Megasporogenesis

DSE-2
UNIT-3

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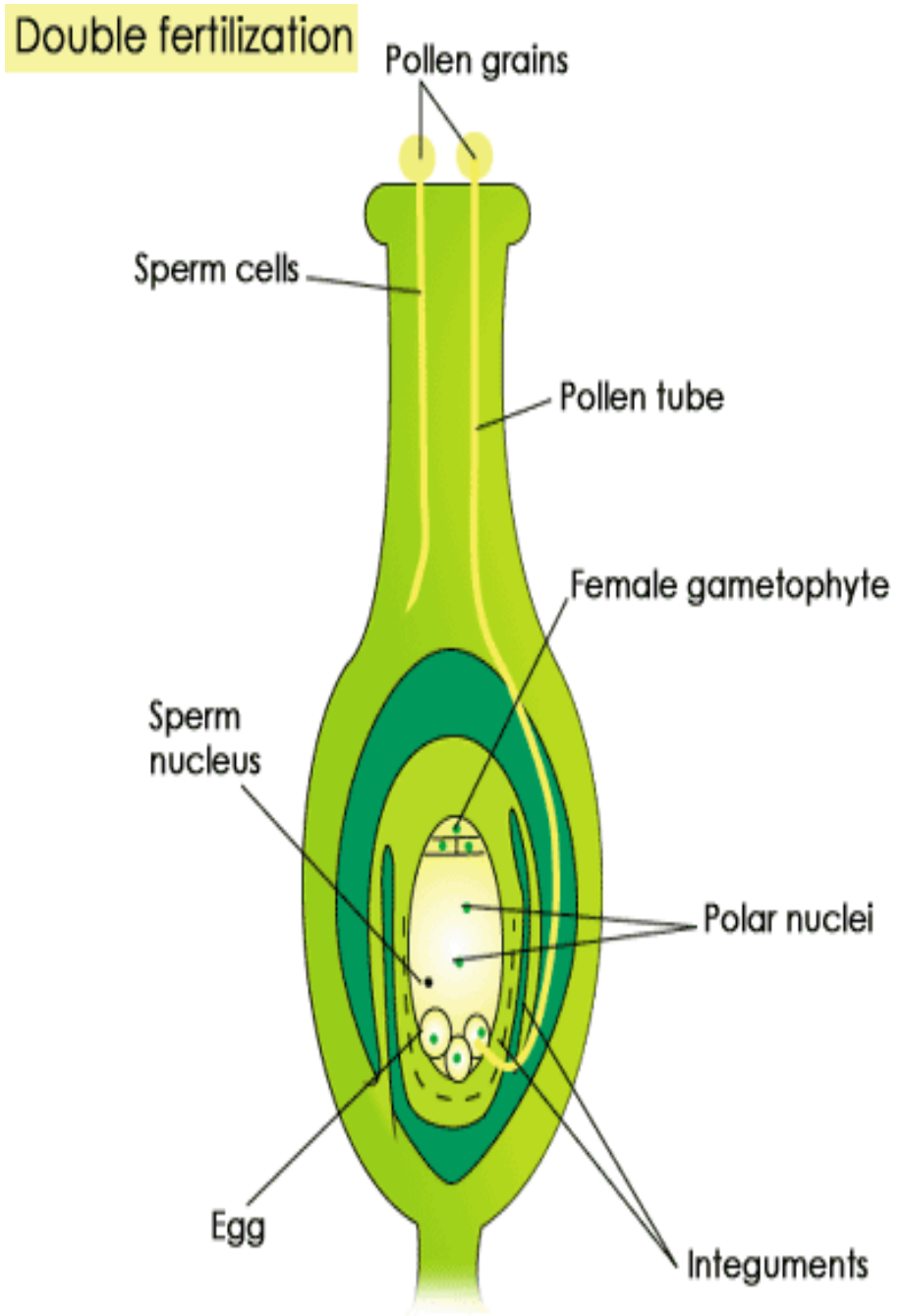
Introduction

- Ovule produces megaspore mother cell
- Megaspore mother cell produces megaspores (female spores) via meiosis

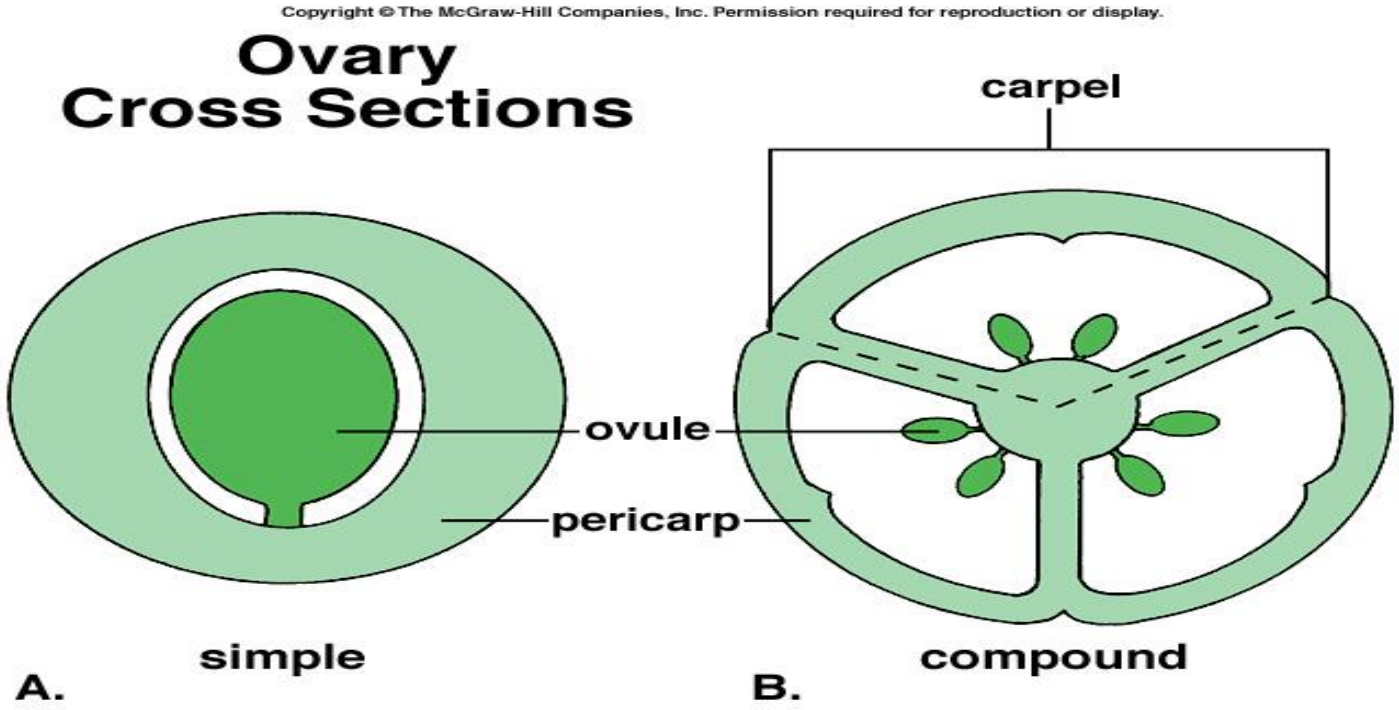
Pistil

- **Pistil- female reproductive part of flower.**
- **It may be mono or bi or tri or polycarpellary, syncarpous or apocarpous.**
- **Each pistil consists of ovary, style and stigma.**



Ovary and Ovule

- The ovary has one or more cavities called locules.
- Placenta in locules bears ovules.
- Number of ovules may be one or more.



Ovary and Ovule

Development of Ovule (Megasporangium):

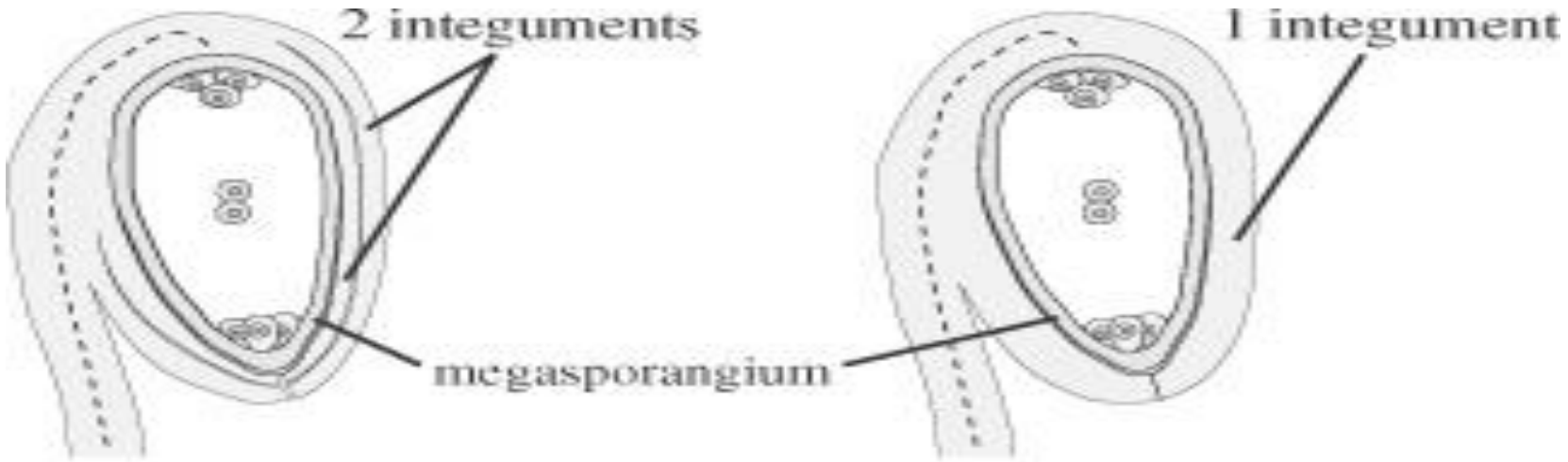
(a) Ovule arises as a small mound of homogenous tissue on the inner wall of the ovary (placenta).

(b) This mound develops to form the inner central part of the ovule, called nucellus.

(c) Integumentary' processes arise close to the base of this mound, which forms outer covering of the ovule.

Ovule

- The short stalk which attach ovule with placenta is funicle.
- The primordium grows into a mass of cells forming nucellus, the body of ovule.
- The two protective covering of nucellus is integuments, except at the tip leaving a small opening called Micropyle.



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Ovule

- Basal part of ovule is called chalaza that lie opposite to micropyle.
- Cells of nucellus are rich in reserve food.
- One of the nucellar cell in the micropylar region is differentiated into megaspore mother cell.

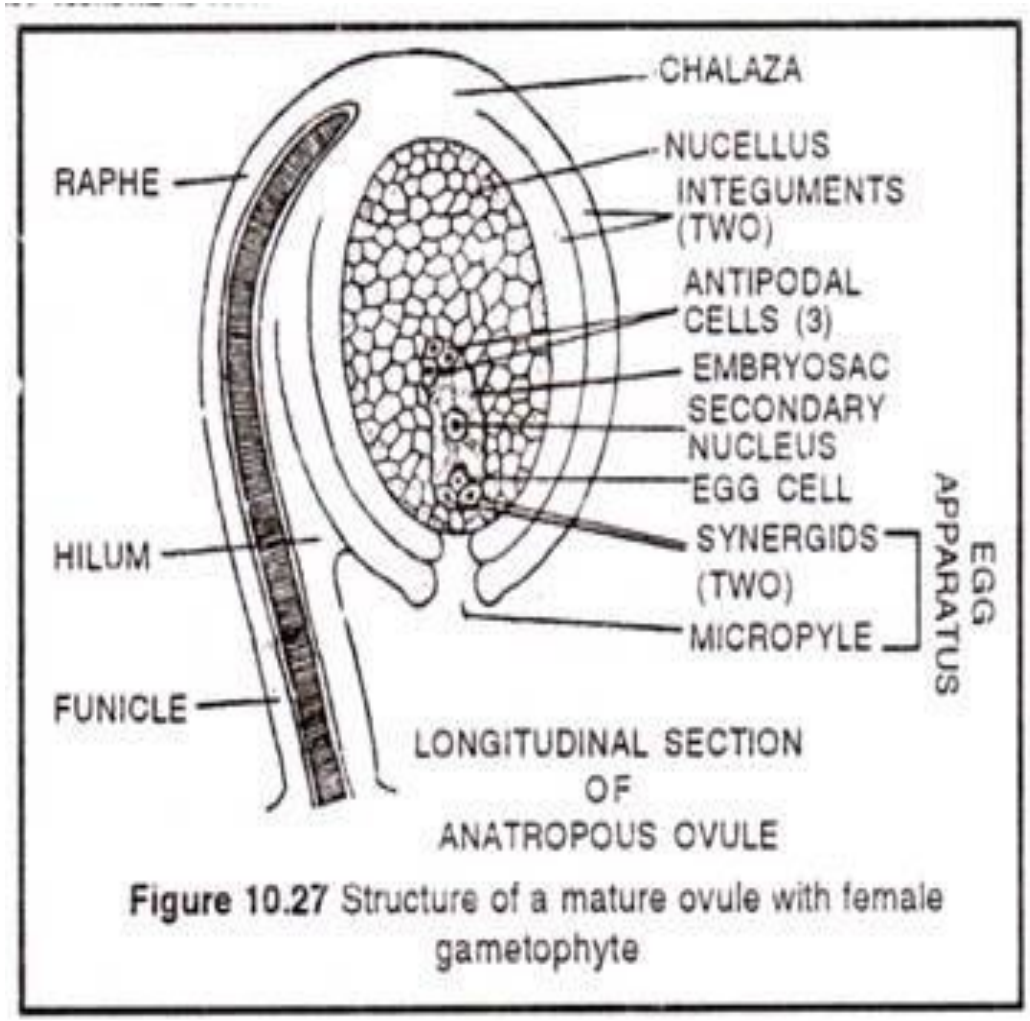


Figure 10.27 Structure of a mature ovule with female gametophyte

Ovule

- The cell is larger, contains dense cytoplasm and a prominent nucleus.
- It undergoes meiosis forming 4 haploid cells called megaspore tetrad.
- 3 megaspores degenerate and only one megaspore become functional.
- In mature ovules, the female gametophyte or embryo sac is present in the centre. The embryosac consists of egg cell (female gamete), synergid cells, antipodal cells and polar nuclei, (this is described a little later).

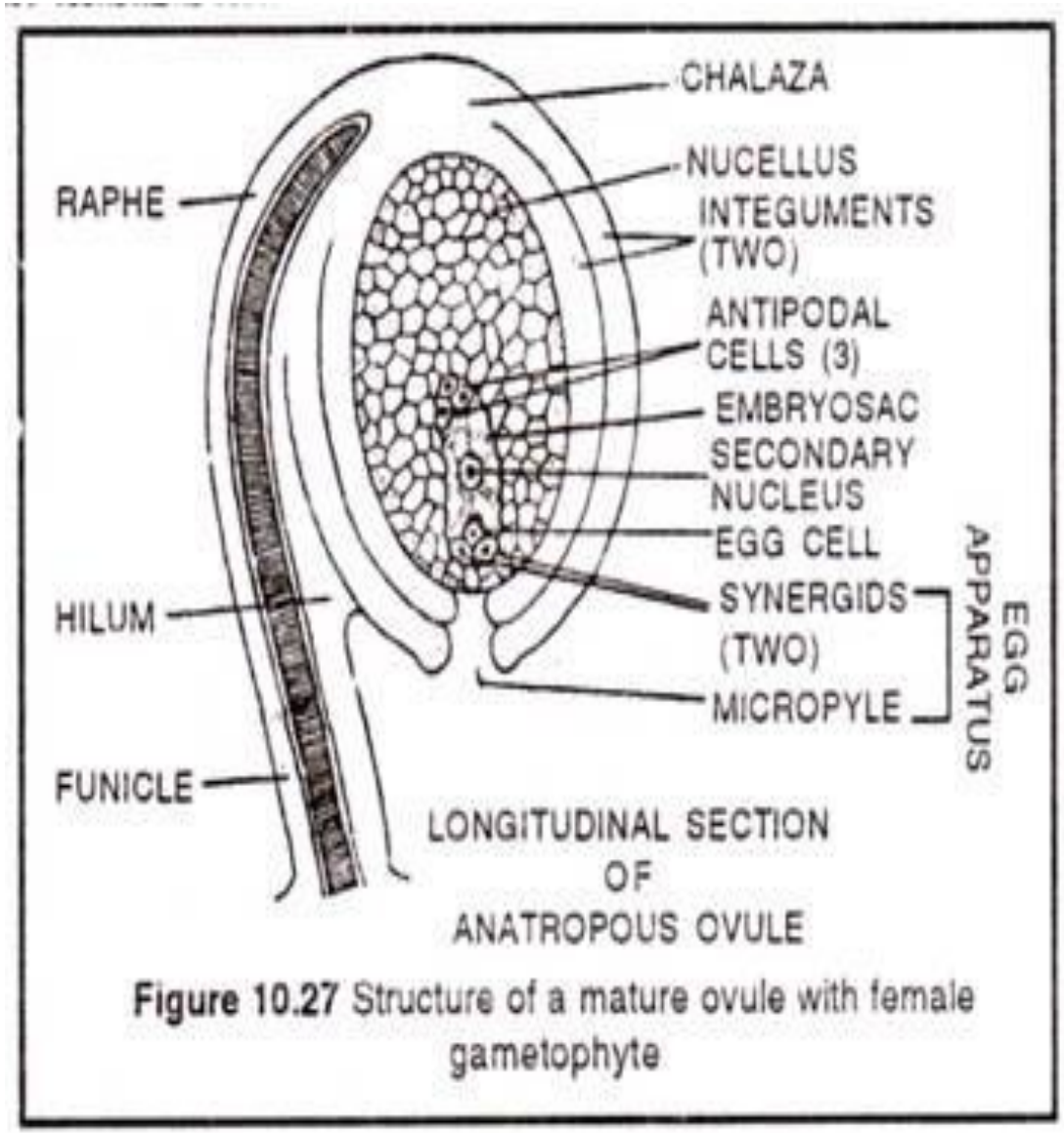


Figure 10.27 Structure of a mature ovule with female gametophyte

Functions of Ovules

The ovule plays a vital role in sexual reproduction.

Once a pollen grain lands on the stigma of a flower of its same species, it sends out a pollen tube down through the style.

This tube then enters the ovary and reaches the ovule of the plant.

Once that occurs, fertilization can arise as the nucleus of the pollen grain is sent down the tube to merge with the nucleus in the embryo sac.

Types of Ovules

Types of Ovules

On the basis of position of micropyle, with respect to the funiculus, ovules are 6 types:

1. Orthotropous ovule
2. Anatropous ovule
3. Hemianatropous or hemitropous ovule
4. Campylotropous ovule
5. Amphitropus ovule
6. Circinotropous ovule

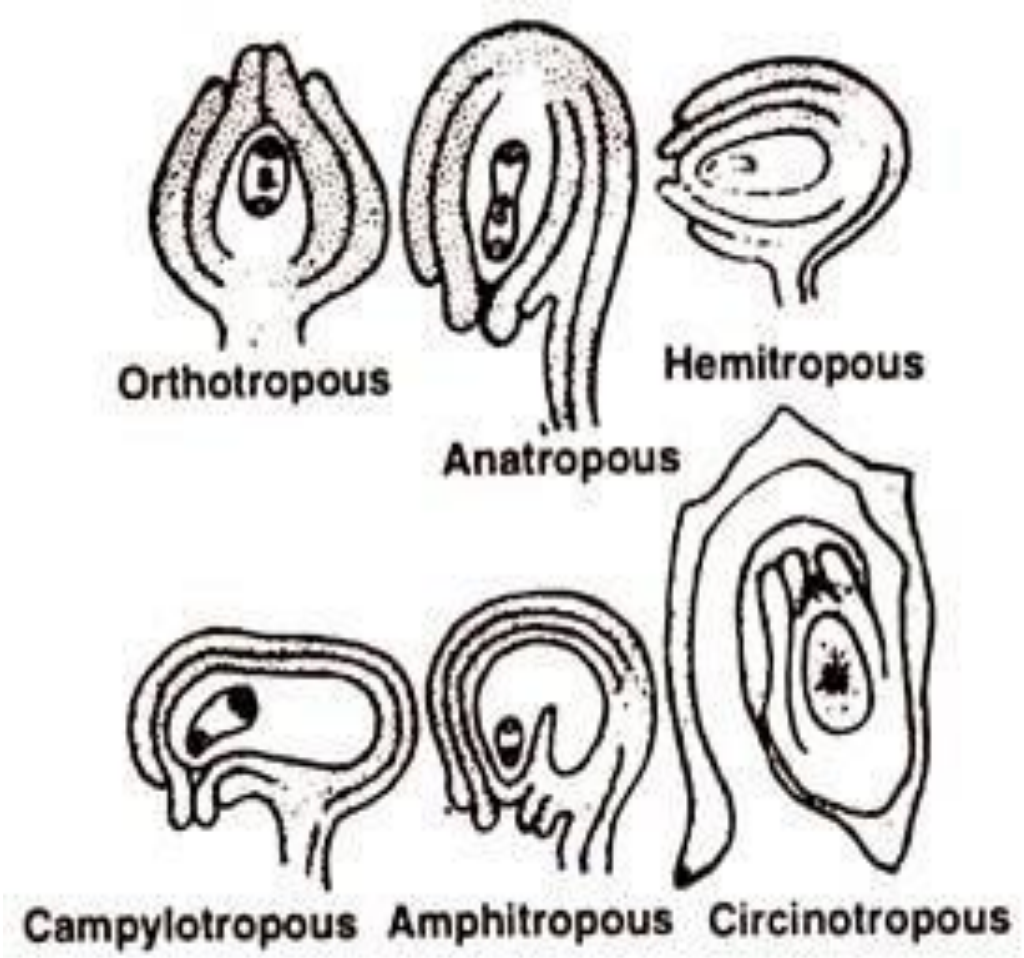


Fig. 60. Kinds of ovules

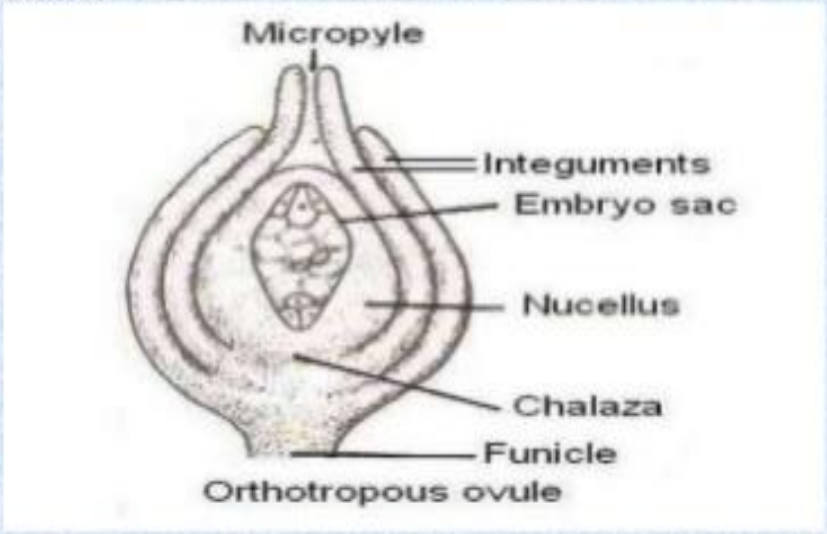
Types of Ovules

1. Orthotropous ovule:

It is atropous or straight, where the micropyle, chalaza and the funiculus, all are in the same line. Ex- Cycas, Family Polygonaceae and Piperaceae.

(1) Orthotropous Or Straight

- In this type the Ovule is erect or straight so that the funicle, chalaza, micropyle lie one and the same vertical line, as in members of polygonaceae and piperaceae.



Types of Ovules

2. Anatropous ovule:

It is of the most common occurrence more than 80% of angiosperm family). In this ovule, the funicle is long whole body of the ovule is inverted, through 180°. As a result the micropyle comes close to the funicle. Ex-Most common in dicots and monocots, Ex Asteraceae, Solanaceae.

(2) Anatropous Or Inverted

- In this type the Ovule bends along the funicle so that the micropyle lies close to the hilum. The chalaza lies at the other end. This is the commonest type of Ovule found both in monocots and dicots.

Diagrammatic view of a typical anatropous ovule

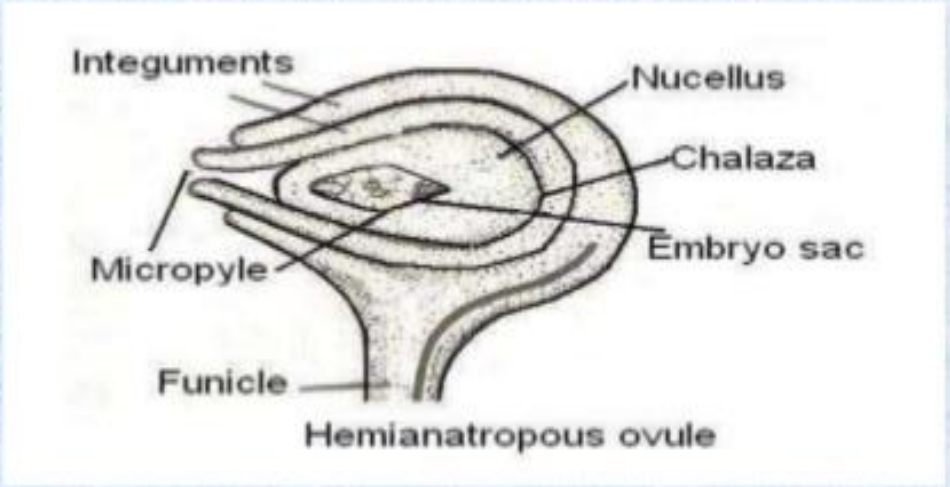
Types of Ovules

3. Hemianatropous or hemitropous ovule:

In this case the body of the ovule is inverted only through 90°. As a result the funicle comes to lie at right angle to the nucellus. Micropyle and chalaza, lie in the same plane Ex-Ranunculus.

(3) Hemitropous Or Hemianatropous

- In this type the body of the Ovule is straight but twisted in such a way that it is placed transversely at right angle and so the chalazal , micropyle line is at right angle to the funiculus. It is found in Ranunculus.



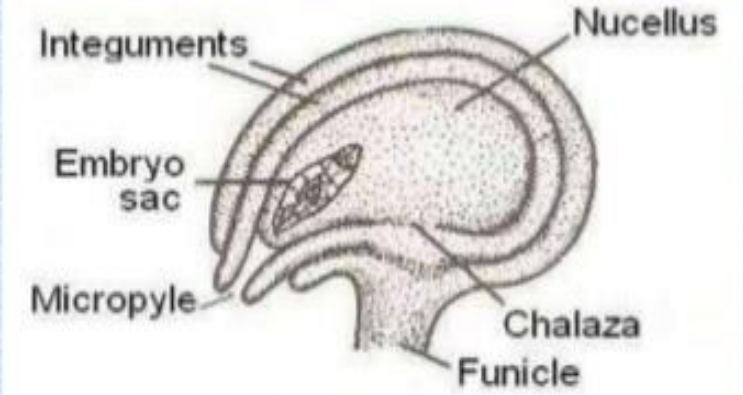
Types of Ovules

4. Campylotropous ovule:

When body of the ovule is not completely inverted, but is it bent like-'horse shoe'. The micropyle and chalaza do not lie in the same plane (however the nucellus/ embryo-sac remain straight). Ex-Family Capparidaceae, Cruciferae (Brassicaceae), Carypohyllaceae, Fabaceae etc.

(4) Campylotropous Or Curved

- In this type the transverse Ovule is bent round like a horse-shoe so that the micropyle and the chalaza do not lie in the same line, as in cappsris, Cruciferae , Mirabilis jalapa etc.



Campylotropous ovule

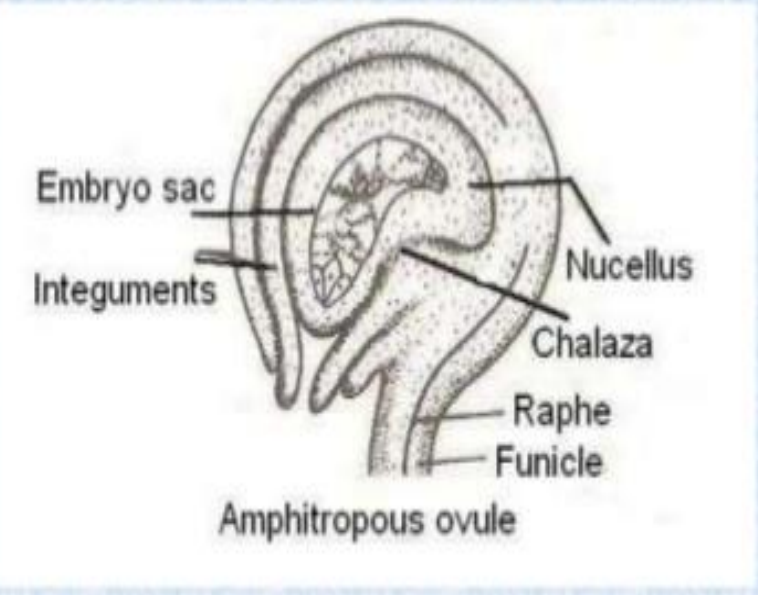
Types of Ovules

5. Amphitropus ovule:

It is similar to campylotropous, but in the case the nucellus/embryo-sac is also bent like 'horse shoe' Ex- Family Alismaceae,

(5) Amphitropous Or Transverse

- In this type the Ovule is placed transversely at a right angle to its stalk or funicle, as found in Alismeceae , Butomaceae.



Amphitropous ovule

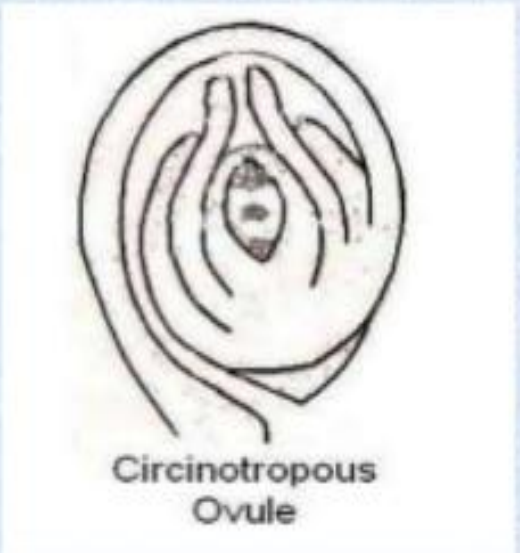
Types of Ovules

6. Circinotropous ovule:

It is of a very rare occurrence. Here the body of the ovuyle is bent through 360°, so that it takes a one complete turn. (Micropyle, chalaza and the nucellus are all in same plane). Ex-Opuntia

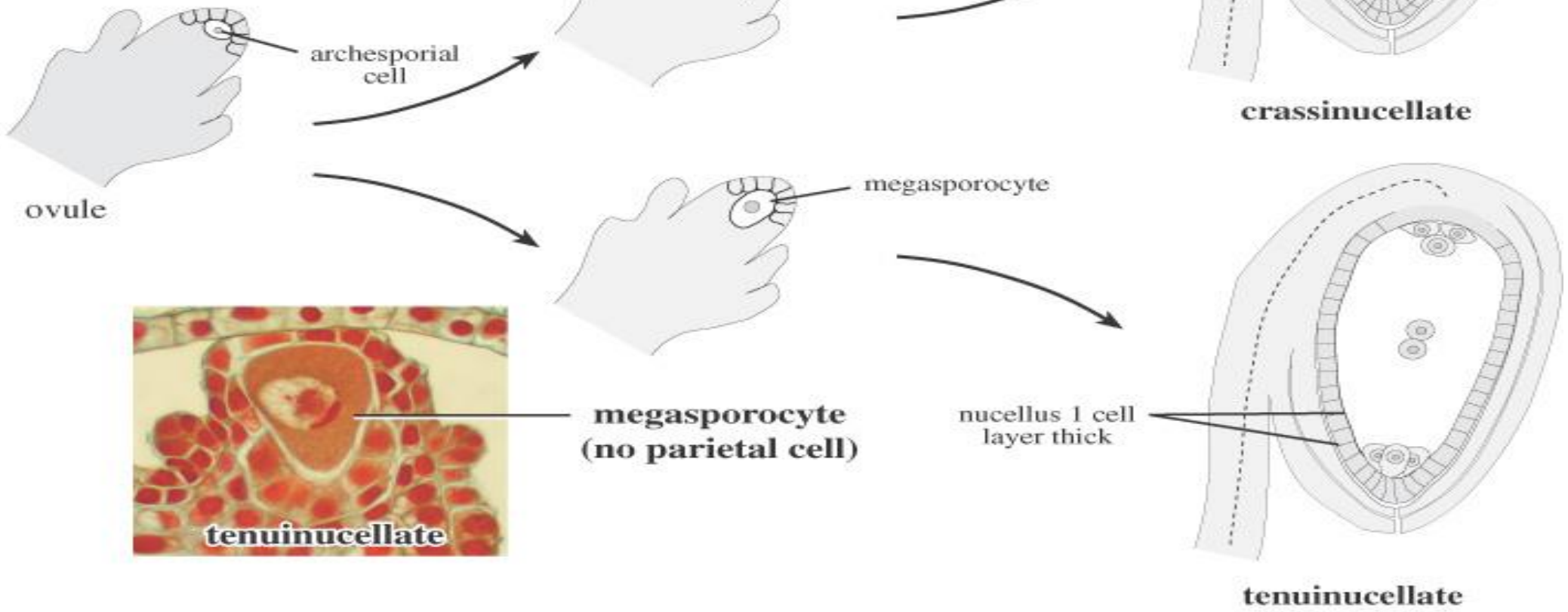
(6) Circinotropous Type

- Initially the Ovule is Orthotropous type but with continuous unilateral growth the Ovule becomes Anatropous and subsequently the micropyle again points upward in fully mature Ovule as in opuntia and plumbago.



Circinotropous Ovule

Crassinucellate and Tenuinucellate ovule



Megasporogenesis

Archesporial Initial

1. It is hypodermal in origin.
2. Archesporial initial is bigger than that of its surrounding cells.
3. A conspicuous nucleus and dense cytoplasm is present in it.
4. In its later stages, it divides into two cells forming an outer parietal cell which form the parietal tissue and inner megaspore mother cell.

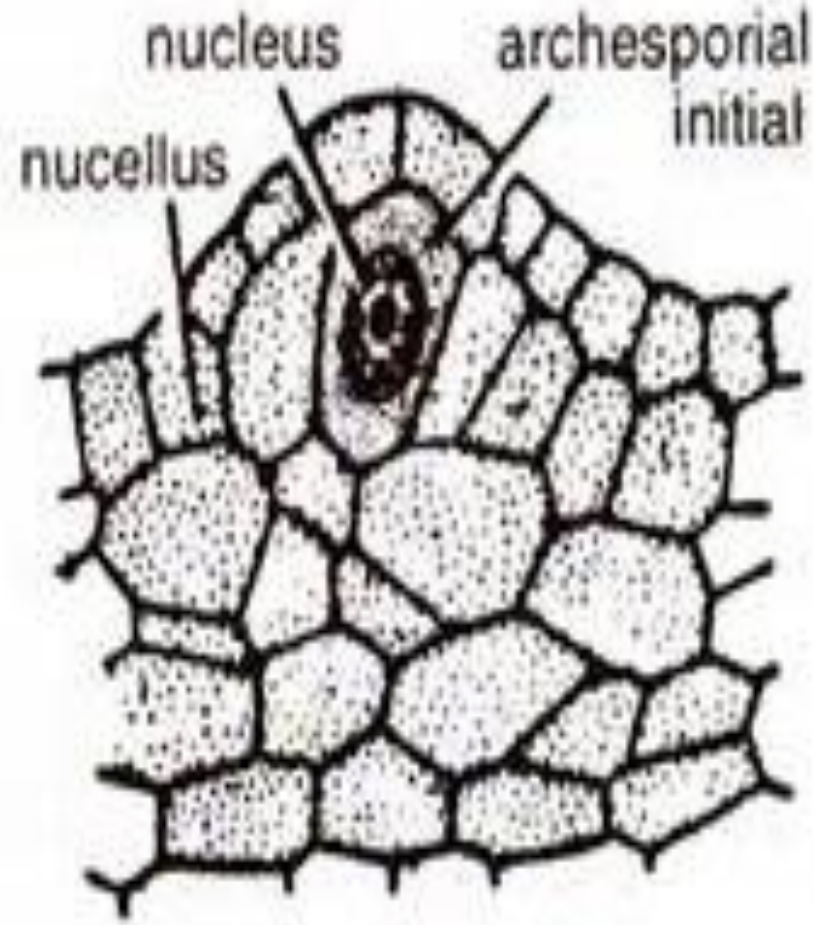


Fig. 62. An archesporial initial.

Megasporogenesis

Two-celled Megaspore Mother Cell:

1. Two cell are present one above the other.
2. These are formed after reduction division and so each cell contains haploid set of chromosomes.
3. From these two cells, tetrad is formed.

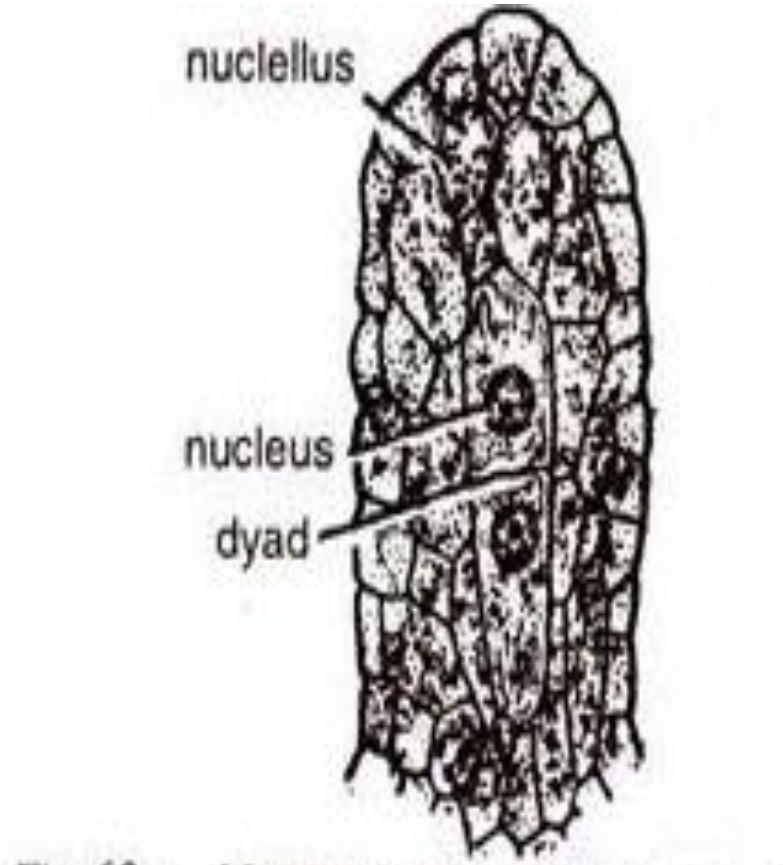


Fig. 63. Megaspore mother cell (2-celled stage)

Megasporogenesis

Linear Tetrad of Megaspores

1. Four megaspores are arranged in linear fashion.
2. These are haploid in nature.
3. Out of the four, only one remains functional which is near the chalazal end. Remaining three degenerate.
4. Functional megaspore is the First cell of the female gametophyte and develops into the embryo sac.

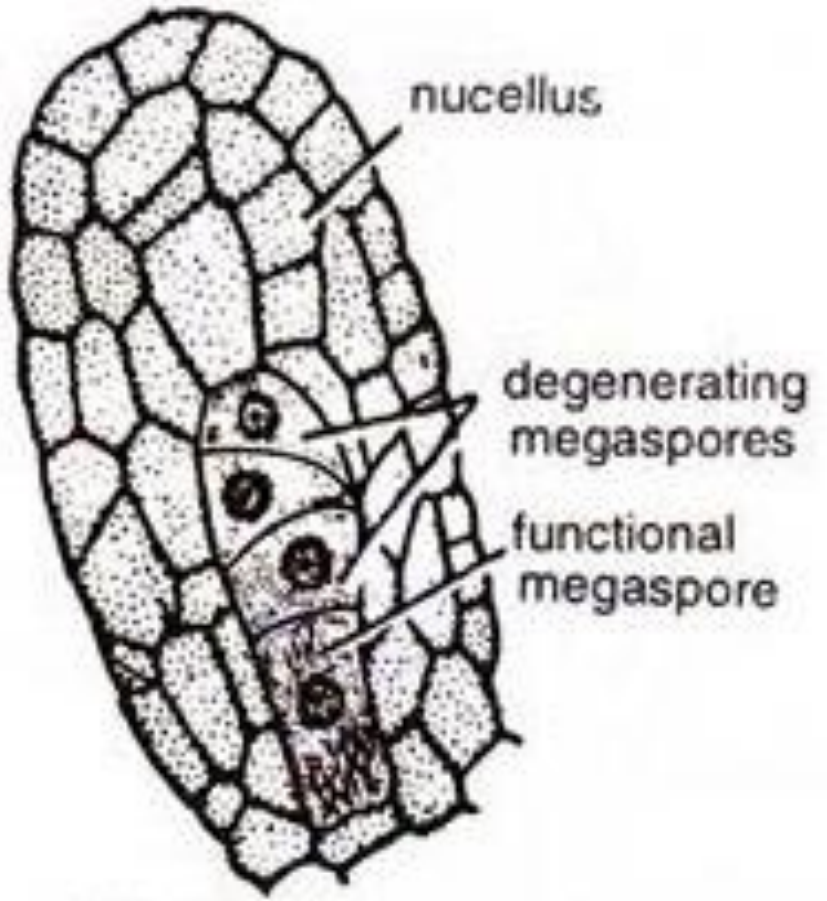


Fig. 64. Megaspore tetrad.

Megasporogenesis

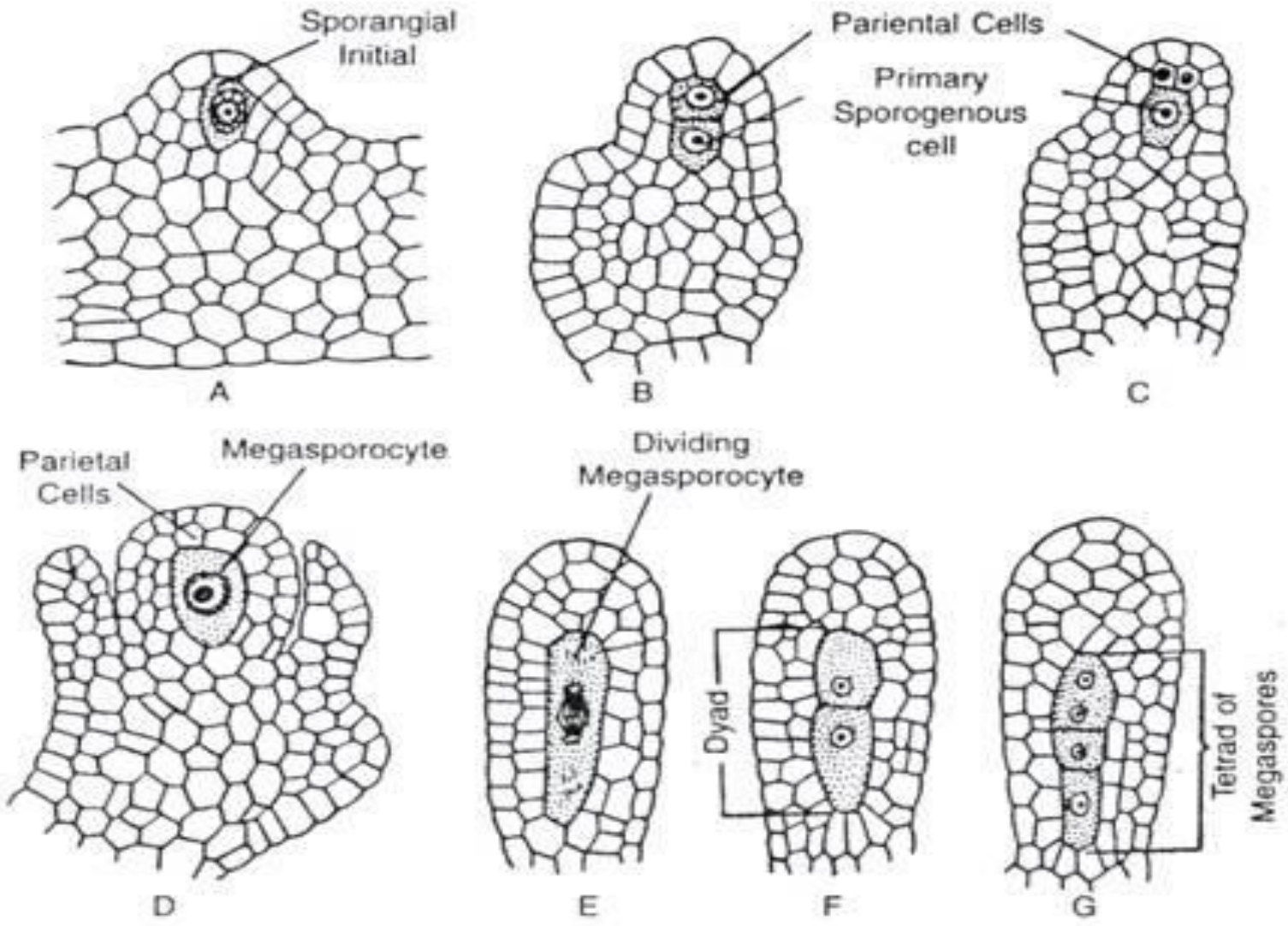
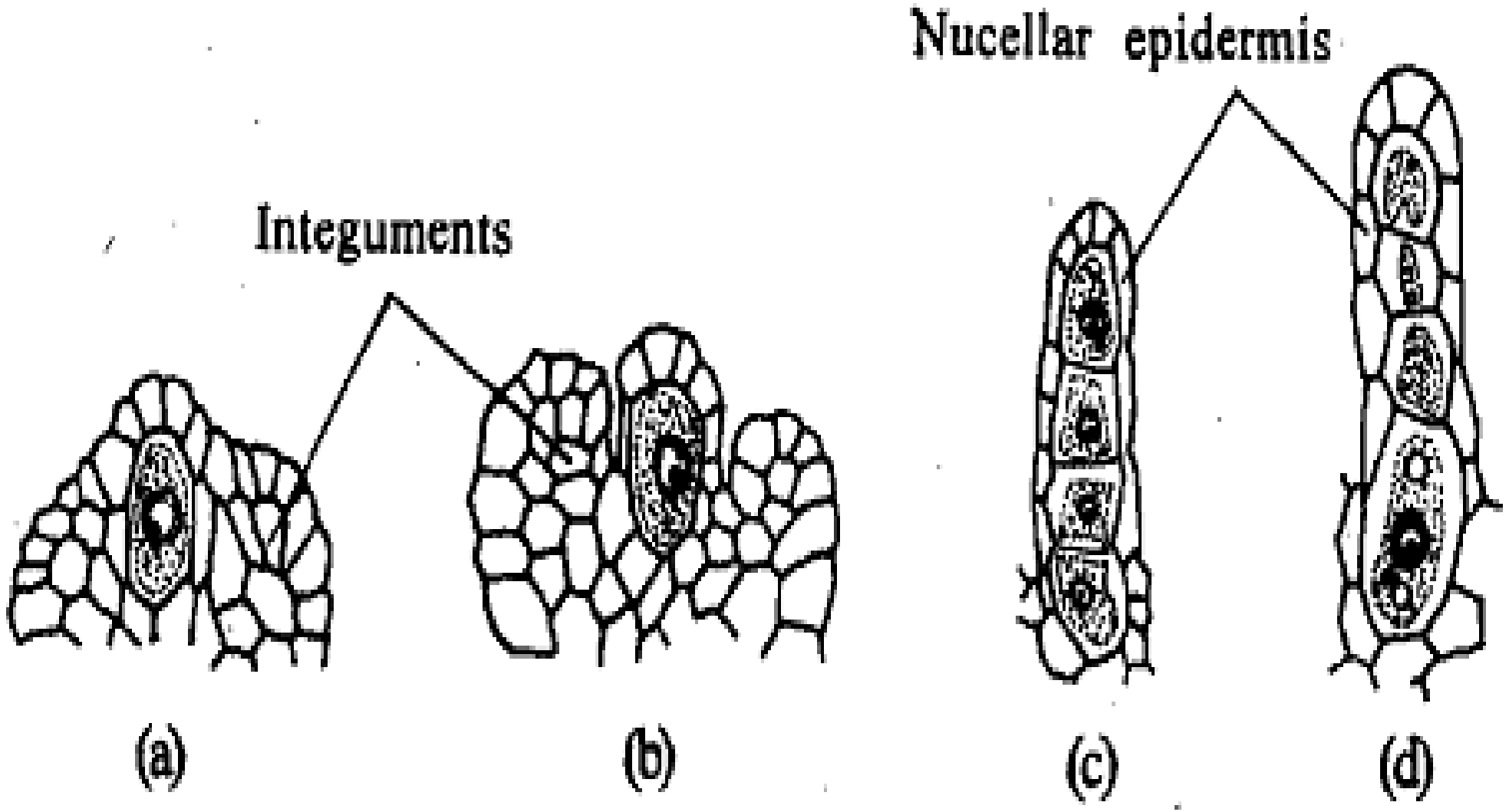
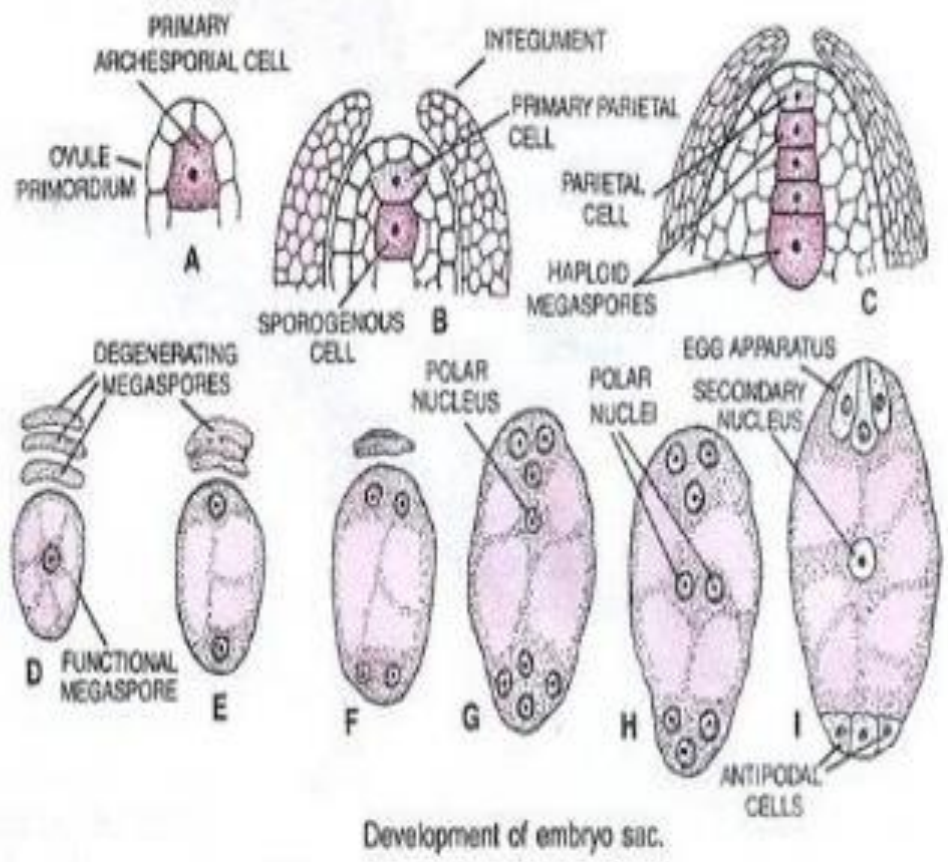


Fig. 46.15. Megasporogenesis. A, hypodermal sporangial initial; B-C, periclinal division of sporangial initial forming parietal cell D, megasporocyte being situated below the layer of wall cells; E-F, formation of dyad cells; G, linear tetrad of megaspores.

Tenuinucellate ovule



Megasporogenesis



Development of embryo sac.

- **Thus embryo sacs maintain physical contact with the parent sporophyte throughout their development, this association of the female gametophyte and the sporophyte provides an opportunity to examine interactions between cells, tissues, and genomes.**