

Topic: Nature & Development of Endosperm

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Nature of the Endosperm

There are different hypothesis about the nature of endosperm. These are:

- **Gametophytic nature:** Endosperm is formed in the embryo sac by free nuclear division. Therefore, some botanists take it vegetative tissue of the female gametophyte. But this hypothesis is not accepted because it develops as a new structure after triple fusion.
- **Sporophytic nature:** The endosperm nucleus produced as a result of the fusion of second male gamete with the secondary nucleus. Therefore, some botanists consider it a sporophyte tissue homologous to embryo. But the product of this fusion is not a new plant. Therefore, this fusion cannot be regarded as fertilization. This fusion forms a simple triploid ($3n$) nutritive tissue, not an embryo.
- **Special undifferentiated nature:** According to this view, it is neither sporophytic tissue nor gametophytic tissue. But it is special undifferentiated triploid tissue. It provides nourishment to developing embryo in angiosperms. It is most accepted hypothesis.

Development of Endosperm

The endosperm is important because it is the main source of food for the embryo. The primary endosperm nucleus divides repeatedly. It forms polyploidy nutritive tissue called endosperm. There are two types of seeds for storage of food:

- **Endospermic or albuminous seed:**

The endosperm supply food to the developing embryo. Such seeds are called endospermic seeds. In plants like corn, wheat, the endosperm tissue is present in the time of seed germination. So these are endospermic seeds.

- **Non-endospermic or ex-albuminous seeds:**

In some cases, the endosperm is completely utilized by developing embryo. Such seeds are known as non-endospermic seeds. In beans and peas the endosperm tissue is completely digested by the developing embryo and stored in the cotyledons.

Formation of Endosperm

Endosperm is formed from the **primary endosperm nucleus**. Its formation starts before the formation of embryo. Primary endosperm nucleus is produced by

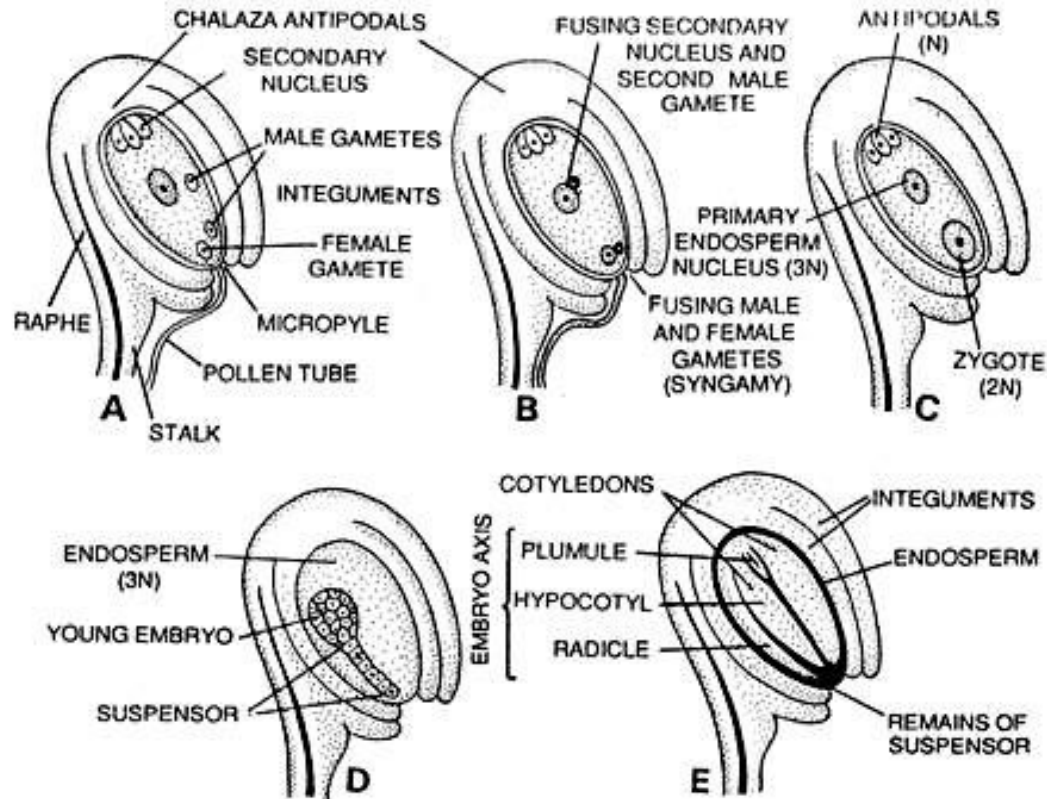


Fig. Fertilization and post-fertilization changes. A, two male gametes discharged in the embryo sac; B, syngamy and double fertilization; C, formation of zygote (2n) and primary endosperm nucleus (3n); D-E, post fertilization changes.

fusion of monoploid polar nuclei (secondary nucleus) and a monoploid second male gamete. The endosperm is thus triploid ($3n$). However in some case, it may be pentaploid (Peraea). It may be even $9n$ (Pepromia).

Structure of Endosperm

The cells of the endosperm are isodiametric. They store large quantity of food materials. The storage food is present in the form of starch granules, granules of proteins, or oils.

In certain plants, the endosperm cells develop very thick hard walls of hemicelluloses. The parietal layer of the endosperm of grass functions like a cambium. This layer produces on its inside layers of thin-walled cells.

These cells are packed with starch. The cells of outermost layer stops dividing. It is filled with aleurone grains. This layer is called **aleurone layer**. The cells of this layer secrete diastase and other enzymes. These enzymes digest the food stored in endosperm for developing embryo.

Types of Endosperm

There are three types of endosperms on the basis of mode of development.

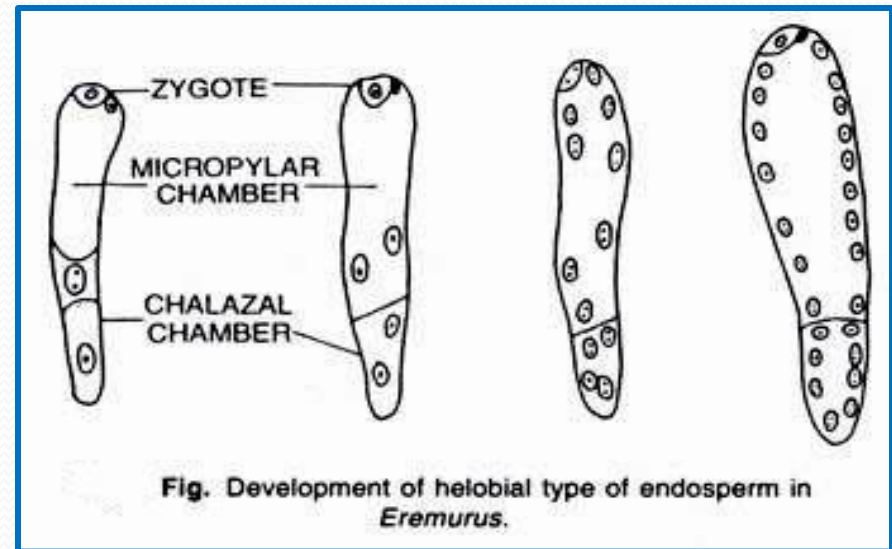
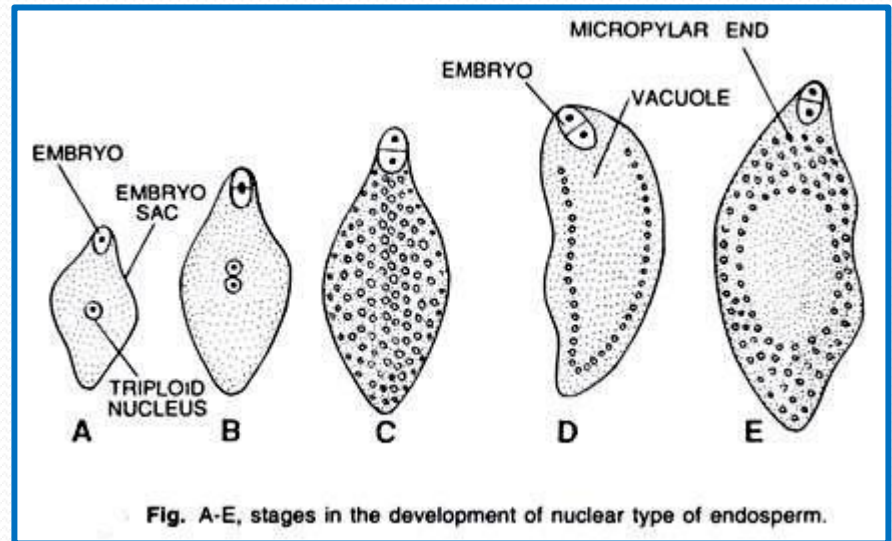
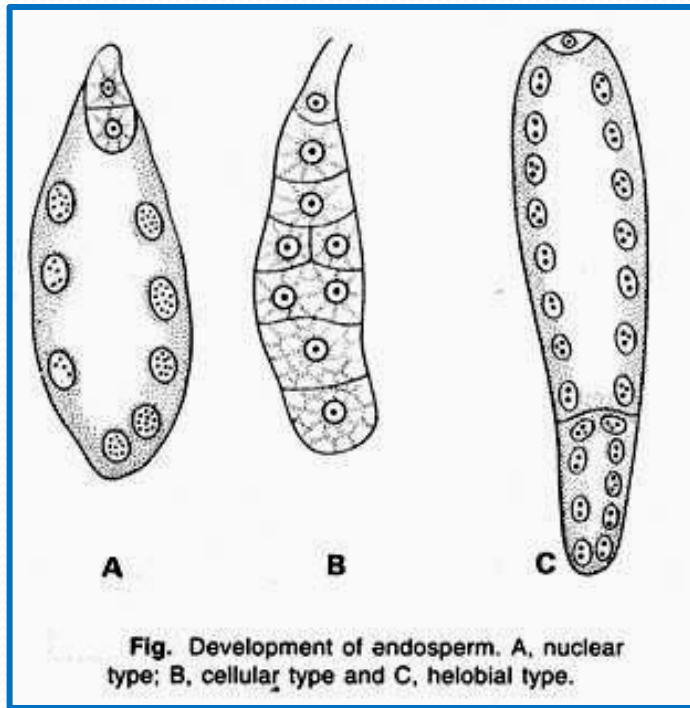
These are nucelar type, cellular type and Helobial type.

- **Nuclear Type:**

In this case, the primary endosperm nucleus divides by free nuclear divisions. Their wall is not formed between them. A vacuole appears in the centre of the embryo sac. It increases in size and. Therefore, the nuclei are pushed to the periphery along the wall of the embryo sac. Later, walls develop between the nuclei. Thus cellular tissues are formed.

- **Cellular Type:**

In this case, the primary endosperm nucleus divides and walls are formed between the daughter nuclei. These walls may be either transverse or longitudinal. It divides the embryo sac into two cells. Later, these cells divide by repeated divisions. It produces a tissue of irregularly arranged cells.



- **Helobial Type:** This type of endosperm occurs in the order Helobiales (Monocotyledons). In this case, first division of primary endosperm nucleus is followed by a transverse wall. This wall divides the embryo sac into a small chalazal chamber and a large micropylar chamber. Then the nuclei in each chamber divide by free nuclear divisions. But, there are few nuclear divisions in the calazal chamber. The endosperm in this chamber degenerate. Walls develop between nuclei in micropylar chamber. It produces cellular endosperm.