

# I SEM MSC BOTANY

## EMBRYOLOGY

### TOPIC:

## FERTILIZATION-1

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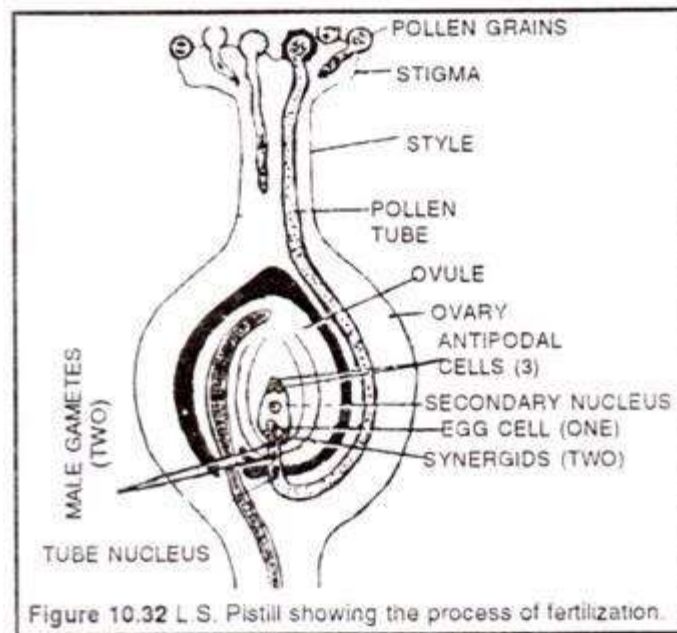
# FERTILISATION:

- ❑ Fertilisation in angiosperms, is unique.
- ❑ It is called double fertilisation. This is because there are two sperms per pollen tube.
- ❑ One of the sperms fertilises the egg cell to form zygote, while remaining sperm fertilises two polar nuclei, resulting in the formation of a triploid endosperm cell.
- ❑ The phenomenon of fertilization was first reported by Strasburger (1884) in *Monotropa*.
- ❑ The male gametes are brought to the egg present in female gametophyte by a pollen tube.
- ❑ This phenomenon is called **siphonogamy** which was discovered by G. B. Amici in *Protulaca* plant.

- ◉ Fertilisation in angiosperms starts with compatible type of pollen (male gametophyte) reaching the pistil and concludes with the fusion of male and female gametes in the embryo sac
- ◉ The pollen received by the pistil are normally held at the stigma , and there is no device for them to reach the egg in the embryo sac , seated deep in the ovarian cavity
- ◉ Therefore, to effect fertilization , the pollen adhere ,hydrate and germinate on the stigma by putting forth a pollen tube , which penetrates the stigmatic tissue ,grows down the style enters ovary and finds its way into the ovule and finally into female gametophyte (embryosac) to deliver 2 sperms in the vicinity of female gametes

- ◉ The distance a pollen tube has to travel to reach the egg depends on the length of the style which is quite variable in different species
- ◉ During its passage through the stigma and style the male gametophyte interacts with various sporophytic tissues of the pistil (viz. stigma, style, transmitting tract, placenta, funiculus, and integuments)
- ◉ The pistil facilitates the pollen tube journey by providing multiple stage specific nutritional and guidance cues or signals along its path

- The first requirement for pollen to germinate is their adhesion on the stigma and hydration ,which take from a few seconds to few minutes



# STRUCTURE OF STIGMA

- ◉ It is the terminal part of pistil , the female sex organ , which receives the pollen and provides necessary conditions to support the germination and initial pollen tube growth.
- ◉ The main functions of stigma are recognition of the pollen and to provide them with water necessary for their germination
- ◉ In many plants stigma also supplies the necessary medium for pollen germination in the form of exudates

- ◉ The chief components of the exudates are lipid and phenolic in nature
- ◉ In addition small amounts of free sugars, amino acids, proteins and peptides are also present
- ◉ Composition of exudates may vary from species to species

- ◉ There are two types of stigma
- ◉ The stigma that secrete exudates on their surface are called **wet stigmas** (eg. Petunia, Nicotiana, Liliium)
- ◉ Those which do not secrete any exudate are termed **dry stigma**(Asteraceae)



- ❖ A young stigma of this plant shows a columnar tissue with a slight depression in the centre , and is divisible into two zones: an upper zone with epidermis forming the secretory zone and lower 1-3 layers of laterally extended cells constituting the storage zone .
- ❖ Many of the epidermal cells divide forming bi celled stigmatic papillae . The exudation accumulates in the schizogenous cavities
- ❖ In the wet stigma , the exudate begins to accumulate in the subcuticular zone. Consequently , both cuticle and pellicle become distended and get ruptured , thereby releasing the exudate, which collects on the stigma

Several important roles have been assigned to the stigmatic and stylar exudates:

1. Help in adhesion, hydration and germination of pollen on the stigma
2. Protect the stigma from insect attack and or microbial infection
3. Act as liquid cuticle to protect stigma from dehydration
4. Serve as food for vectors during pollination ,and
5. Serve as nutrition for the growing pollen tubes through the stigma and style

- ❑ The so called dry stigma does possess a hydrated layer, called pellicle over the cuticle . The pellicle is a dynamic system. It consists of a lipid film in which float a mosaic of proteins , many of them capable of rapid renewal under artificial conditions. Some of these proteins possess esterase activity

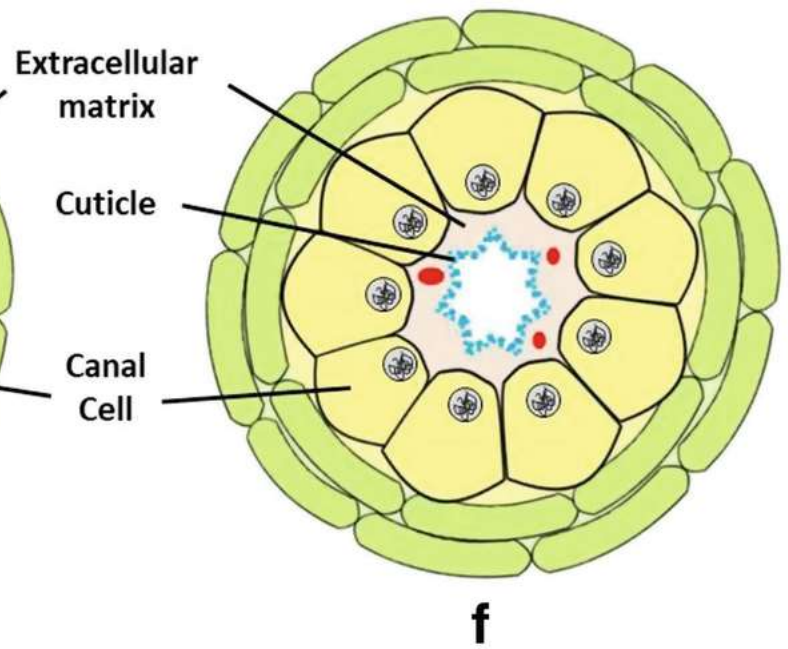
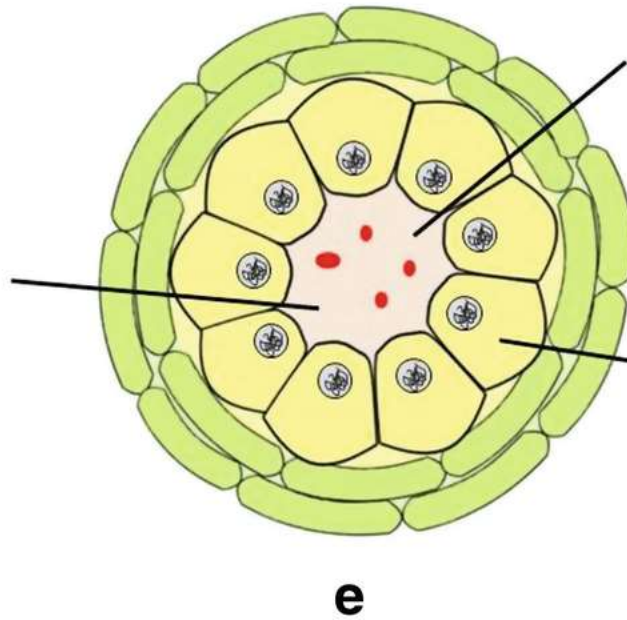
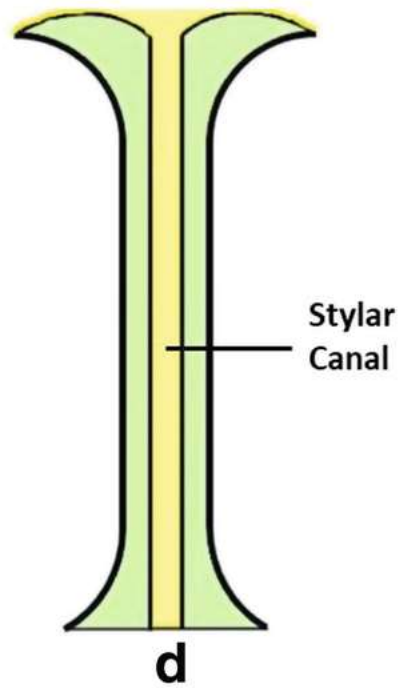
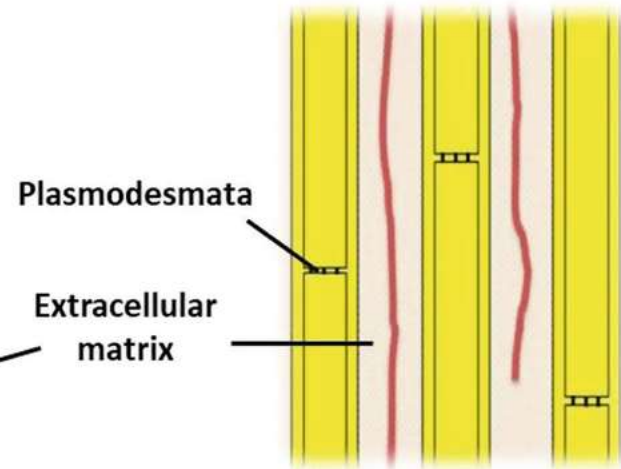
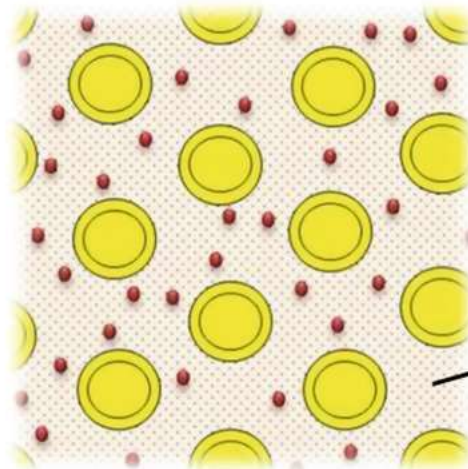
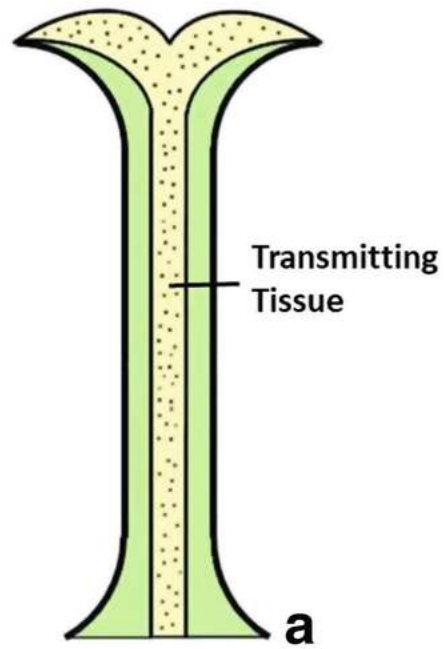
- ❑ Soon after receiving the pollen the stigmatic surface becomes moist due to water exuded by the papillate cells of the stigma . Stimulated by this , the exine held proteins flow out within seconds and bind with the proteins of the pellicle
- ❑ The pellicle has been suggested as the receptor sight for the exine proteins on the stigma, and the interaction between the two proteins is responsible for the recognition of the pollen

style

The length a pollen tube has to travel in order to bring about fertilization depends on the length of style which separates the stigma and ovary

Based on morphological features , three types of styles have been recognised:

1. Solid or closed style:
2. Semi solid or half closed style
3. Open style



## Closed or solid style:

- ❑ occurs mainly in dicots (Brassica, Nicotiana, Arabidopsis), is characterised by the presence of a central strand of elongated, specialised cells that constitute the “conducting tissue” or the “transmitting tissue”.
- ❑ In a transection, the cells of the transmitting tissue appear circular and separate with exceptionally thick cell walls surrounded by intercellular substance which is pectinaceous.



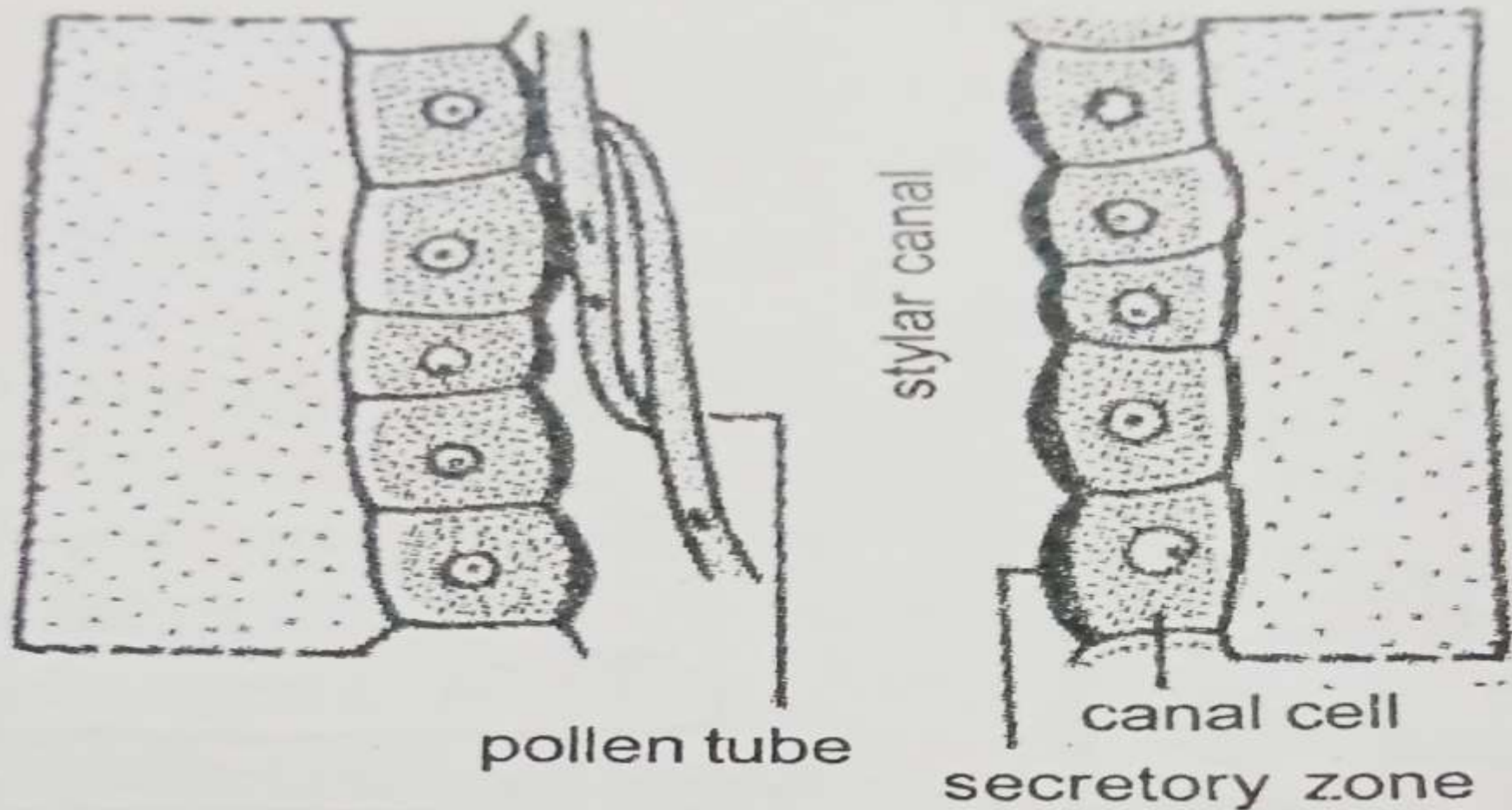
- ❑ The cells of the transmitting tissue are generally uninucleate and densely cytoplasmic .
- ❑ When the style is solid , the pollen tubes grow by making way through the pectin rich wall layer

## Half closed or semi solid:

this type of style consist of canal which is rudimentary transmitting tissue consisting of 2-3 layers of glandular cells(cactaceae)

Open style : eg Aristolochiaceae,  
papavaraceae etc

There is a wide stylar canal lined by an inner epidermis . In open styles the stylar canal are lined by canal cells which are secretory in nature . The most striking structural feature of the canal cell is the presence of thick dome shaped secretory zone facing the canal . The secretions from canal cells consist of proteins,carbohydrates lipids etc



**Fig. 9.7 A.** Longitudinal section of the pistil of *Lilium*, showing hollow style. **B.** The stylar canal is lined with large canal cells with a secretory zone facing the canal.

**THANK YOU**