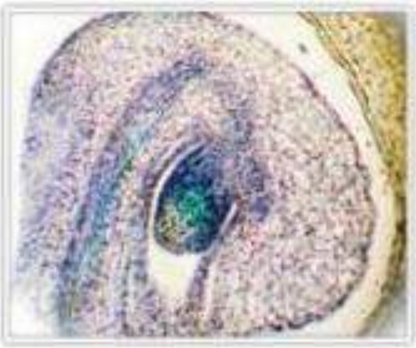
Ovule



View under microscope

Structure of an ovule

- **Structure**
- **Types**
- **Special structures**
- **Female gametophyte**
- **Mega gametogenesis**
- **Organization and ultra structure of mature embryo**

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Structure of ovule (Megasporangium)

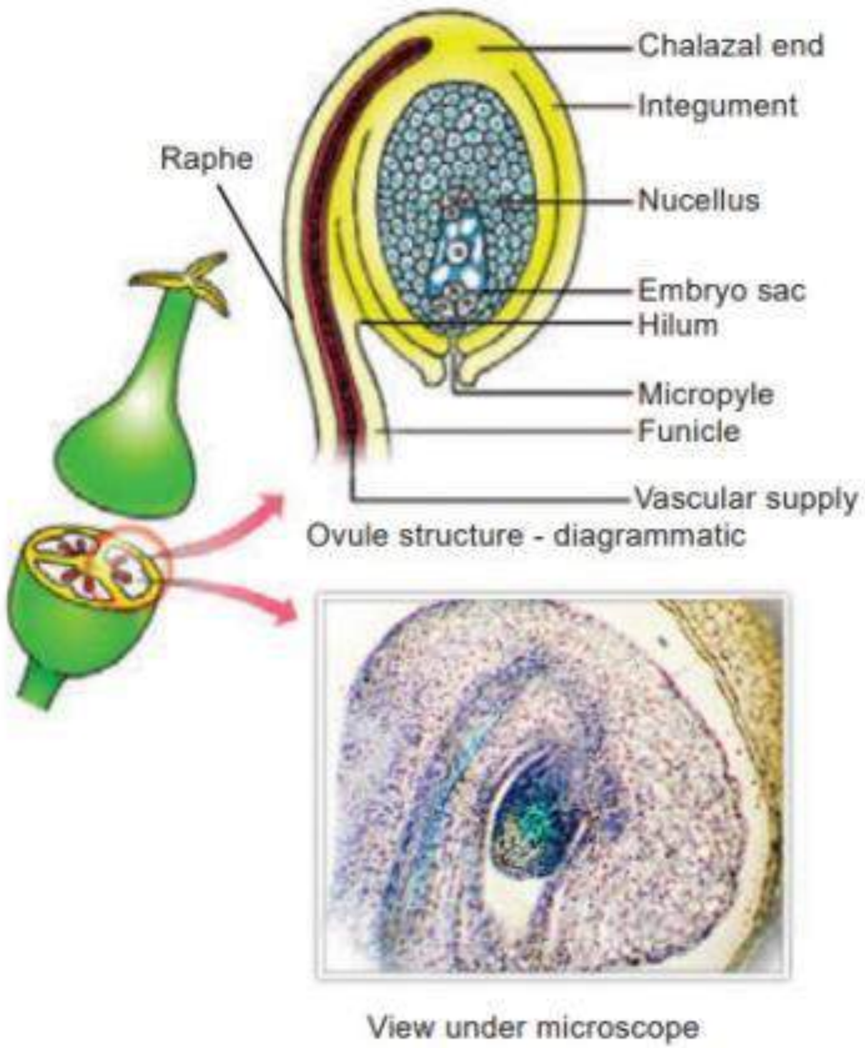
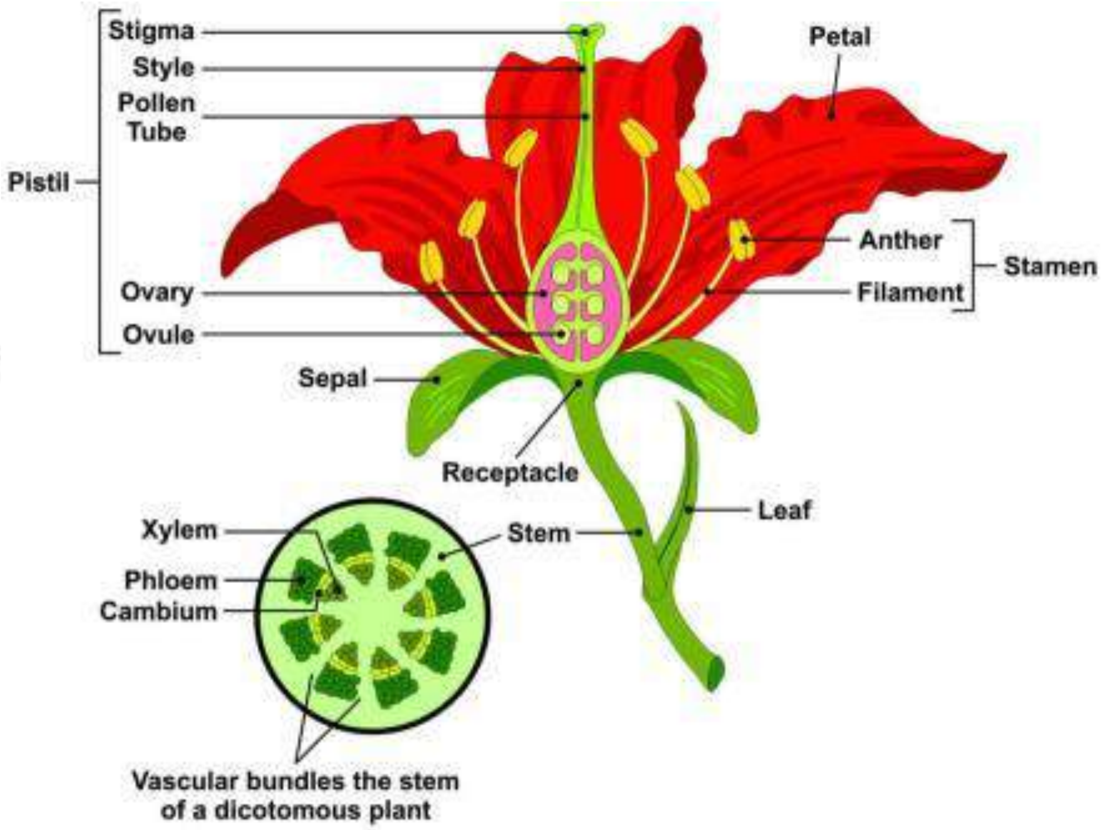
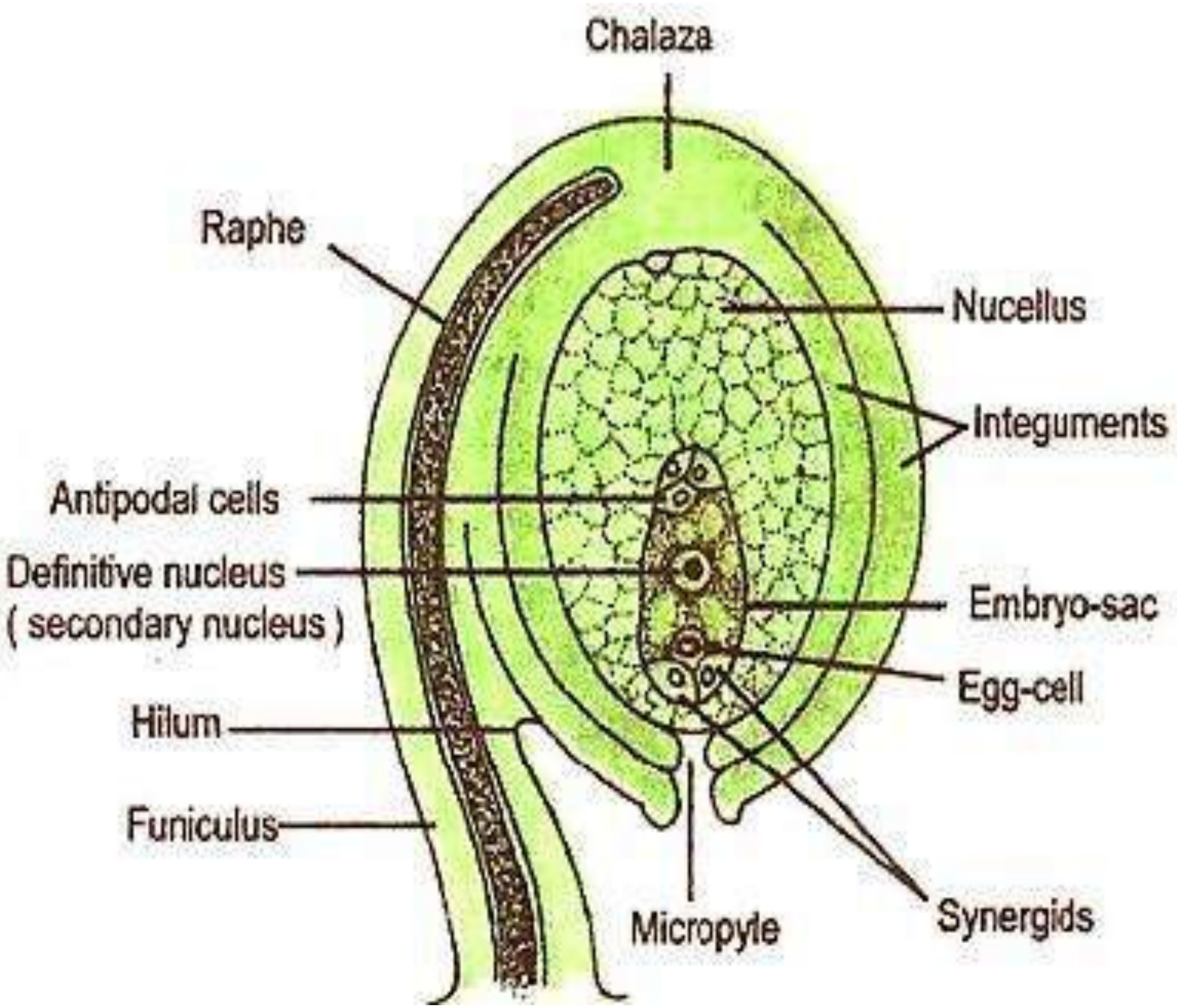


Figure 1.7 Structure of an ovule



Structure of ovule (Megasporangium)



Ovule is also called megasporangium and is protected by one or two covering called **integuments**. A mature ovule consists of a stalk and a body. The stalk or the **funiculus** (also called funicle) is present at the base and it attaches the ovule to the placenta. The point of attachment of funicle to the body of the ovule is known as **hilum**. It represents the junction between ovule and funicle. In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called **raphe**. The body of the ovule is made up of a central mass of parenchymatous tissue called **nucellus** which has large reserve food materials. The nucellus is enveloped by one or two protective coverings called **integuments**. Integument encloses the nucellus completely except at the top where it is free and forms a pore called micropyle. The ovule with one or two integuments are said to be **unitegmic** or **bitegmic** ovules respectively. The basal region of the body of the ovule where the nucellus, the integument and the funicle meet or merge is called as **chalaza**.

Types of Ovules

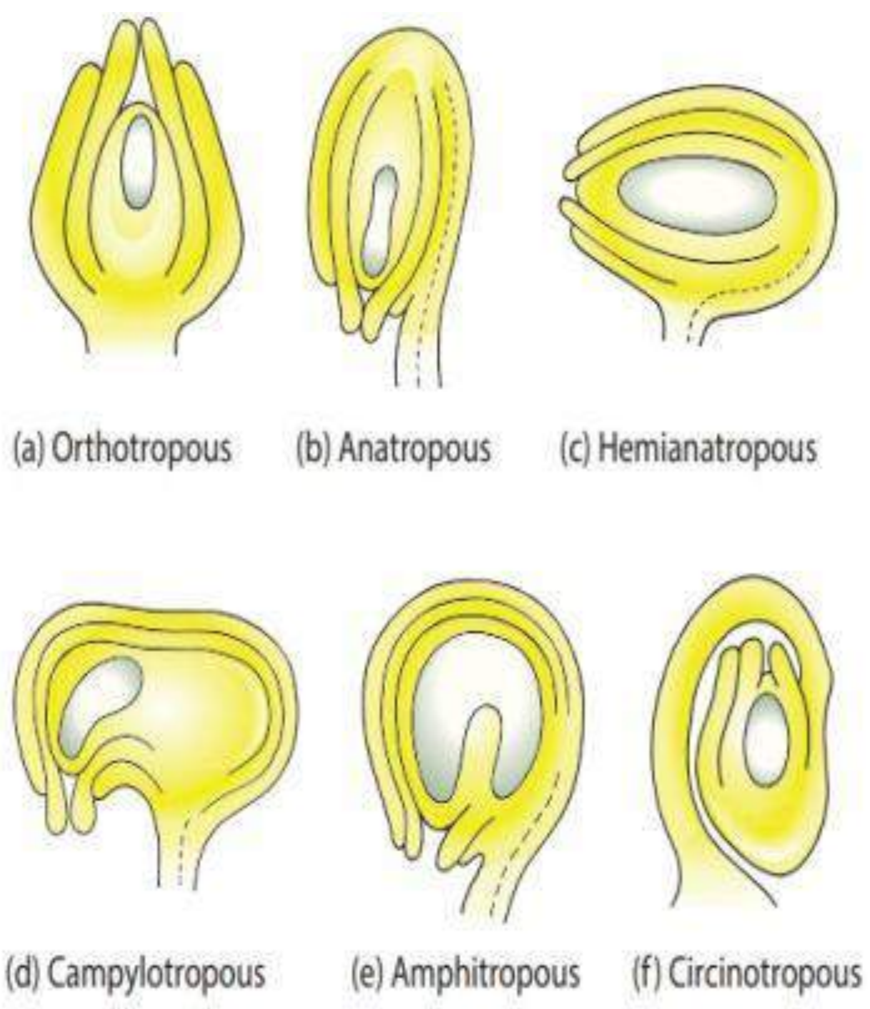


Figure 1.8 Types of ovule

Orthotropous: In this type of ovule, the micropyle is at the distal end and the micropyle, the funicle and the chalaza lie in one straight verticalline. Examples: Piperaceae, Polygonaceae.

Anatropous: The body of the ovule becomes completely inverted so that the micropyle and funiculus come to lie very close to each other. This is the common type of ovules found in dicots and monocots.

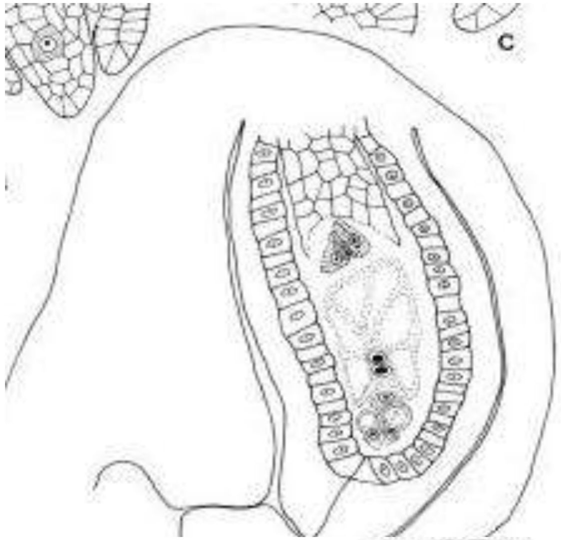
Hemianatropous: In this, the body of the ovule is placed transversely and at right angles to the funicle. Example: Primulaceae.

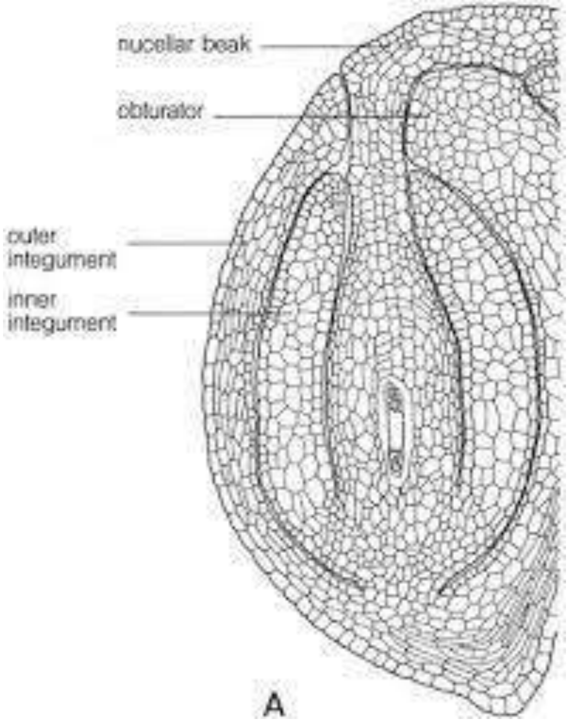
Campylotropous: The body of the ovule at the micropylar end is curved and more or less bean shaped. The embryo sac is slightly curved. All the three, hilum, micropyle and chalaza are adjacent to one another, with the micropyle oriented towards the placenta. Example: Leguminosae

Amphitropous: The distance between hilum and chalaza is less. The curvature of the ovule leads to horse-shoe shaped nucellus. Example: some Alismataceae.

Circinotropous: Funiculus is very long and surrounds the ovule. Example: Cactaceae.

Special Structures of ovule



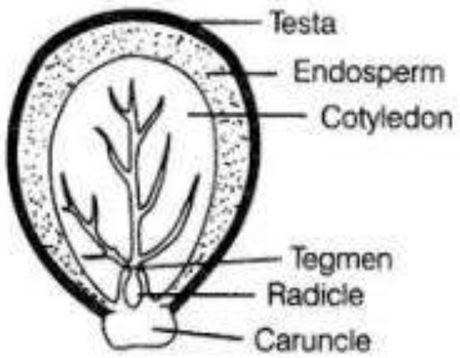


In some plants having unitegmic and tenuinucellate ovules, the nucellus degenerates at an early stage. In such ovules, the innermost layer of the integument becomes specialized to perform the nutritive function of the growing embryo sac. This specialized tissue is called the **Endothelium**. The endothelium is generally single layered and the cells are radially elongated and have dense cytoplasm. Hence, in the ovule Endothelium is the inner part of the integument.

An **obturator** is present in the ovary of some plants, near the micropyle of each ovule. It is an outgrowth of the placenta, important in nourishing and guiding pollen tubes to the micropyle.

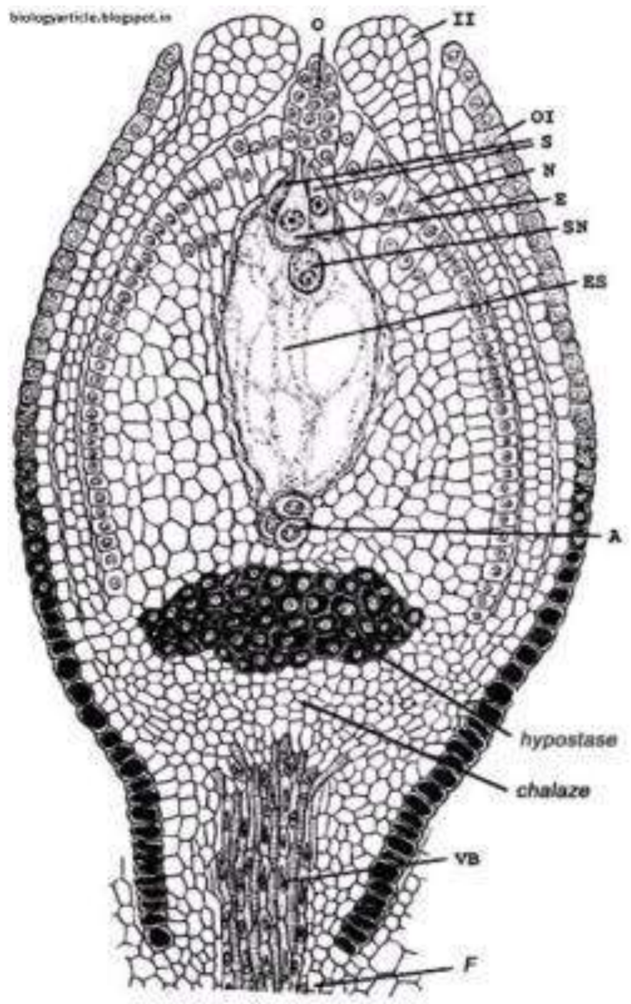
Special Structures of ovule

An **aril** also called an arillus, is a specialized outgrowth from a seed that partly or completely covers the seed. An arillode or false aril is sometimes distinguished: whereas an aril grows from the attachment point of the seed to the ovary (from the funiculus or hilum), an arillode forms from a different point on the seed coat. The term "aril" is sometimes applied to any fleshy appendage of the seed in flowering plants, such as the mace of the nutmeg seed. Arils and arillodes are often edible enticements that encourage animals to transport the seed, thereby assisting in seed dispersal. Example litchi etc.



The **caruncle** is a structure(flashy outgrowth arises) present in the micropylar region of Euphorbiaceae **seeds**. This structure has the. ecological function of promoting **seed** dispersal by ants (myrmecochory), but it is debated whether it also has an agronomical importance influencing **seed** germination. Example Linseed, Castor bean.

Special Structures of ovule



HYPOSTASE

Hypostase is one of the unusual features present at the chalazal region of the embryo sac and situated immediately below it. It represents an irregularly outlined group of nucellar cells which are poor in cytoplasmic contents but have their walls partially lignified or suberized.

The name Hypostase to this group of unusual cells was first given by Van Tieghem. According to him the hypostase forms a barrier or boundary to prevent the further growth of the embryo sac.

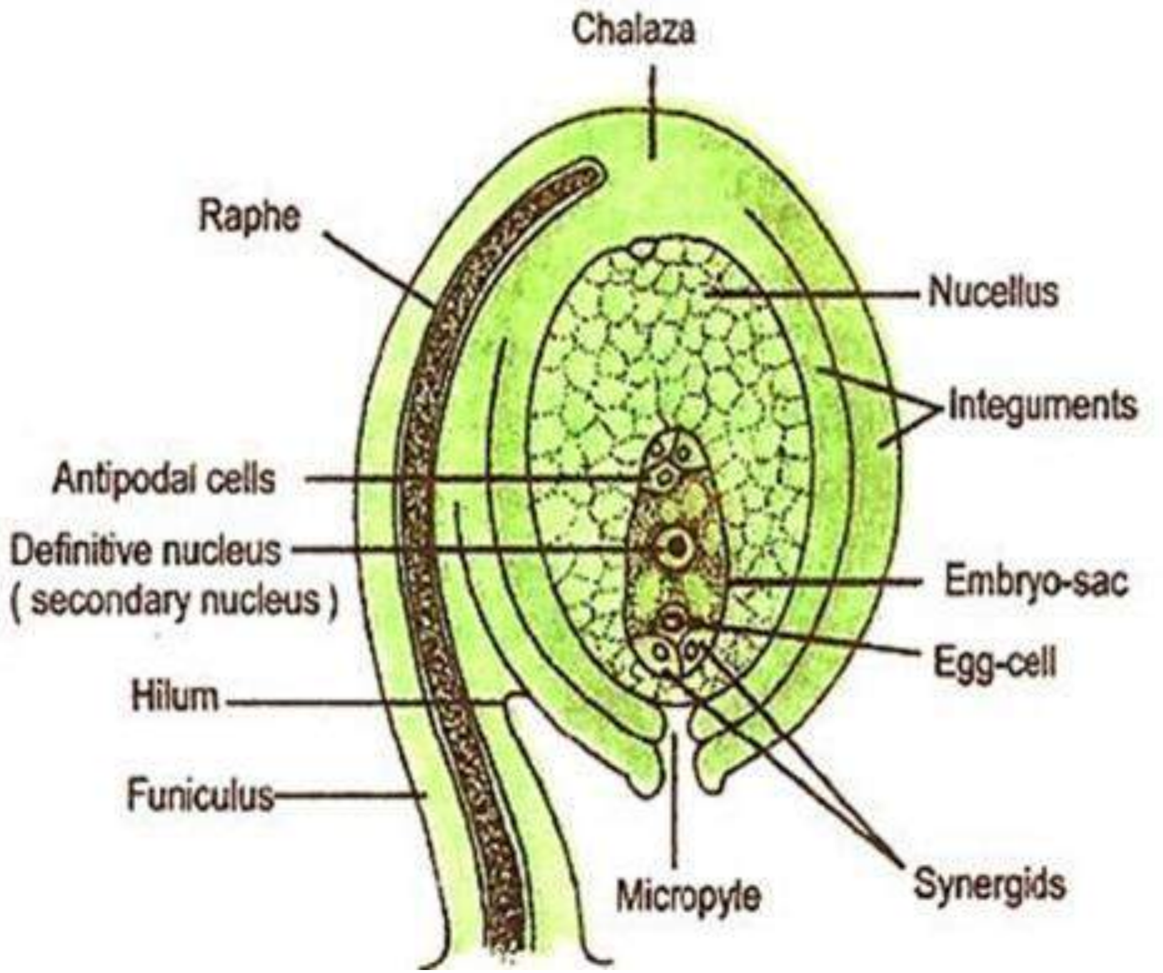
Even though hypostase is limited to basal region of the embryo sac occasionally they may cover the embryo sac extending up to the micropylar half.

Hypostase has been reported from a number of families Amaryllidaceae, Villiaceae, Zingiberaceae, Euphorbiaceae, Crossomataceae, Theaceae and Umbelliferae.

At the stage of the organized embryo sac the cluster of hypostase cells appear like a beard at the chalazal region of the embryo sac.

Megasporogenesis

Megasporogenesis refers to the **development of megaspores** from the megasporocyte, the cell that undergoes meiosis. Meiosis of the megasporocyte nucleus results in the formation of four haploid **megaspore** nuclei. In most taxa, meiosis is followed by cytokinesis, resulting in four **megaspore** cells.



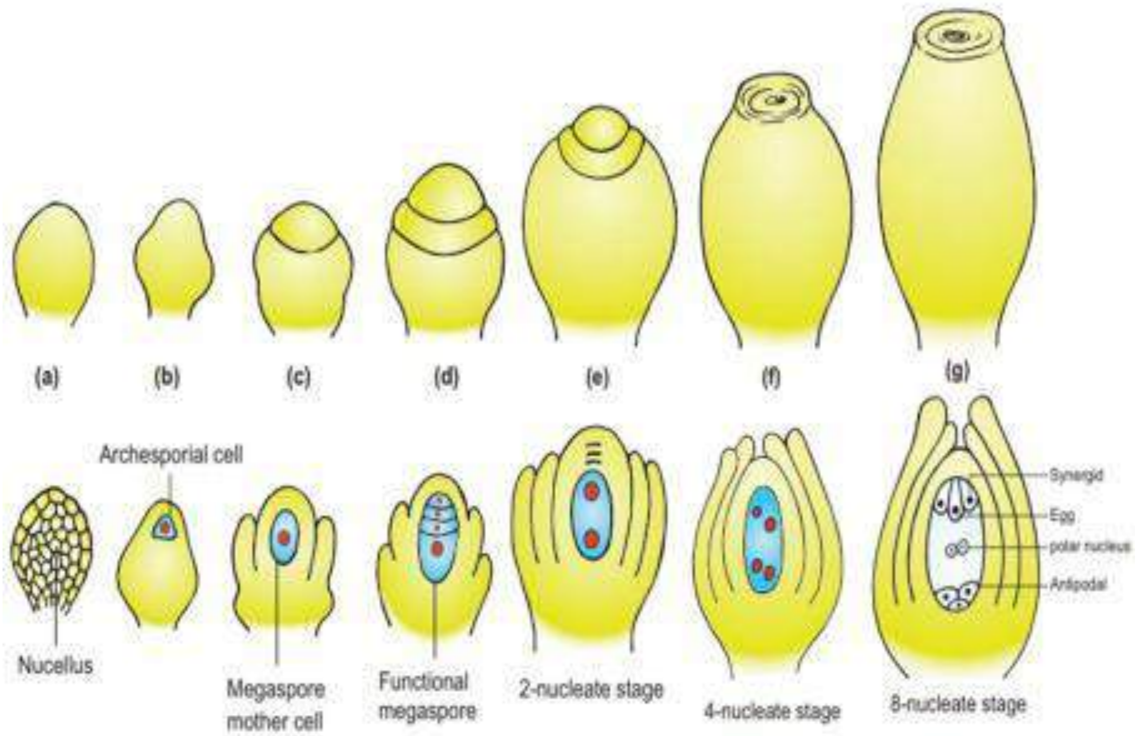
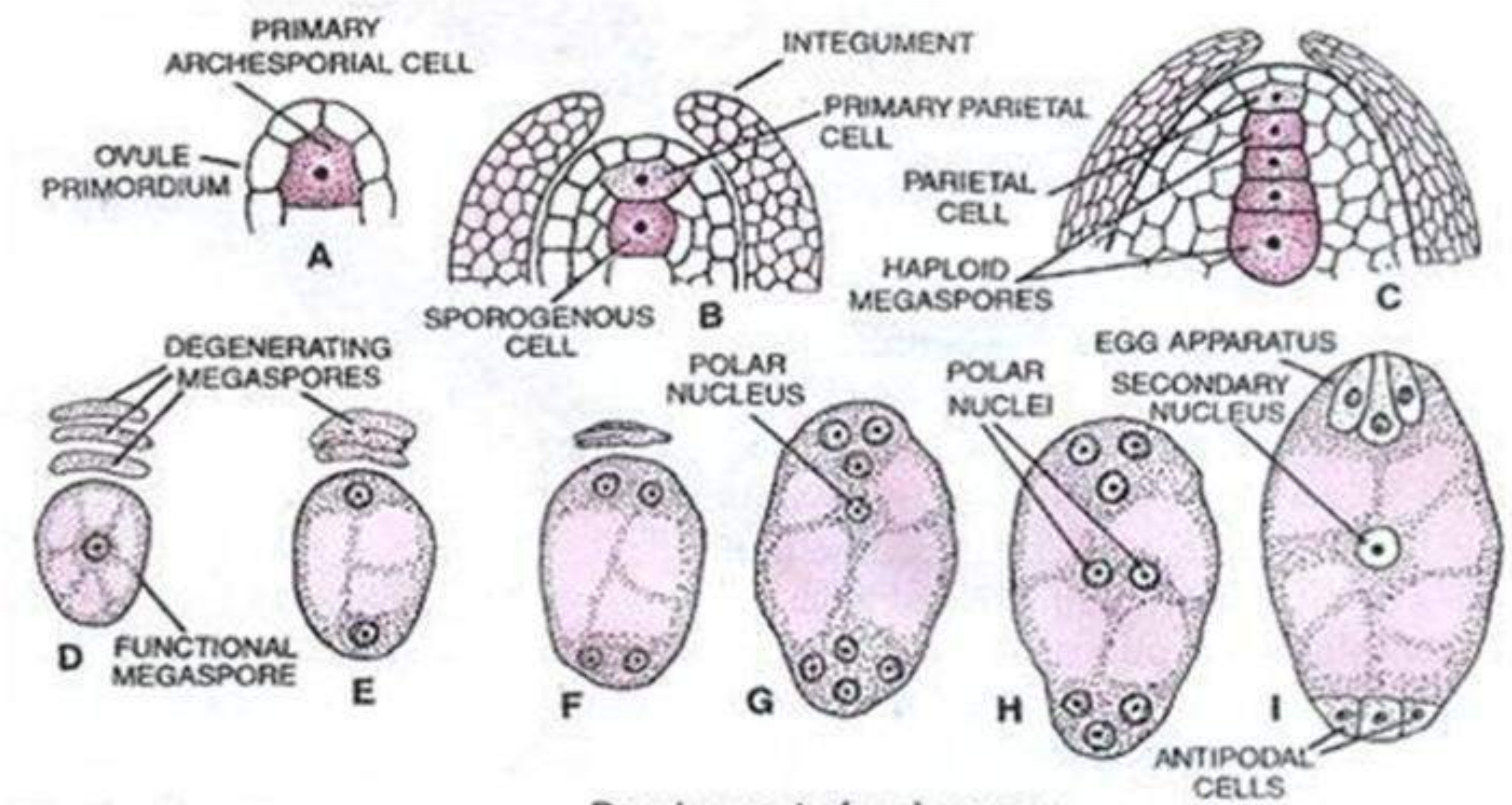


Figure 1.9 Development of ovule and embryo sac (*Polygonum type*).

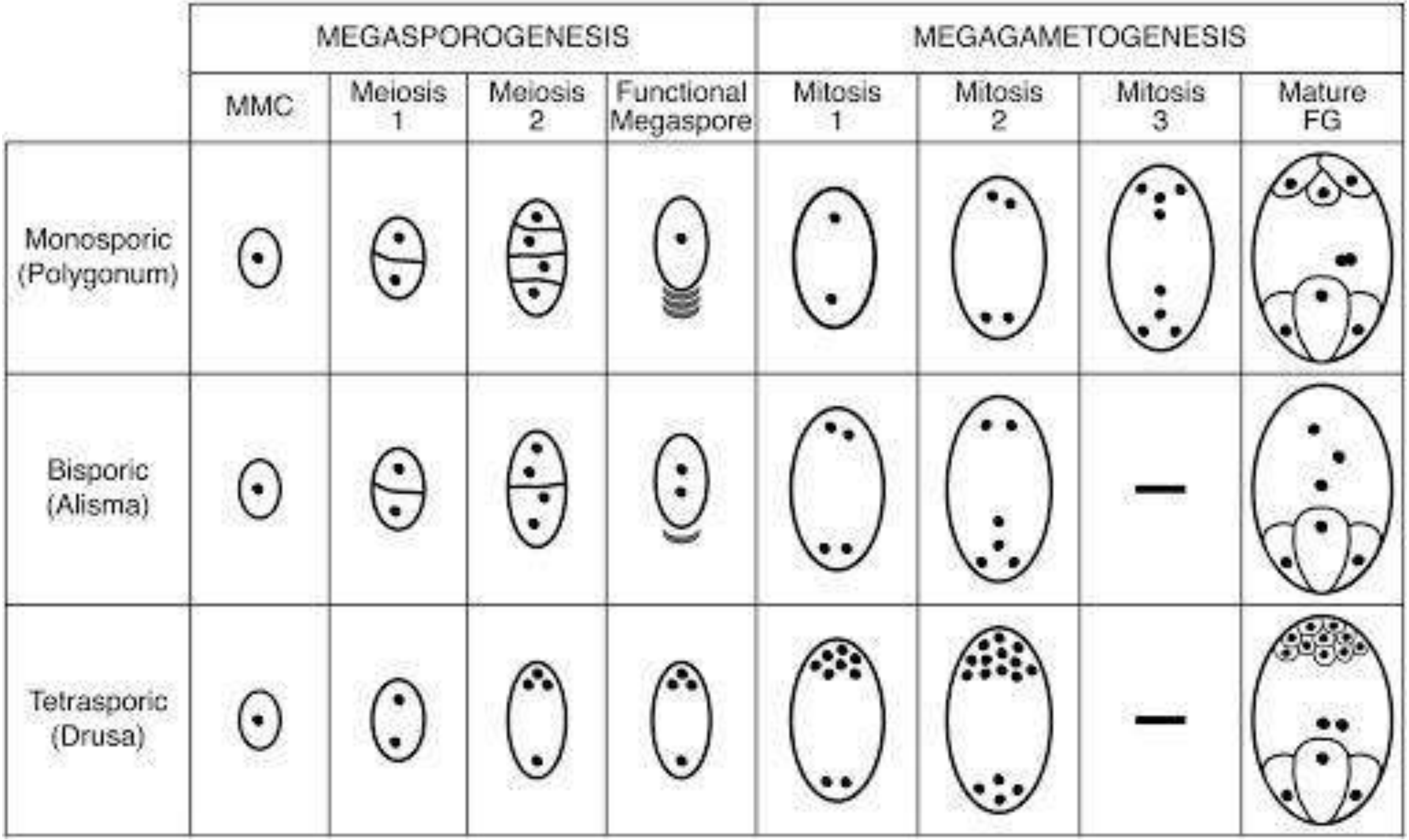
Megaspore is the first cell of the **female gametophyte**. ... **Monosporic development** starts with meiosis in megaspore mother cell to form a dyad and then tetrad of megaspores. Out of four, one is functional that undergoes the three simultaneous divisions to form 2-, 4- and finally 8-nucleate and 7-celled embryo sac.

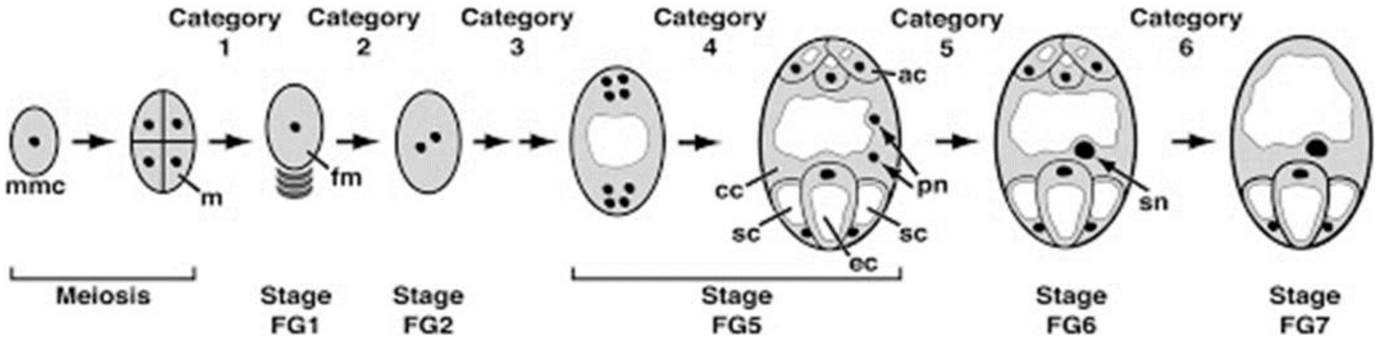


Development of embryo sac.

→ Megasporogenesis

→ Megagametogenesis


MEGASPOROGENESIS
MEGAGAMETOGENESIS
MMC
Meiosis 1
Meiosis 2
Functional Megaspore
Mitosis 1
Mitosis 2
Mitosis 3
Mature FG
Monosporic (Polygonum)
Bisporic (Alisma)
Tetrasporic (Drusa)

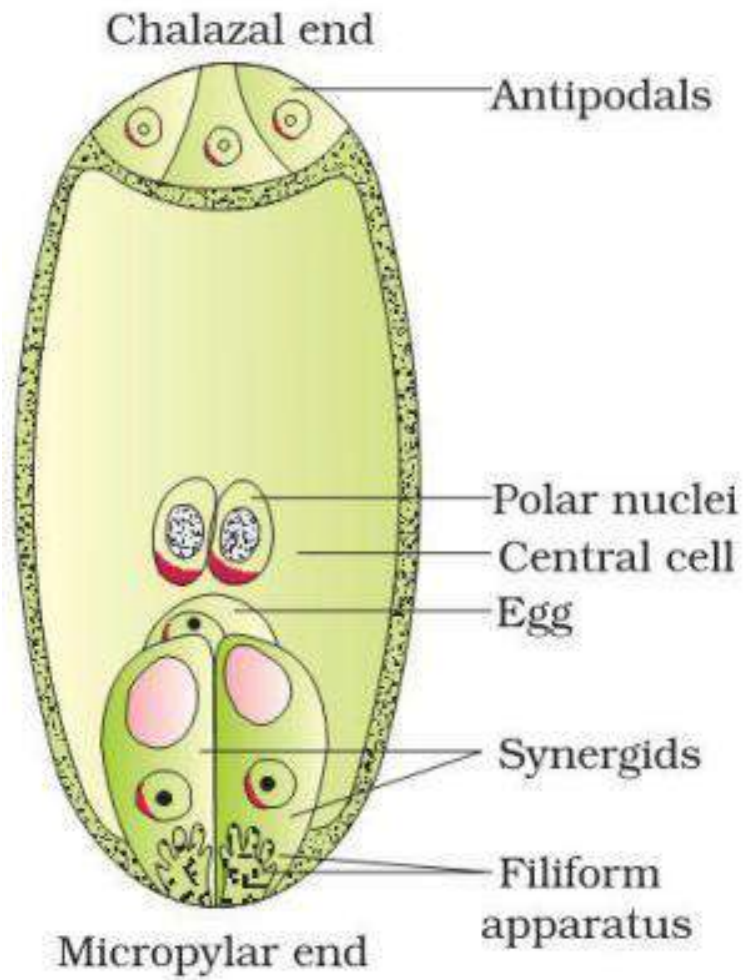


1) MONOSPORIC

- ***A monosporic embryo sac is derived from a single haploid megaspore.***
- ***All the nuclei in the embyo sac are genetically idwntical, as they develop from the same megaspore.***
- ***There are tow subtypes of monosporic female gametophytes.***
- ***There are the,***

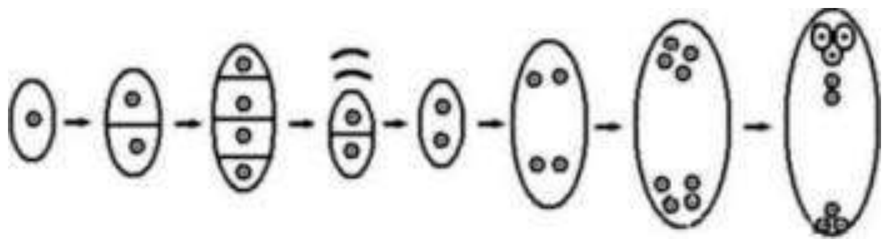
1) Polygonum type

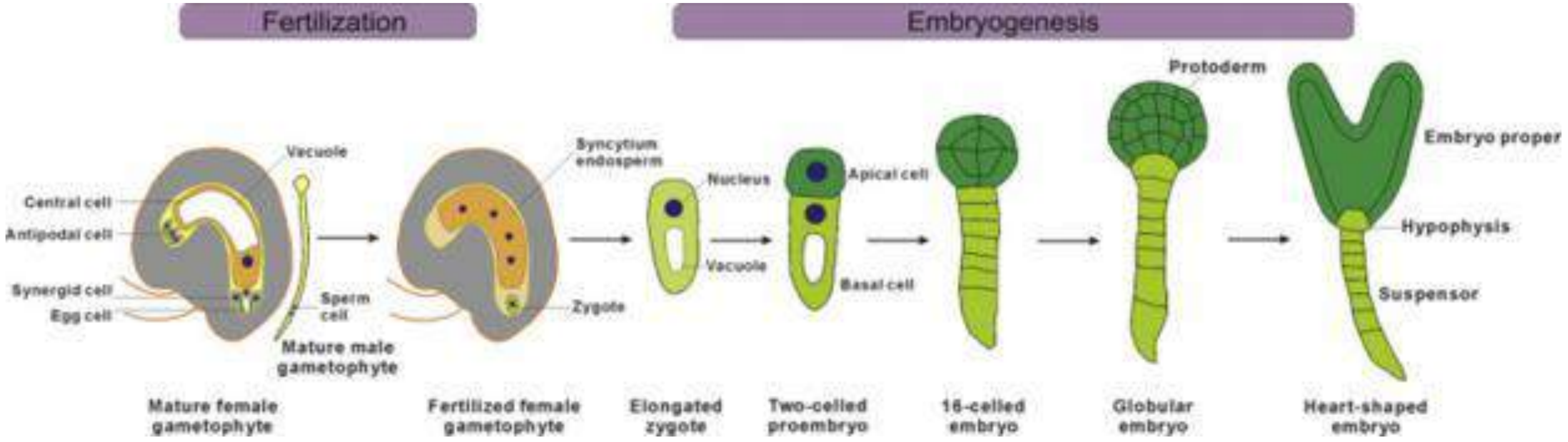
2) oenothera type.

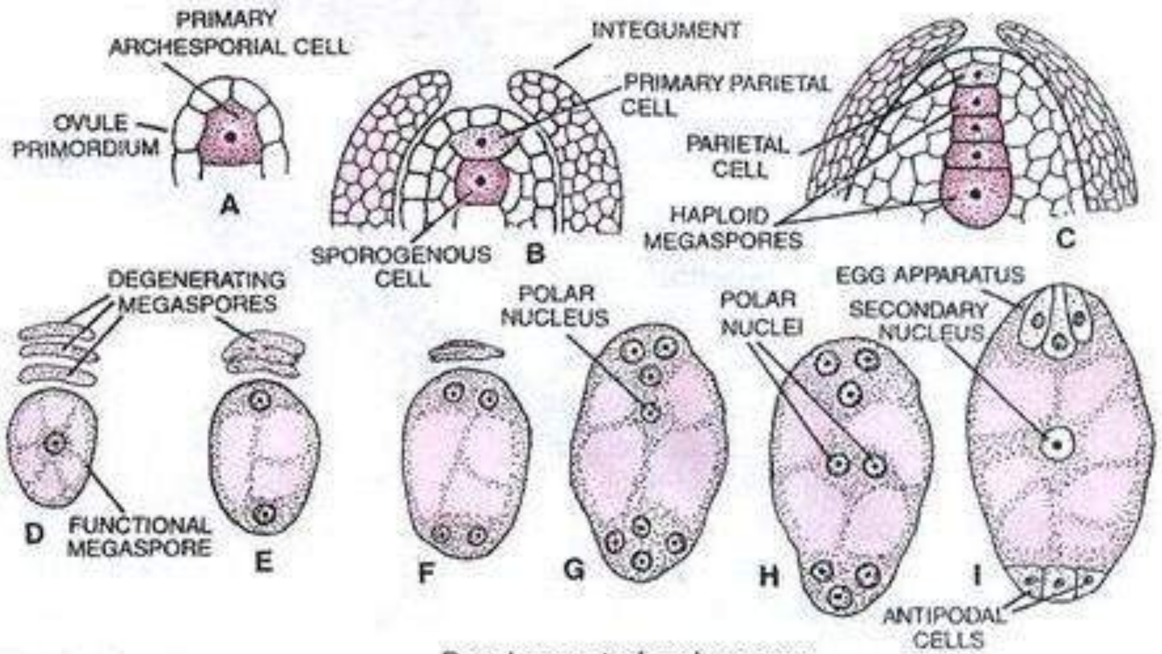


2) BISPORIC

- *In the plant bearing bisporic ES the first division is accomplished by wall formation so that a dyad is formed.*
- *One of the dyad cell undergoes the sec division, whereas the other one degenerates.*
- *Both the megaspore contribute in the formation of mature bisporic ES.*
- *Each megaspore nucleus undergoes two mitotic division, forming 8 nuclei.*
- *The final organization of the embryo sac is similar to the polygonum type.*







Development of embryo sac.

← Megasporogenesis

← Megagametogenesis

Thank You