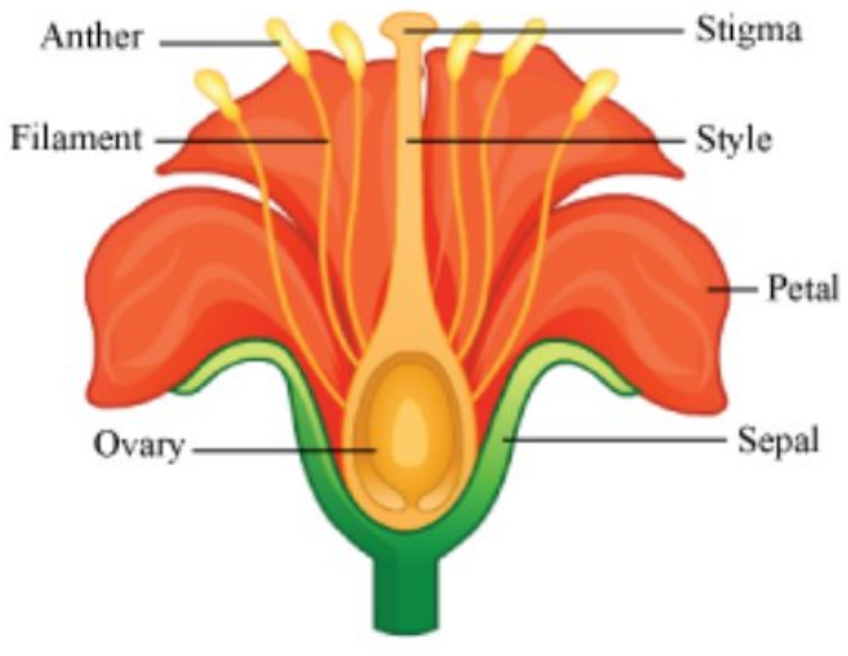
Sexual Reproduction in Flowering Plants

Pre-Fertilisation Events

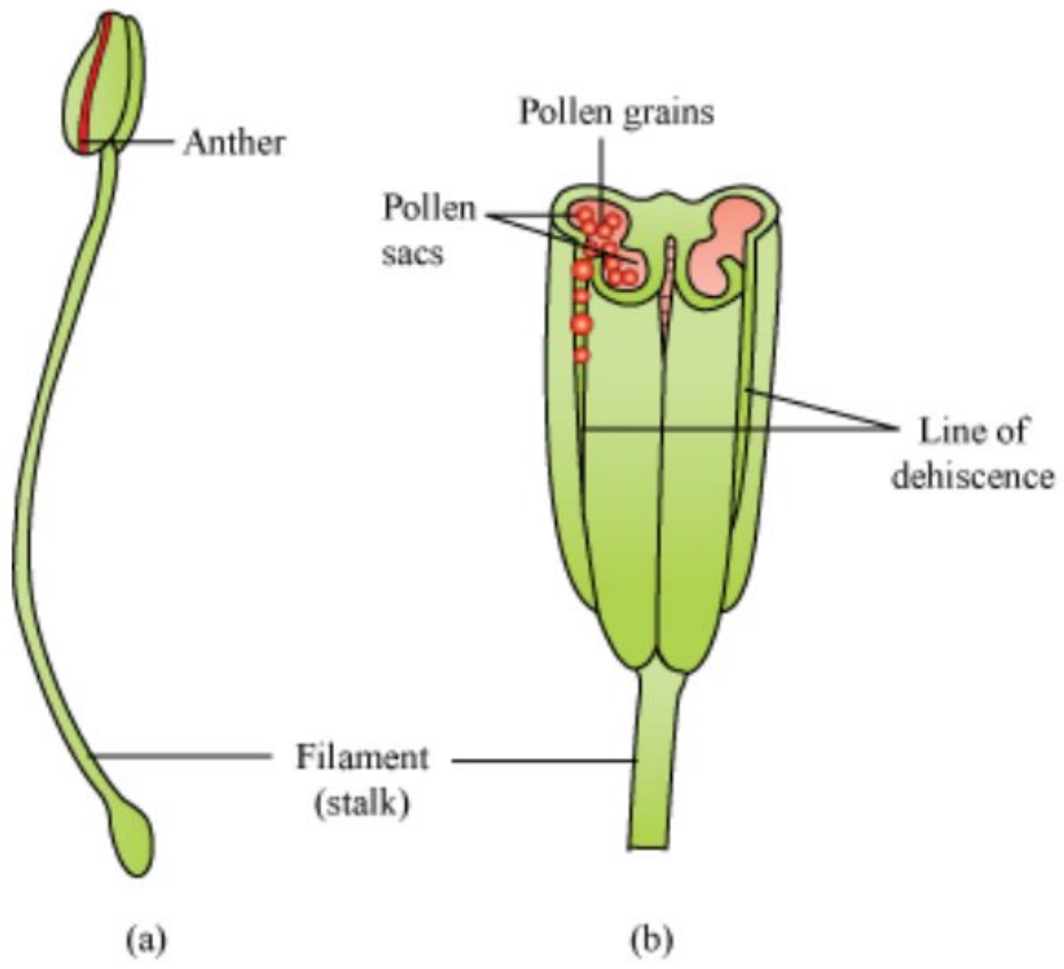
- Several hormonal and structural changes result in the development of a flower.
- Inflorescences bear the flower buds, and then the flowers.
- Flowers are the reproductive parts of a plant.
- In the flowers, the androecium (male reproductive part) and the gynoecium (female reproductive part) develop.



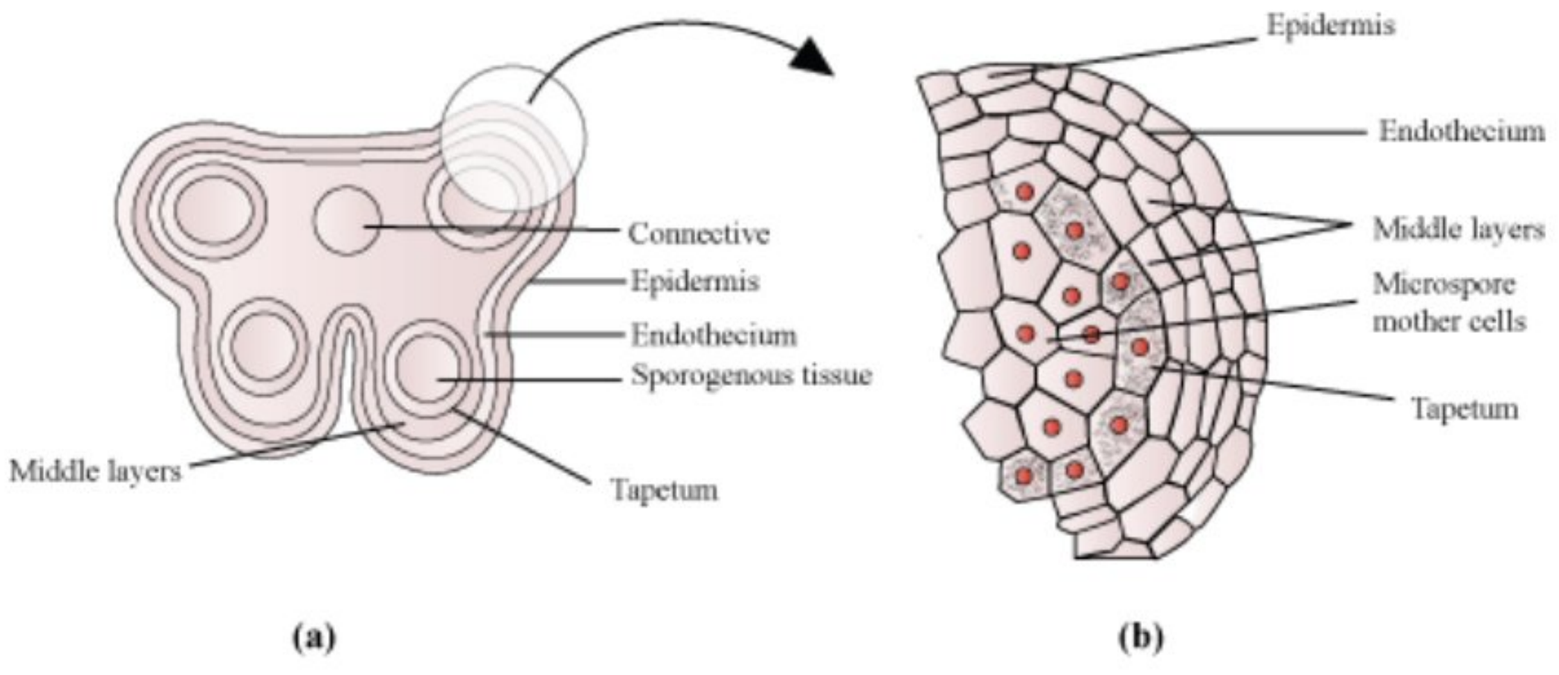
Androecium

- The androecium consists of whorls of stamen.
- The stamen consists of the **filament** (long and slender stalk) and **anther** (bilobed structure).
- Filament is attached to the thalamus or to the petal.
- **Anther**:
    - A typical anther is bilobed and each lobe is dithecous (consists of two theca).
    - Theca are separated by a longitudinal groove running lengthwise.

- The microsporangia are located at the corners, two in each theca. They further develop to form pollen sacs, which contain the pollen grains.



- **Structure of microsporangium**
  - The microsporangium is surrounded by four wall layers (epidermis, endothecium, middle layers, and tapetum).
  - The outer three layers are protective and help in dehiscence of anther to release the pollen grains. The tapetum provides nourishment to the developing pollen grains.
  - In the young anther, the sporogenous tissue forms the centre of each microsporangium.



(a) (b)

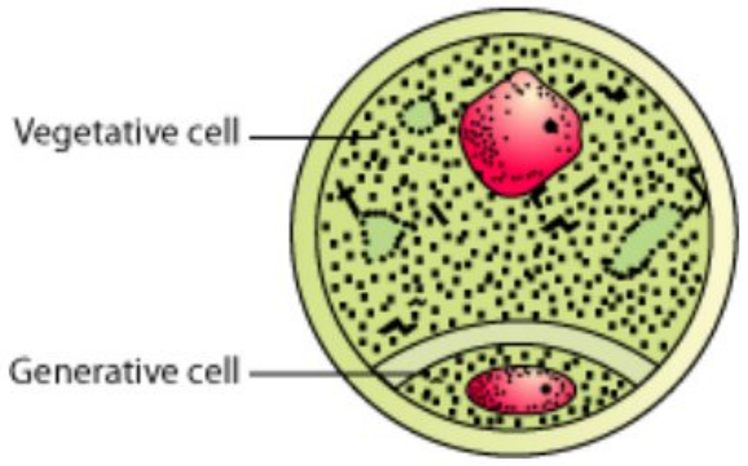
Microsporogenesis

- It is the process of formation of microspore from PMC (Pollen Mother Cells).
- As development occurs in the anther, the sporogenous tissue undergoes meiosis to form microspore tetrad.
- Each cell of sporogenous tissue has capacity to give rise to a tetrad. Hence, each cell is a potential pollen or PMC.
- As the anther matures, the microspores get detached from each other and develop into pollen grains.

Pollen grains

- Represent the male gamete and are spherical, having a two-layered wall:
    - Exine (outer) – Hard layer made of sporopollenin, which is extremely resistant and can withstand high temperatures, acidic and alkaline conditions, and enzymes
    - Intine (inner) – Thin and continuous layer made up of cellulose and pectin
- Mature pollen grain contains two cells:

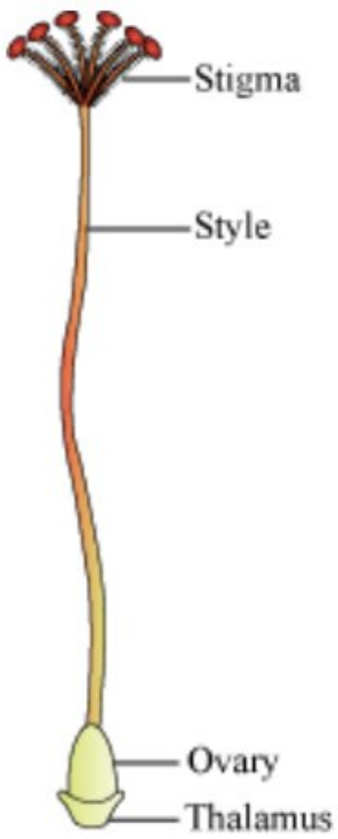
- Vegetative cell – Large with irregular nucleus, contains food reserves
- Generative cell – Small and floats in the cytoplasm of the vegetative cell



- In 60% of the angiosperms, pollen grains are shed at 2-celled stage while in others generative cell undergoes mitosis to form two male gametes (3-celled stage).
- The viability of pollen grains after they are shed depends upon temperature and humidity. It ranges from 30 minutes to few months.

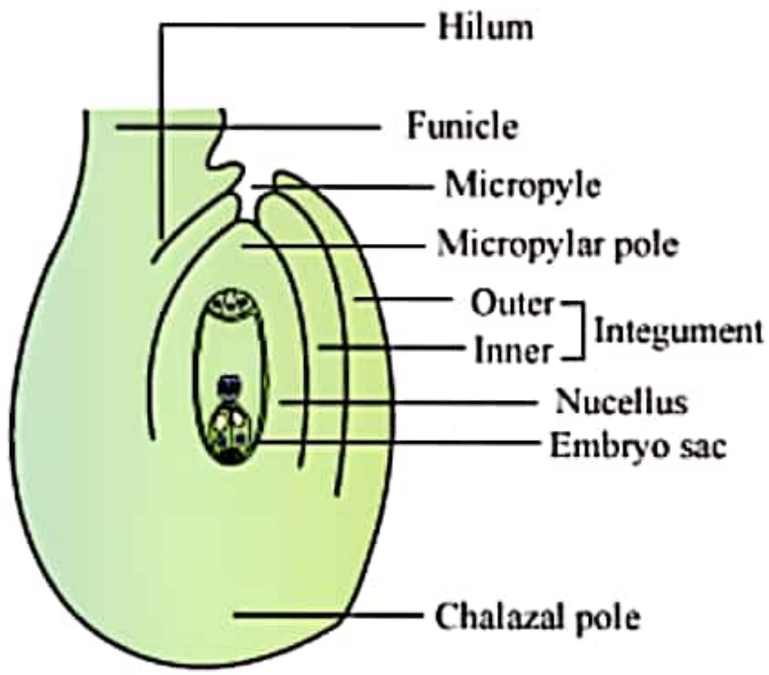
Gynoecium and Formation of Female Gametophyte

- The gynoecium represents the female reproductive part of a flower.
- It may be mono-carpellary (one pistil) or multi-carpellary (many pistils). In multi-carpellary, the pistils may be fused in one (syncarpous) or free (apocarpous).
- Each pistil consists of:
  - **Stigma** – Receives the pollen grains
  - **Style** – Elongated, slender part below the stigma
  - **Ovary** – Bulged basal part containing the placenta, which is located inside the ovarian locule (cavity)
  - The placenta contains the megasporangia or ovules.



Megasporangium

- The ovule is attached to the placenta by the **funicle**. The junction of the ovule and the funicle is called **hilum**.
- Each ovule has one or two protective layers, called **integuments**, which cover the rest of the ovule, except for a small opening called **micropyle**.
- The **chalaza** lying on the opposite side of the micropyle end represents the basal part of the ovule.
- **Nucellus** is present within the integuments and contains reserved food. The **embryo sac** or female gametophyte is located within the nucellus.



Megasporogenesis

- The **megaspore mother cell** (MMC) gets converted into megaspores by the process of megasporogenesis.
- The MMC is large and contains a dense cytoplasm and a prominent nucleus. It undergoes meiosis to produce four megaspores.