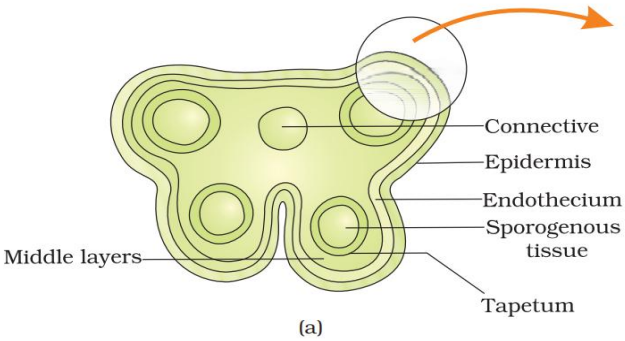
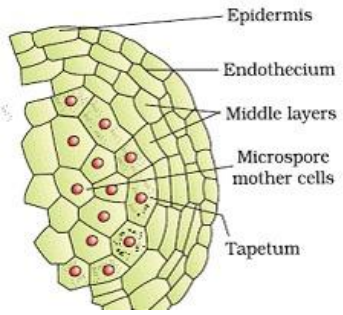
Pre-fertilization: Structures and Events

- Several structural and hormonal changes lead to formation and development of the floral primordium.
- Inflorescence is formed that bears floral buds and then flower.
- The anther is a four-sided (tetragonal) structure consisting of four microsporangia located at the corners, two in each lobe.
- The microsporangia develop further and become pollen sacs.

Structure of Microsporangium

- In a transverse section a typical microsporangium appears circular in outline.
- In Young anther microsporangium is surrounded by four walls:

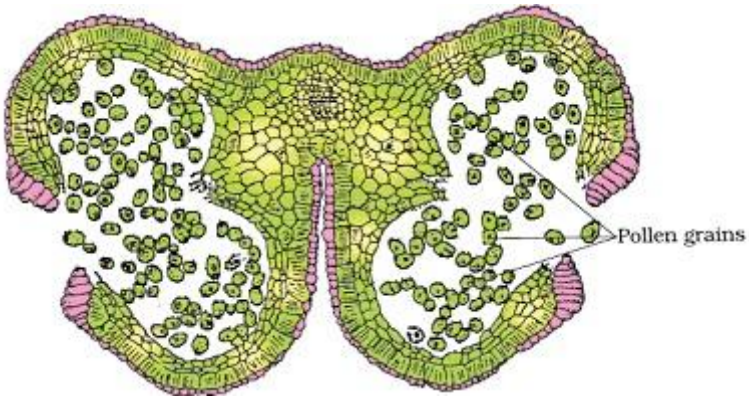




TS of Young Anther *Enlarged view of one microsporangium*

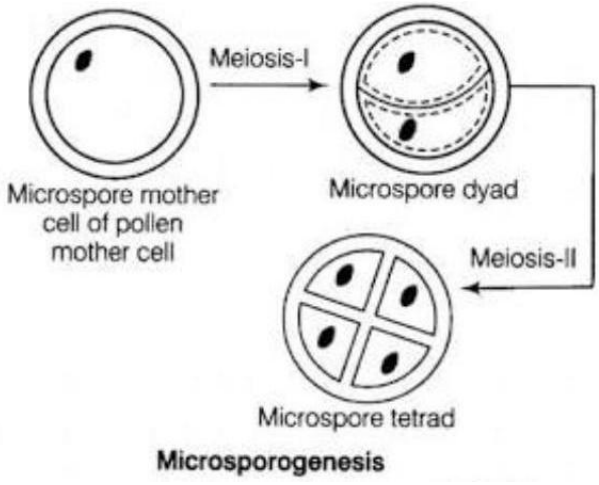
1) **Epidermis :** Outermost continuous Layer
   Helps in protection and dehiscence of anther.
2) **Endothecium :** A continuous fibrous layer Present beneath Epidermis
   Helps in protection and plays **main role Dehiscence of anther** to release pollen grain.
3) **Middle Layer:** Present between Endothecium and Tapetum
   Helps in protection and dehiscence of anther.
4) **Tapetum:** Innermost layer, provide nourishment to developing pollen, have dense cytoplasm possess More than one nuclei (by Mitosis- free nuclear division).
   Provide Sporopollenin covering, Secrete enzymes (like callase-break callose) , hormones, special protein to recognise compatibility & incompatibility. Provide Pollen kitt (helps in insect attractant and sticking, protect from UV rays) & tryphine (poisonous substance causes pollen allergy & hay fever)

- In Mature anther only two layers remain i.e. Epidermis and Endothecium.
- As the anthers mature and dehydrate, the microspores dissociate from each other as callase enzyme degrade callose (polysaccharide holding microspore tetrad) and each microspore develop into pollen grains.
- Inside each microsporangium, several thousands of microspores are formed that are released with dehiscence of anther.



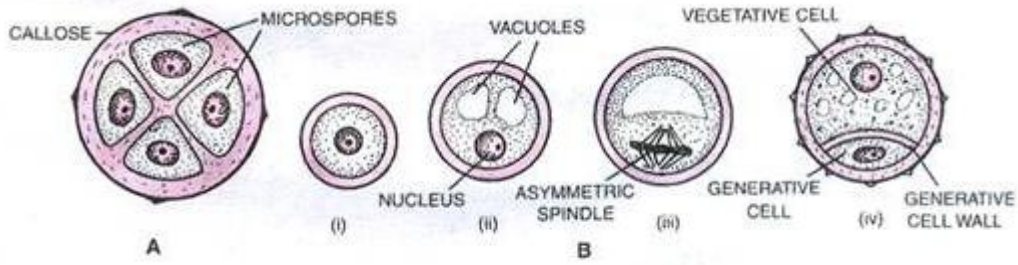
Sporogenous tissues- It is compactly arranged homogenous cells which are present at centre of each microsporangium when the anther is young. It gives rise to a microspore tetrad.

- Each sporogenous cell is potential pollen or microspore mother cell.
- Microspore Mother Cell **(2n)** divide **meiotically** to form four haploid microspores **(n).**
- The microspores, formed, are arranged in a cluster of four cells- the microspore tetrad.
- All the four microspores of a spore tetrad are functional.
- The process of formation of microspores from a pollen mother cell through meiosis is called **microsporogenesis.**



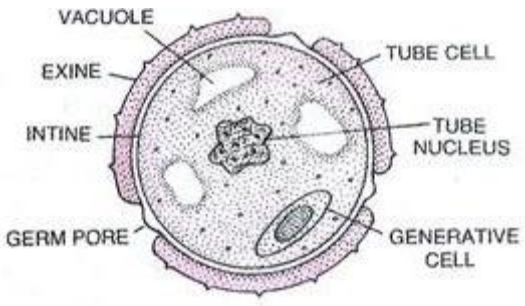
Microsporogenesis

- The vacuoles develop inside the microspore shifting the nucleus to periphery.
- Asymmetric spindles develop, leading to unequal division (Mitotically), the larger cell with vacuole forms **vegetative cell** and the smaller one forms **generative cell** forming two cell stage.



Microsporogenesis. A, a microspore tetrad. B, a microspore maturing into a pollen grain.

- Each Pollen Grain has first two celled stage.
    1. **Vegetative Cell-** Has Abundant food reserve & provides nourishment
       Its nucleus called tube nucleus.
       It is Bigger in size and has large irregular nucleus
       Responsible for the development of pollen grain
    2. **Generative Cell**- Contains mate gamete further divide meiotically to form two male gametes.
       Comparatively smaller in size and floats in cytoplasm of vegetative cell.
       Involves in syngamy & triple fusion.
       It is spindle shape and has dense cytoplasm and nucleus.
- After pollination the pollen grain germinates on the stigma to produce the pollen tube through germ pore.
- **In over 60 % of angiosperms, pollen grains are shed at 2-celled stage** (the generative divide mitotically inside the style while growing pollen tube).
- In the **remaining 40 % species**, the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed (**at 3-celled stage**).



Pollen grain represents the male gametophytes.
Generally spherical in shape and 25-50 micrometers in diameter
Pollen varies in sizes, shapes, colours, designs.
The cytoplasm of the pollen grain is surrounded by a plasma membrane and has prominent 2 layered Wall.

1. **Intine**:- Inner wall of pollen, thin and continuous layer, made of cellulose and pectin
2. **Exine** :- Hard Sculptured outer discontinuous layer.
   Exhibits a fascinating array of patterns and designs.
   Made of **sporopollenin**- most resistant organic matter known. It can withstand high temperatures

and strong acids and alkali. No enzyme can degrade sporopollenin. It helped pollen to preserved as fossils.

Germ pores– apertures on exine where sporopollenin is absent helps in formation of pollen tube.

Dicot Plants have Tricolpate Pollen (Three Germ pores) and Monocots have monocolpate pollen (Pollen with single germ pore)

Pollen grains Allergies- Many species like Parthenium (Carrot grass came to India as contaminant with imported wheat) cause severe allergies and bronchial diseases in some people and leads to chronic respiratory disorders– asthma, bronchitis, etc.

Pollen grains as rich source of nutrients- They are rich in nutrients and are used as pollen tablets or syrup in western country as food supplements by Athletes and Race Horses to enhance their performances.

Viability- The period for which the pollen grains retain the ability to germinate on landing on the stigma.

- It depends on Temperature and Humidity
- It varies with species to species:
- Rice & Wheat loses viability within 30 mins.
- Rosaceae, Solanaceae and Leguminoseae maintain viability for months

Pollen grains of large number of species are stored in liquid nitrogen at temperature – 196^0C called pollen bank and can be used for crop breeding programmes.