



NEET 2025

CLASS 12

SEXUAL REPRODUCTION IN FLOWERING PLANTS

Lecture ②

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CONTENTS

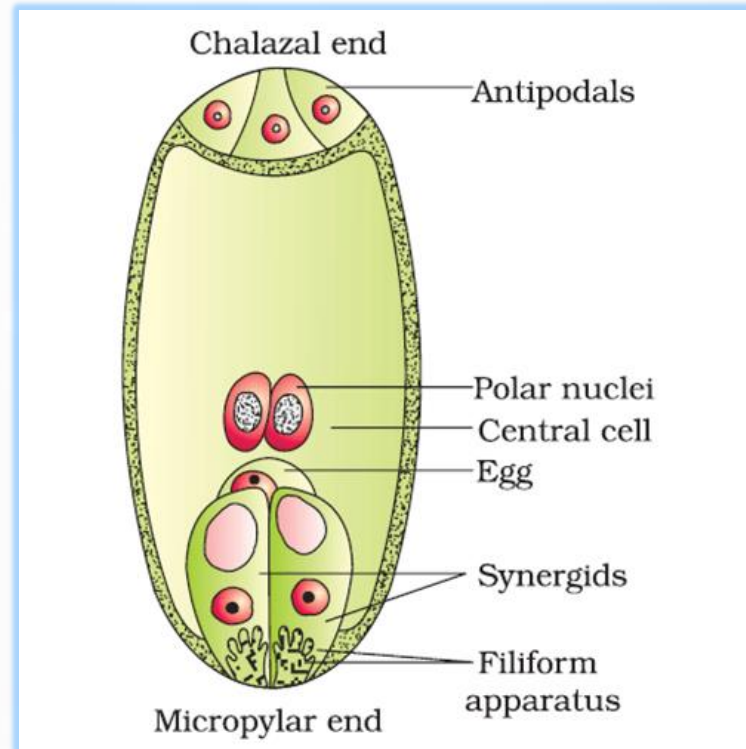
Structure of pistil

Structure of ovule

Embryo sac

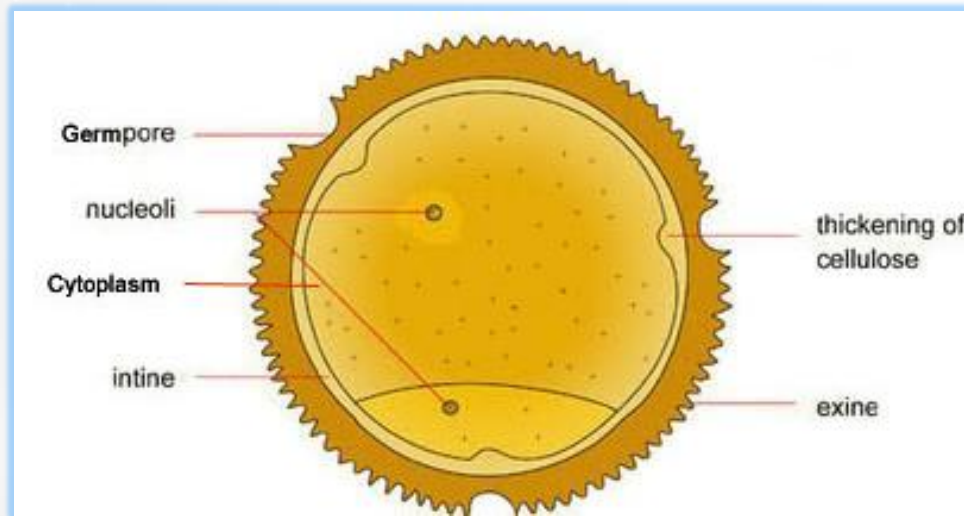
Megasporogenesis

Examples



Pollen Grain

- ❖ Pollen grains are covered with sporoderm.
- ❖ The sporoderm is composed of two layers:
Outer exine - Composed of sporopollenin.
Inner Intine - Composed of pecto cellulose.



Development of the Pollen

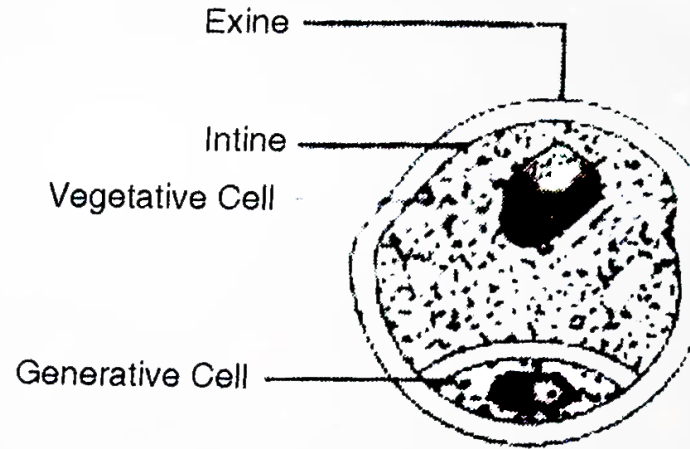
Protoplasm of the Pollen

❖ Small generative cell

- ❑ 2 male gametes
- ❑ Dense cytoplasm and a nucleus

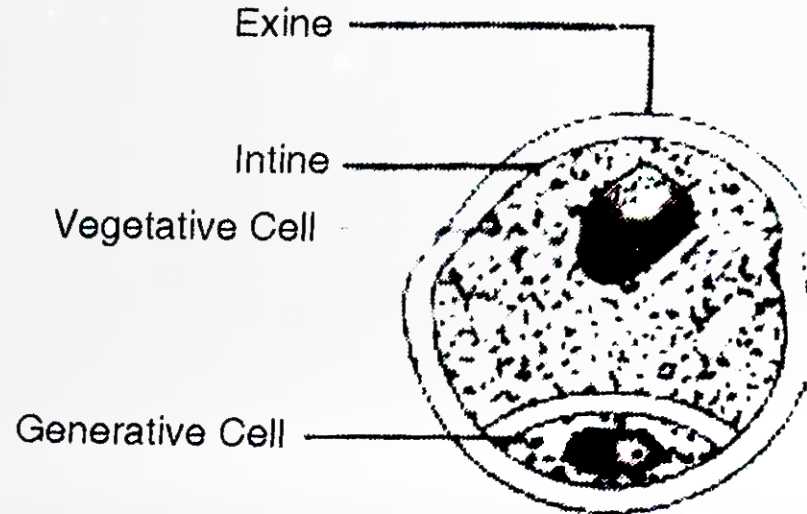
❖ Large tube cell or Vegetative cell

- ❑ Abundant food reserve and a large irregularly shaped nucleus.



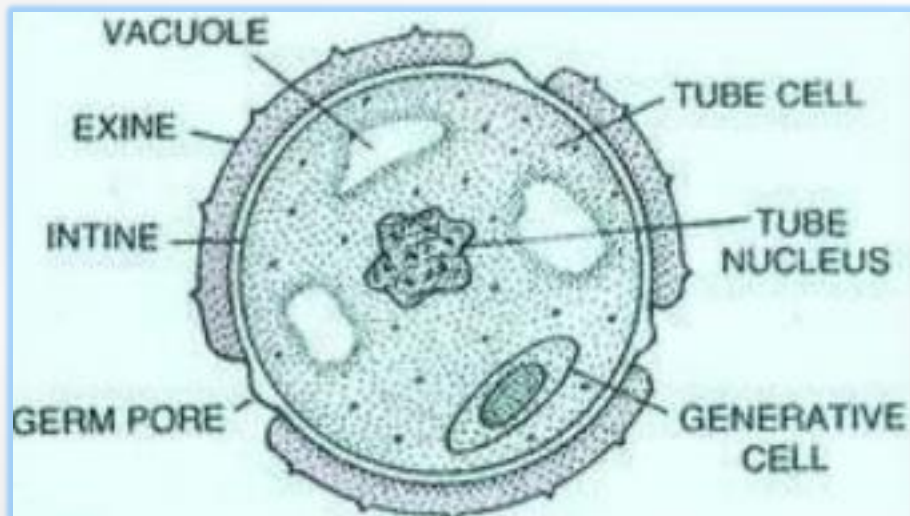
Development of the Pollen

- ❖ At the time of pollination, the pollen grain is either 2-celled (tube cell + generative cell) or 3-celled (tube + two male gametes).



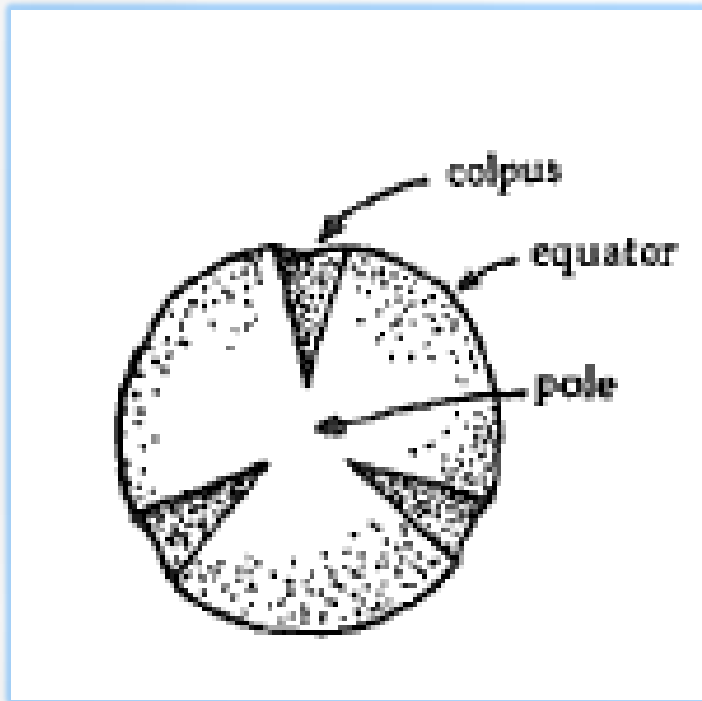
Germ Pore

- ❑ In some parts of the pollen surface exine is thin or absent.
- ❑ They are called germ pores or germinal furrows
- ❑ At these points intine may be thick or callose deposition happens.



Germ Pore

- ❑ Pollen grains are usually with three germ pores (tricolpate) in dicots and with single germinal furrow (monocolpate) in monocots.



Pollen allergy

- ❑ **Parthenium or Carrot Grass, came into India as a contaminant with imported wheat, has become ubiquitous in occurrence and causes pollen allergy.**



Pollen Viability

- ☐ **The duration for which pollen grains retain the ability to germinate.**
- ☐ **It is about 30 minutes in cereals like wheat and paddy.**
- ☐ **In rosaceae, leguminose and solanaceae family the pollen viability is long and remain for a few months.**

Pollen Viability

- ☐ Pollen grains can be stored for years in liquid nitrogen (-196°C) in pollen banks.
- ☐ They are used in plant breeding programmes.

Pollen Allergy

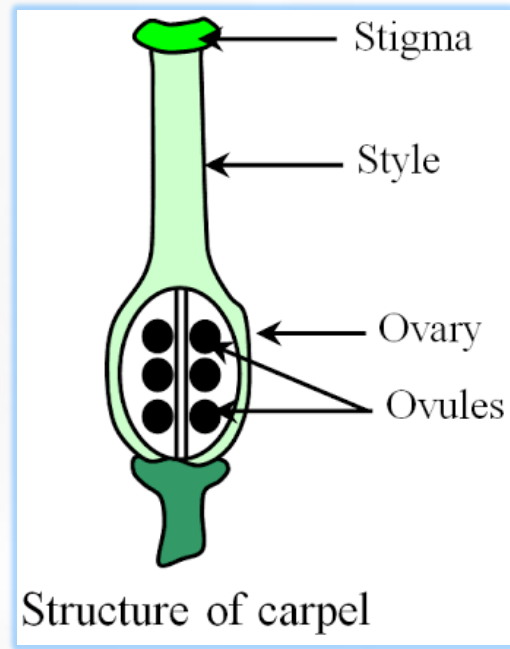
- ☐ **Wind pollinated plants (anemophilous species) produce pollen grains in Large number.**
- ☐ **They remain suspended in air and enter respiratory tracts.**
- ☐ **It can cause allergy in some individuals, and cause respiratory disorders like rhinitis, asthma and bronchitis.**

Pollen Products

- ☐ The bee pollen grains (collected by Bees) are used in cosmetics and as food supplements.
- ☐ Pollen grains are rich in nutrients
 - **Protein 7 - 26%,**
 - **Carbohydrates 24 - 48 %**
 - **Fats 0.9 - 14.5%**
- ☐ Pollens are taken as tablets or syrups to improve the performance of athletes and race horses.

Gynoecium

- ❑ The female reproductive whorl of the flower.
- ❑ It is composed of one or more carpels.
- ❑ Each carpel is differentiated into three parts
 - Ovary
 - Style
 - Stigma



Gynoecium

- ❑ Based on the number of carpels, the ovary can be of the following types:

Monocarpellary - only one carpel.

E.g, Pea, Bean.

Bicarpellary - two carpels.

E.g, Mustard, tomato.

Tricarpellary - three carpels.

E.g, Cucurbita, Lily.

Pentacarpellary - five carpels.

E.g, Hibiscus.

Multicarpellary - many carpels.

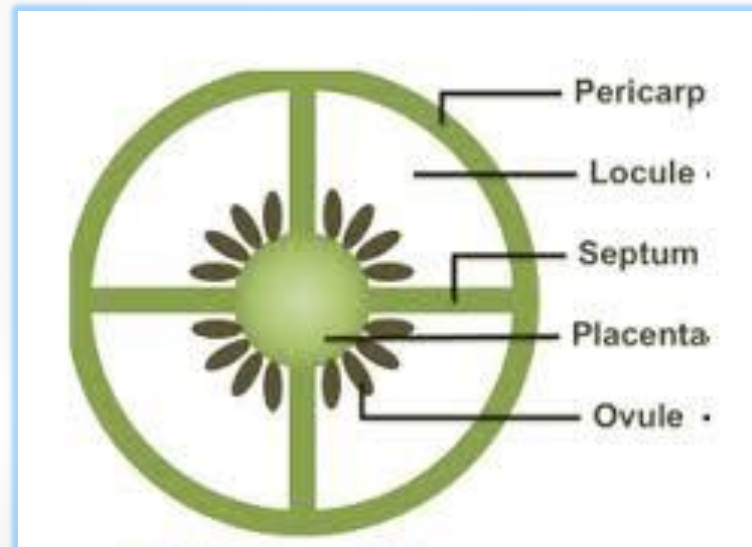
E.g, Papaver.

Gynoecium

- ☐ A polycarpellary pistil may be apocarpous or syncarpous.
- ☐ The free condition of the carpel is termed as apocarpous (eg., rose).
- ☐ The united condition of the carpel is known as syncarpous (eg., coconut, brinjal and hibiscus).

Gynoecium

- ❑ Ovary is the basal swollen part of the pistil.
- ❑ It has an ovarian cavity with one or more chambers or locules.
- ❑ The ovule is attached with parenchymatous Cushions called placenta.



Gynoecium

- ❑ An ovary may have one ovule.

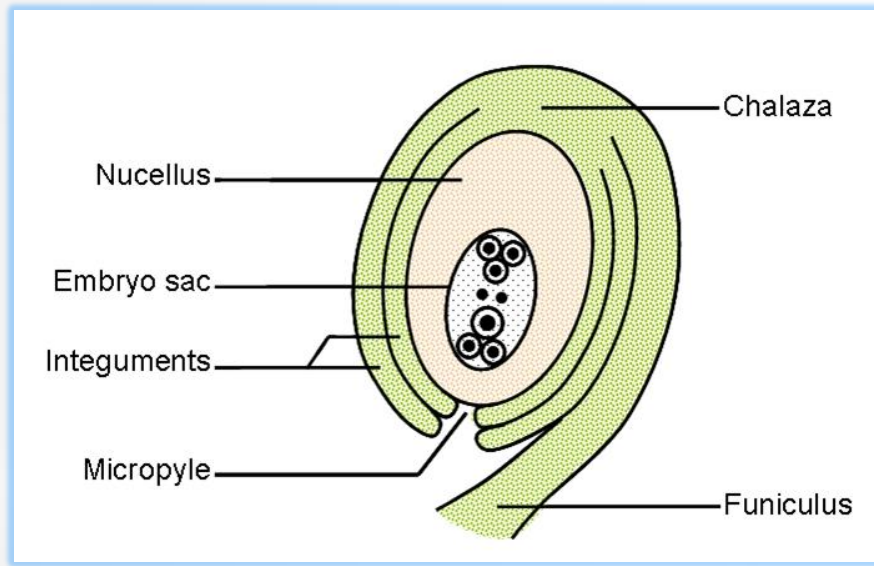
e.g. Wheat, Paddy, Mango

- ❑ It may have several ovules.

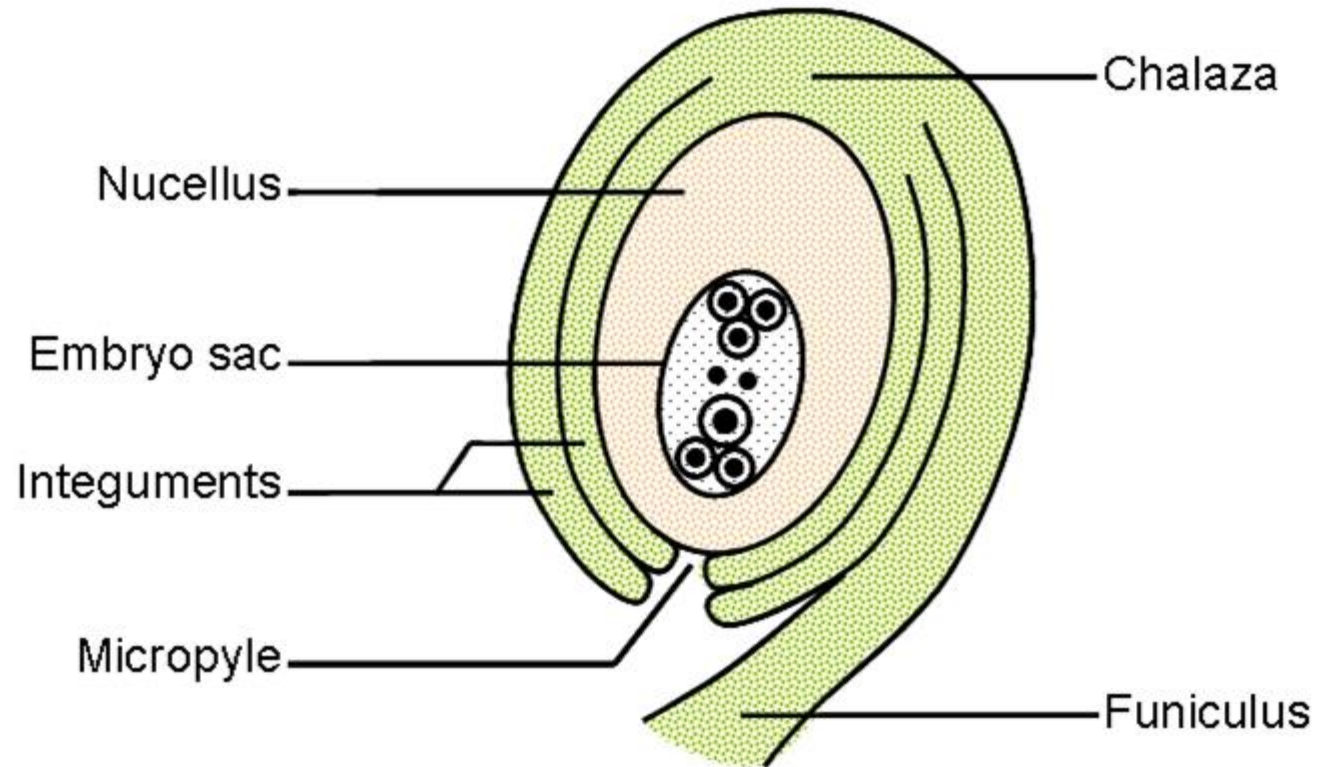
e.g. Papaya, Water Melon, Orchids.

The Megasporangium (Ovule)

- ❑ Ovule occurs inside ovary and is attached to placenta, by means of stalk called funicle.
- ❑ It fuses with ovule at the point known as hilum.



Structure of Ovule

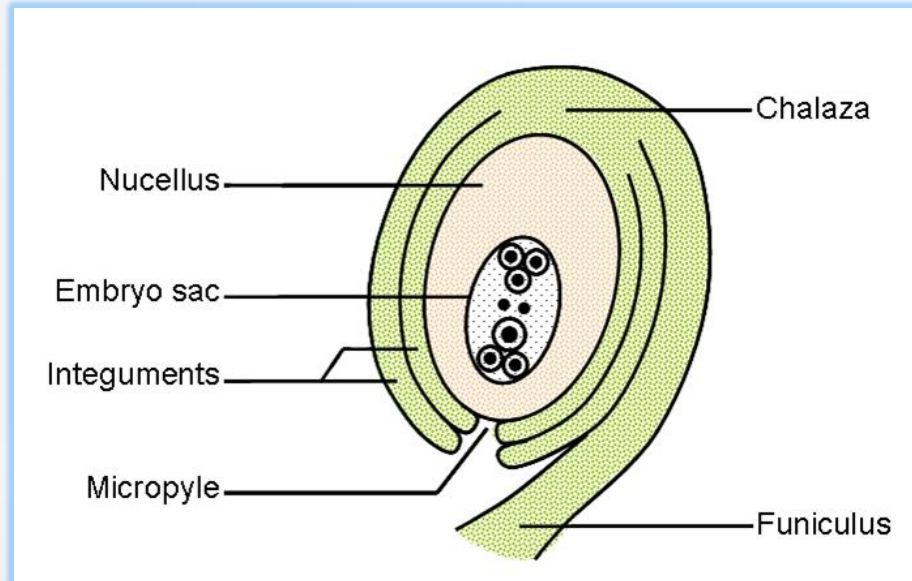


Structure of Ovule

- ☐ **Ovule is an integumented megasporangium and develops into seed after fertilisation.**
- ☐ **An angiosperm ovule occurs inside the ovary.**
- ☐ **it is attached to a parenchymatous cushion called placenta.**

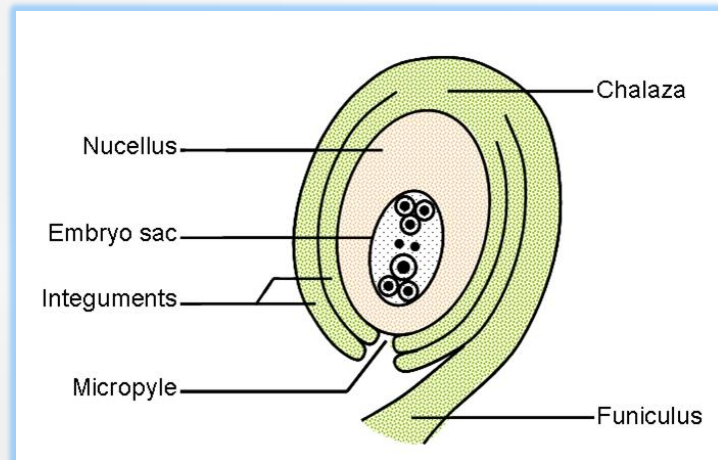
Structure of Ovule

- ❑ Ovules may be single or many.
- ❑ The stalk of the ovule is called funiculus or funicle.
- ❑ The point of attachment of the ovule with the funiculus is known as hilum.



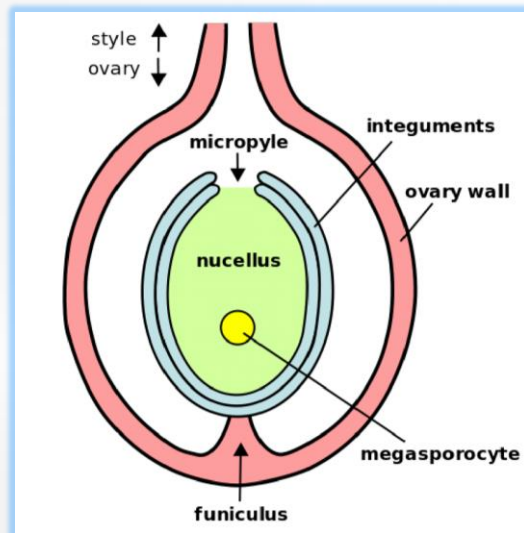
Types of Ovule

- ❑ In the typical (anatropous) ovule the funiculus is fused with body of the ovule lengthwise beyond the hilum.
- ❑ It gives rise to a longitudinal ridge called raphe.
- ❑ Funiculus contains a vascular strand for the supply of nourishment to the ovule.



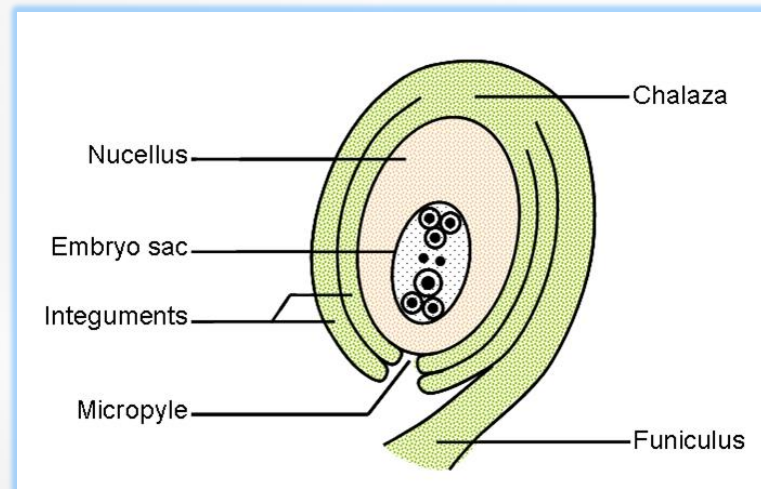
Structure of Ovule

- ❑ The body of the ovule consists of a mass of parenchymatous cells named nucellus.
- ❑ It is equivalent to megasporangium.



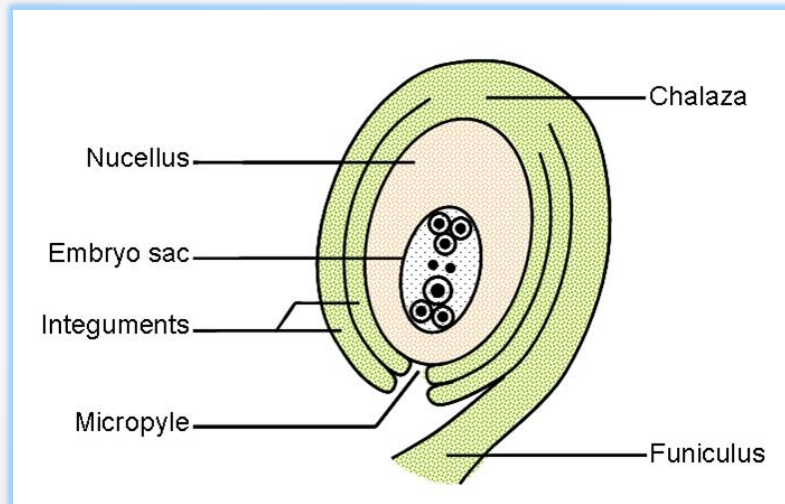
Structure of Ovule

- ❑ The end of integuments have a narrow pore passage.
- ❑ It is known as micropyle.



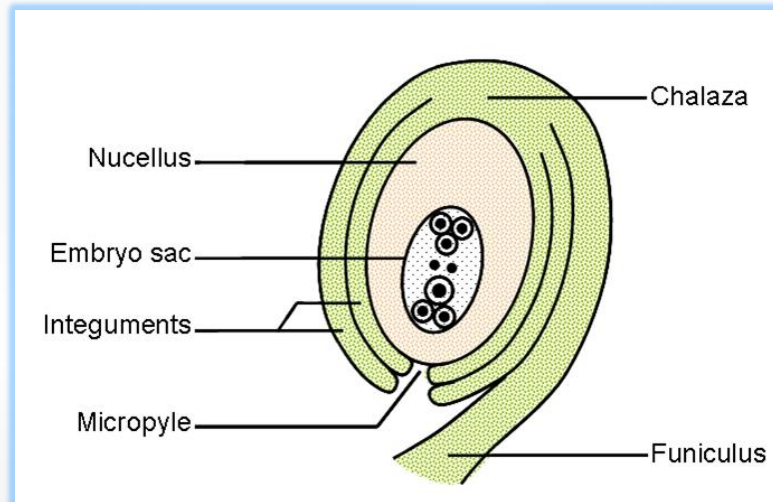
Structure of Ovule

- ❑ The place of origin of the integuments usually lies at the opposite end.
- ❑ It is termed as chalaza.
- ❑ Female gametophyte or embryo sac is embedded in the micropyle half of the nucellus,



Development of Ovule

- ❑ Ovule develops as primordium of nucellus over placenta.
- ❑ Initials of integuments develop from the base of ovule.
- ❑ Integuments grows to surround the nucellus on all sides except at the tip or micropylar region.



Development of Ovule

- ☐ In the hypodermal region of nucellus towards the micropyle end develops a primary archesporial cell.
- ☐ It grows in size and develops a prominent nucleus.

Development of Ovule

- ☐ **The archesporial cell often divides once into outer primary parietal or wall cell and inner primary sporogenous cell.**
- ☐ **Primary parietal cell may divide one or more times.**

Development of Ovule

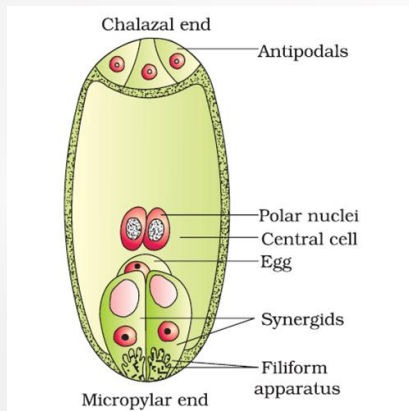
- ☐ The primary sporogenous cell commonly functions directly as diploid megaspore mother cell or megasporocyte.
- ☐ The megaspore mother cell (MMC) undergoes meiosis and forms a linear tetrad of 4 haploid megaspores.

Megasporogenesis

- ☐ **The process of meiotic formation of haploid megaspores from diploid megaspore mother cell is called megasporogenesis.**
- ☐ **Commonly the chalazal megaspore remains functional while the other 3 degenerate.**

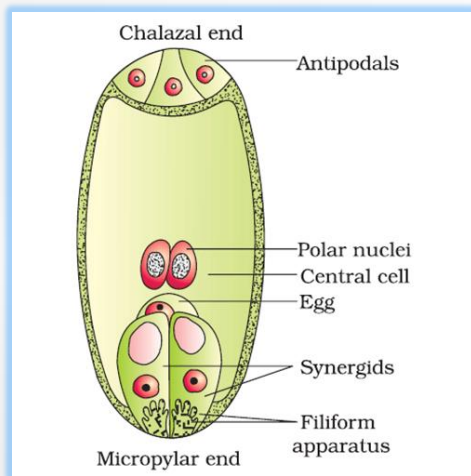
Embryo Sac Formation

- ❑ The two nuclei shift to the two ends and divide there twice forming four nucleate and then eight nucleate structure.
- ❑ One nucleus from each side moves to the middle, they are called polar nuclei.
- ❑ The remaining three nuclei form cells at the two ends, 3 celled egg apparatus at the Micropylar end and three antipodal cells at the chalaza end



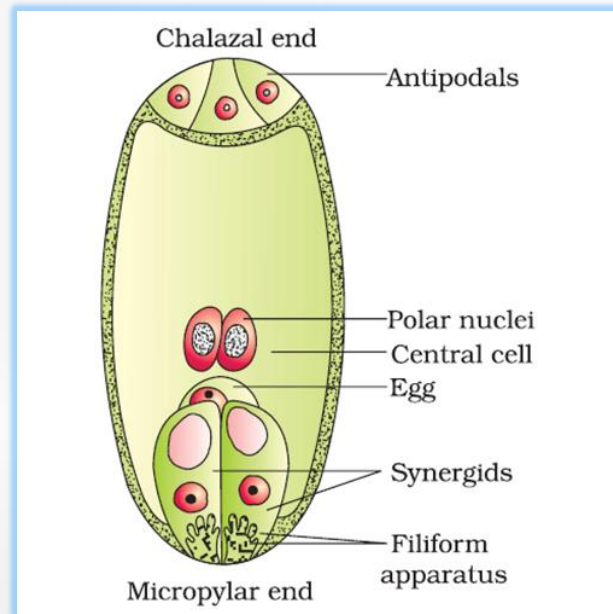
Embryo Sac Formation

- ❑ The middle binucleate part organises itself into central cell.
- ❑ Embryo sac developed from a single megaspore is called monosporic.
- ❑ Bisporic and tetrasporic embryo sacs have two and four megaspore precursors involved in the formation of embryo sac.



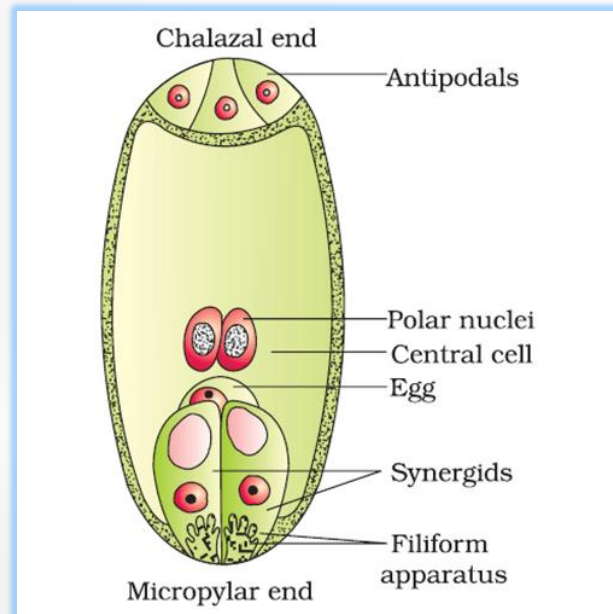
Embryo Sac

- ❑ Three cells are grouped together at the micropylar end to form the egg apparatus, consisting of two synergids and an egg cell.
- ❑ Three cells are grouped together at the chalazal end; they are called antipodal cells.



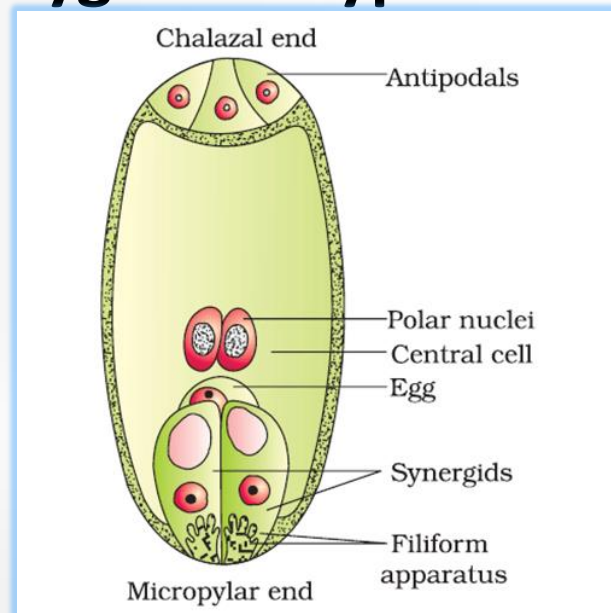
Embryo Sac

- ❑ The remaining two nuclei are called polar nuclei; they move to the centre of the embryo sac (now called central cell) and fuse to form a diploid secondary nucleus.
- ❑ Thus, a typical angiosperm embryo sac is 8-nucleate and 7-celled.



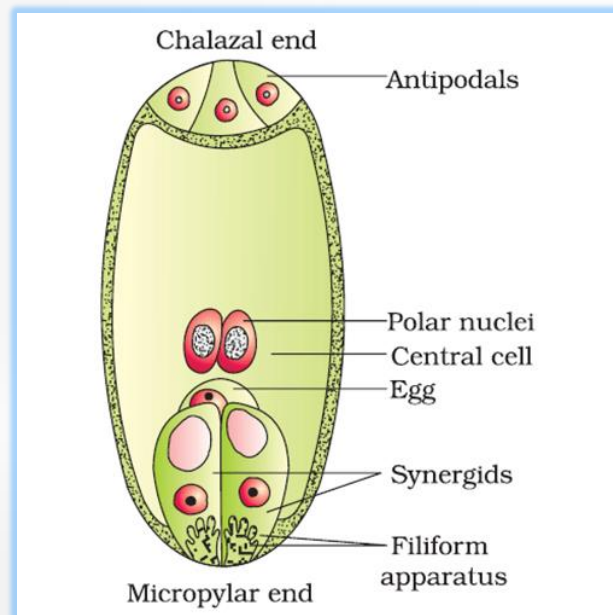
Embryo Sac

- ❑ The embryo sac is covered over by a thin membrane derived from the parent megaspore wall.
- ❑ The typical most common type of embryo sac, found in 80% flowering plants is called polygonum type embryo sac.



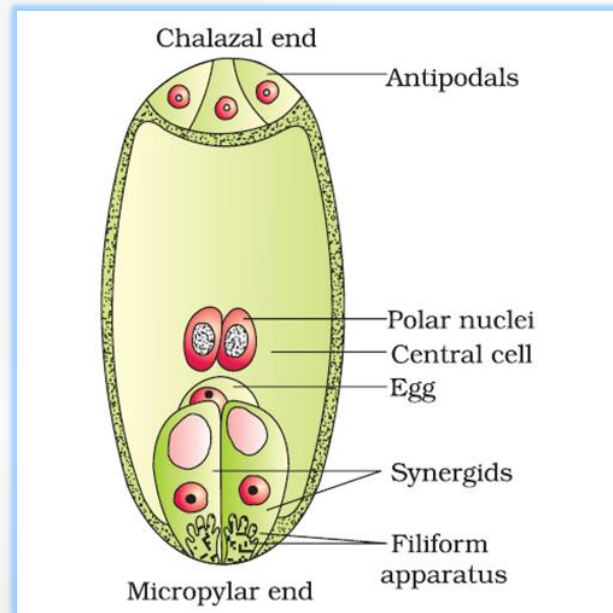
Structure of Embryo sac

- ❑ The three micropylar cells are collectively known as egg apparatus equivalent to one archegonium.
- ❑ They are pyriform in outline and are arranged in a triangular fashion.



Structure of Embryo sac

- ❑ The three cells of egg apparatus have conspicuous common walls towards micropylar half.
- ❑ They separate and become thin towards the central cell.

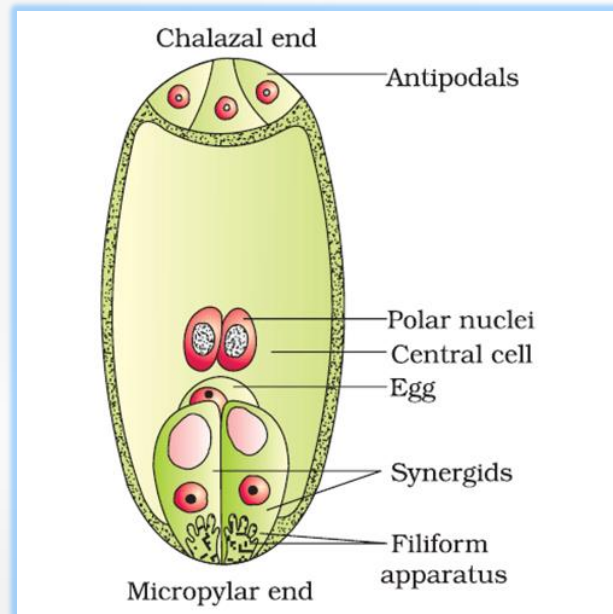


Structure of Embryo sac

- ☐ One middle cell is larger and is called egg or oosphere.
- ☐ It has a central or micropylar vacuole and a nucleus towards the chalazal end.
- ☐ A filiform apparatus may or may not be present.
- ☐ The remaining two cells are called synergids, cooperative cells or help cells.
- ☐ A filiform apparatus of finger like projections of the wall into the cytoplasm.

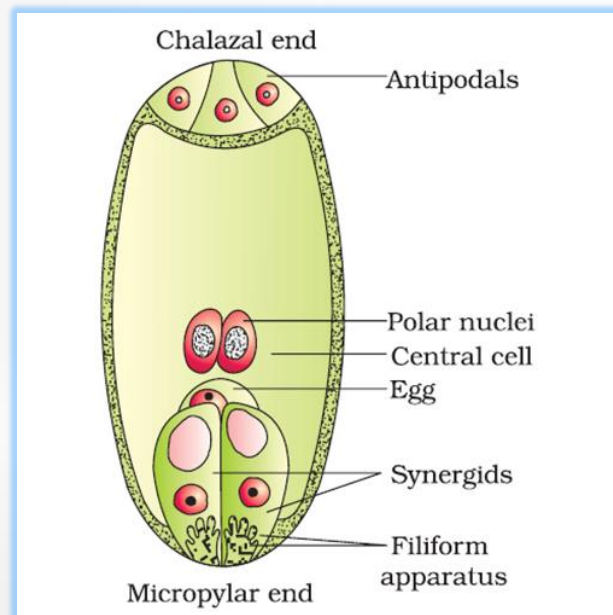
Structure of Embryo sac

- ❑ All the three cells of the egg apparatus communicate with one another and to the central cell by plasmodesmata.
- ❑ The egg or oosphere represents the single female gamete of the embryo sac.



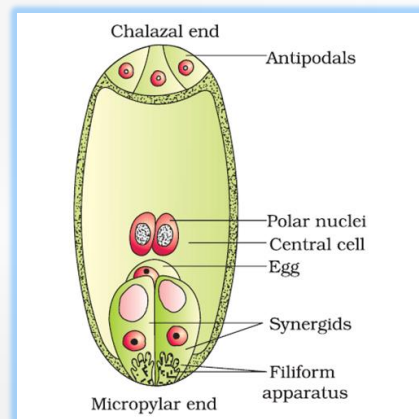
Structure of Embryo sac

- ❑ The synergids help on obtaining nourishment from the outer cells, guide the path of pollen tube by their secretion and function as shock absorbers during the penetration of pollen tube into the embryo sac.



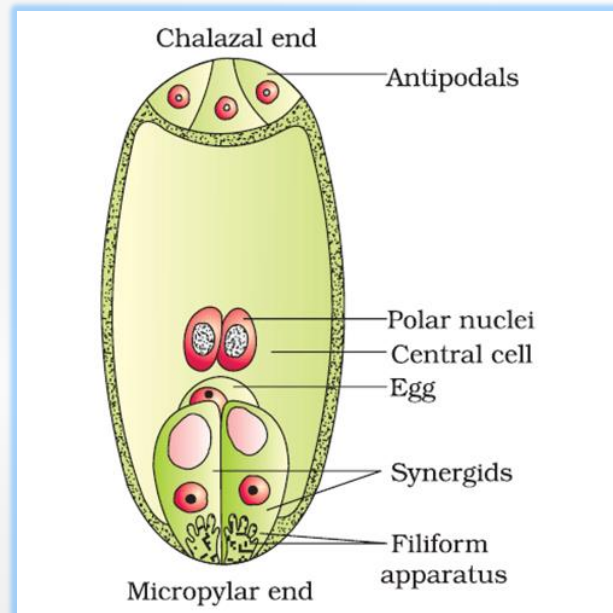
Structure of Embryo sac

- ❑ The three chalazal cells of the embryo sac are called antipodal cells.
- ❑ They are the vegetative cells of the embryo sac which may degenerate soon or take part in absorbing nourishment from the surrounding nucellar cells.
- ❑ Internally they are connected with the central cells by means of plasmodesmata.



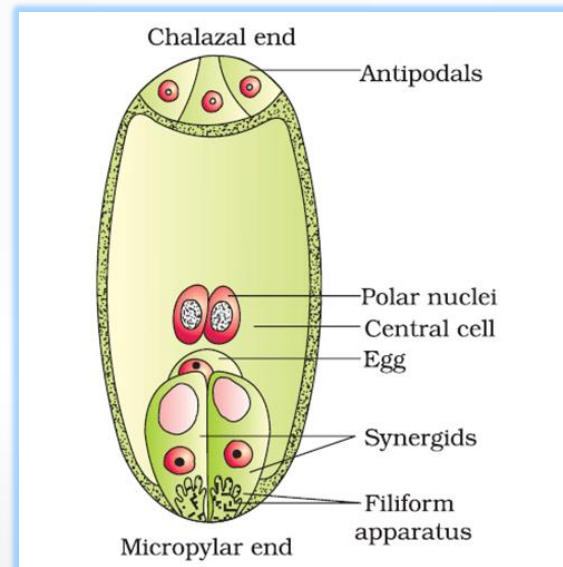
Structure of Embryo sac

- ❑ The central cell is the largest cell of the embryo sac.
- ❑ It has a highly vacuolated cytoplasm which is rich in reserve food and Golgi bodies,
- ❑ In the middle of the cell contains two polar nuclei which are large nucleoli.



Structure of Embryo sac

- ❑ The polar nuclei often fuse to form a single diploid secondary or fusion or definitive nucleus.
- ❑ Thus all the cells of the embryo sac are haploid except the central cell which is first binucleate and then becomes diploid due to fusion of polar nuclei.



Example

Pollen grains can be stored for several years in liquid nitrogen having a temperature of

- (a) -120°C (b) -80°C
(c) -196°C (d) -160°C . (NEET 2018)

Example

Which is the most common type of embryo sac in angiosperms ?

- (a) Tetrasporic with one mitotic stage of divisions**
 - (b) Monosporic with three sequential mitotic divisions**
 - (c) Monosporic with two sequential mitotic divisions**
 - (d) Bisporic with two sequential mitotic divisions**
- (Odisha NEET 2019)**

Example

In majority of angiosperms,

(NEET-II 2016)

- (a) egg has a filiform apparatus**
- (b) there are numerous antipodal cells**
- (c) reduction division occurs in the megaspore mother cells**
- (d) a small central cell is present in that embryo sac.**

Example

The ovule of an angiosperm is technically equivalent to
(NEET-II 2016)

- (a) megasporangium
- (b) megasporophyll
- (c) megaspore mother cell
- (d) megaspore. (NEET-II 2016)

Example

Which one of the following statements is not true?

(NEET-I 2016)

- (a) Pollen grains of many species cause severe allergies.
- (b) Stored pollen in liquid nitrogen can be used in the crop breeding programmes.
- (c) Tapetum helps in the dehiscence of anther.
- (d) Exine of pollen grains is made up of sporopollenin.

Example

In angiosperms, microsporogenesis and megasporogenesis
(2015)

- (a) involve meiosis**
- (b) occur in ovule**
- (c) occur in anther**
- (d) form gametes without further divisions.**

Example

Male gametophyte in angiosperms produces

(2015)

- (a) single sperm and two vegetative cells**
- (b) three sperms**
- (c) two sperms and a vegetative cell**
- (d) single sperm and a vegetative cell.**

Example

Function of filiform apparatus is to
(2014)

- (a) recognise the suitable pollen at stigma**
- (b) stimulate division of generative cell**
- (c) produce nectar**
- (d) guide the entry of pollen tube.**

Example

Which one of the following pairs of plant structures has haploid number of chromosomes? (2008)

- (a) Nucellus and antipodal cells
- (b) Egg nucleus and secondary nucleus
- (c) Megaspore mother cell and antipodal cells
- (d) Egg cell and antipodal cells

Example

In angiosperm, all the four microspores of tetrad are covered by a layer which is formed by

- (a) pectocellulose (b) callose**
- (c) cellulose (d) sporopollenin.**

Add slide