional megaspore
Nuclear migration and cell wall formation
Antipodal cells
Polar Nuclei
Egg
Synergids
Embryo Sac
ovary
ovule
central cell
egg
One sperm fuses with the central cell
One sperm fuses with the egg cell



POST-FERTILIZATION EVENTS:

BEFORE	AFTER
CALYX, COROLLA	FALL OFF
ANDROCEIUM, STYLE	FALL OFF
STIGMA	FALL OFF
OVARY	FRUITS
OVARY WALL	PERICARP
OVULE	SEEDS
INTEUMENT	SEED COAT
OUTER INTEGUMENT	TESTA
INNER INTEGUMENT	TEGMENT
MICROPYLE	MICROPYLE
FUNICLE	STALK OF SEED
EGG CELL	ZYGOTE
SYNERGID	DISINTEGRATE, DISAPPEAR