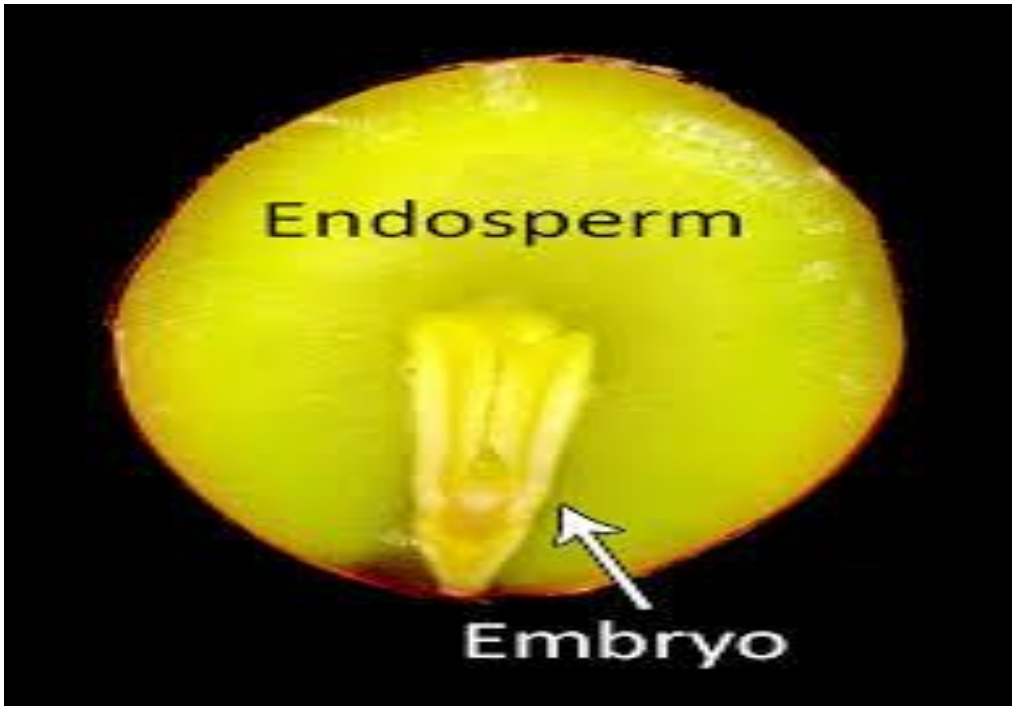
For B.Sc. Part II (Sub.) Group B (Anatomy and Embryology)

ENDOSPERM



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Lecture No.37

Endosperm ????

- In angiosperms one of the two male gametes fuse with the egg to form zygote and other with the polar nuclei (or secondary nucleus, if polar nuclei have already fused) to form PEN (primary endosperm nucleus).
- The fusion of male gamete with secondary nucleus is known as triple fusion and the whole phenomena is known as double fertilization.
- The primary endosperm nucleus forms endosperm (a highly nutritive tissue which provides nourishment to the developing embryo.

- ✓ Endosperm is characteristic of all angiosperms except some families like Orchidaceae, Podostemonaceae and Trapaceae.
- ✓ The seeds without endosperm is known as nonendospermous seeds or exalbuminous seed.
- ✓ The seed containing the endosperm is known as endospermous or albuminous seed.

✓ In plants like beans, peas, etc. the entire endosperm is consumed for the nutrition of developing embryo . Thus the mature seeds are without endosperms and such seeds are known as nonendospermic.

✓The mature seeds of cereals, coconut, castor etc. retain endosperm such seeds are endospermic.

✓Endosperms is usually **triploid (3n)** as it is formed by the fusion of three haploid nuclei – two of these nuclei belongs to the female gametophyte (i.e., polar nuclei) and one to the male gametophyte (i.e. male gamete).

✓But we known's that the number of polar nuclei varies in different types of embryo sacs ,So cytological nature of endosperms also shows some variations. Example- In Oenothera type of embryosac there is only one polar nuclei, the endosperm is diploid(2n) and in Pepromia type of embryo sac has eight polar nuclei hence the endosperm is 9n.

✓The cells of endosperms usually do not contain chlorophyll, but in some species of *Crinum*, *Matthiola*, *Raphanus* and *Viscum* chlorophyll is present in the cells of the endosperm.

Types of Endosperm

➢ Depending upon its mode of development , following three types of endosperm have been recognized

1.Nuclear endosperm

2.Cellular endosperm

3.Helobial endosperm

✓Of these three types, nuclear endosperm is the most common and is found in about 56% families of angiosperms.

✓Cellular endosperms occurs in 25% families.

✓Helobial endosperm occurs in 19% families.

✓Furthure , cellular endosperm is mostly confined to dicotyledonous families and helobial endosperm to the monocotyledonous families.

✓Where the embryos grows slowly and seed contain immature undifferentiated embryo , the endosperm is cellular.

1. Nuclear endosperm

➢ In nuclear type of endosperm, the division of the primary endosperm nucleus and a few subsequent nuclear divisions are not accompanied by wall formation.

➢ This results in a condition where central cell of the embryo sac has formed a few several thousand nuclei freely suspended in its sap.

➢ Such a condition of endosperm may persist until it is consumed by the developing embryo (*Floerkea, Limnanthes, Oxyspora)* or it may become cellular at a later stage.

➢ When latter is the case (cellular at later stage), which is more common, the wall formation is mostly **centripetal.**

Cellularization of nuclear endosperm

✓Cellularization of nuclear endosperm shows variations

✓ In *Acalypha*, the endosperm becomes cellular completely.

✓ In *Grevillea*, the endosperm is cellular in the micropylar region and nuclear in the chalazal end. The nuclear chalazal end develops into a vermiform appendix.

In coconut,the endosperm is nuclear type. Later on it becomes cellular.The PEN undergoes several free nuclear divisions**.**

✓ The endosperm in coconut is partly solid and partly liquid.

✓ In ***Crotalaria,*** the wall formation is confined to the upper region of the embryo sac, the chalazal region remains free- nuclear, and it often elongates and behaves like an haustorium.

✓ In ***Lomatia,*** besides the main chalazal haustorium, numerous single- celled, finger shaped projections are present all over the endosperm. This increases the absorbing surface of the endosperm.

Developmet of endosperm in *Areca catechu* is also more or less similar to that of coconut. The endosperm occupies the entire cavity of the embryo sac and it is very hard.

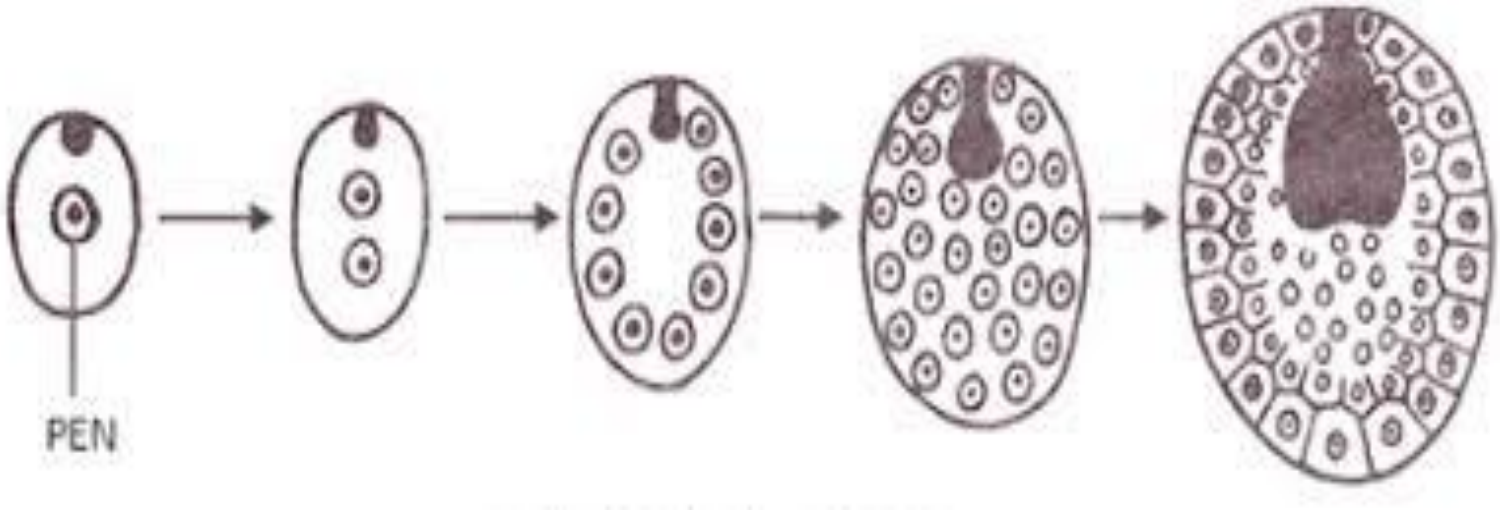

Figure: Stages in the development of nuclear type of endosperm.

2. Cellular endosperm

➢The division of the PEN and its further divisions are followed by immediate wall formation and the free nuclear stage is completely absent.

✓ The occurrence of haustoria is a common feature of this type of endosperm; it is more varied than that is the nuclear endosperm.

✓The haustoria may be micropylar or chalazal and occasionally, present in the same plant.

✓ Micropylar haustoria are known to occur in ***Impatiens roylei and Hydrocera triflora/***

✓ A very aggressive chalazal haustorium is formed in ***Iodina rhombifolia. The haustorium is*** actually formed before fertilization. After fertilization, the division of the primary endosperm nucleus is followed by transverse partitioning of the central cell, resulting in the formation of a micropylar chamber and a chalazal chamber. The endosperm proper is derived from the micropylar chamber alone. The chalazal chamber functions as an aggressive, uninucleate haustorium. Profuse branching at the free- end gives the haustorium a coralloid appearance.

✓ In the Acanthaceae, the endosperm development is asymmetric and it shows characteristic micropylar and chalazal haustoria.

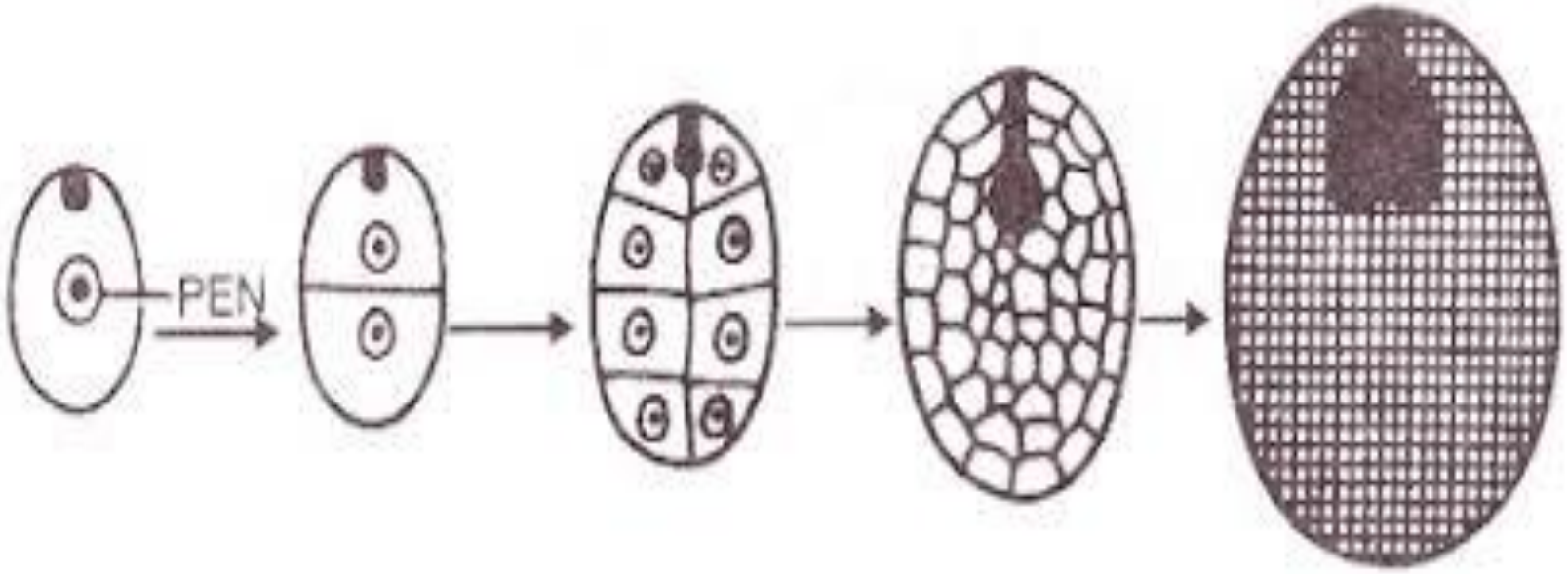

Figure: Stages in the development of Cellular type of endosperm.

✓ In *Nemophila* both micropylar and chalazal haustoria are found.

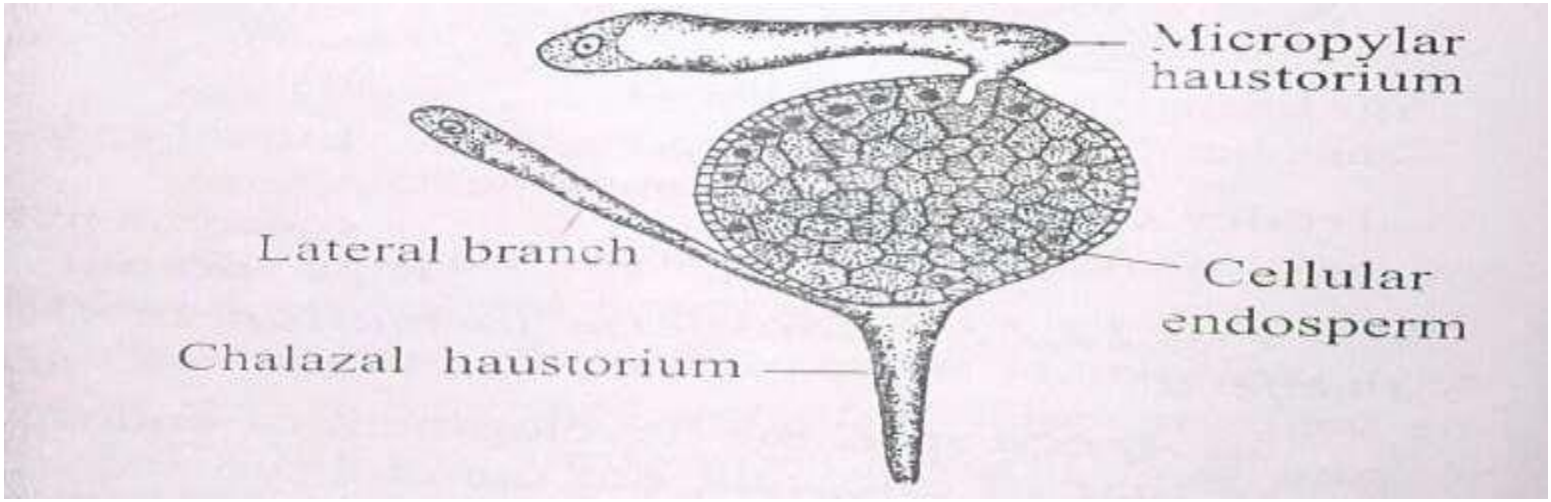

Figure: Endosperm in *Nemophila*

✓ In Impatiens , micropylar haustorium is produced

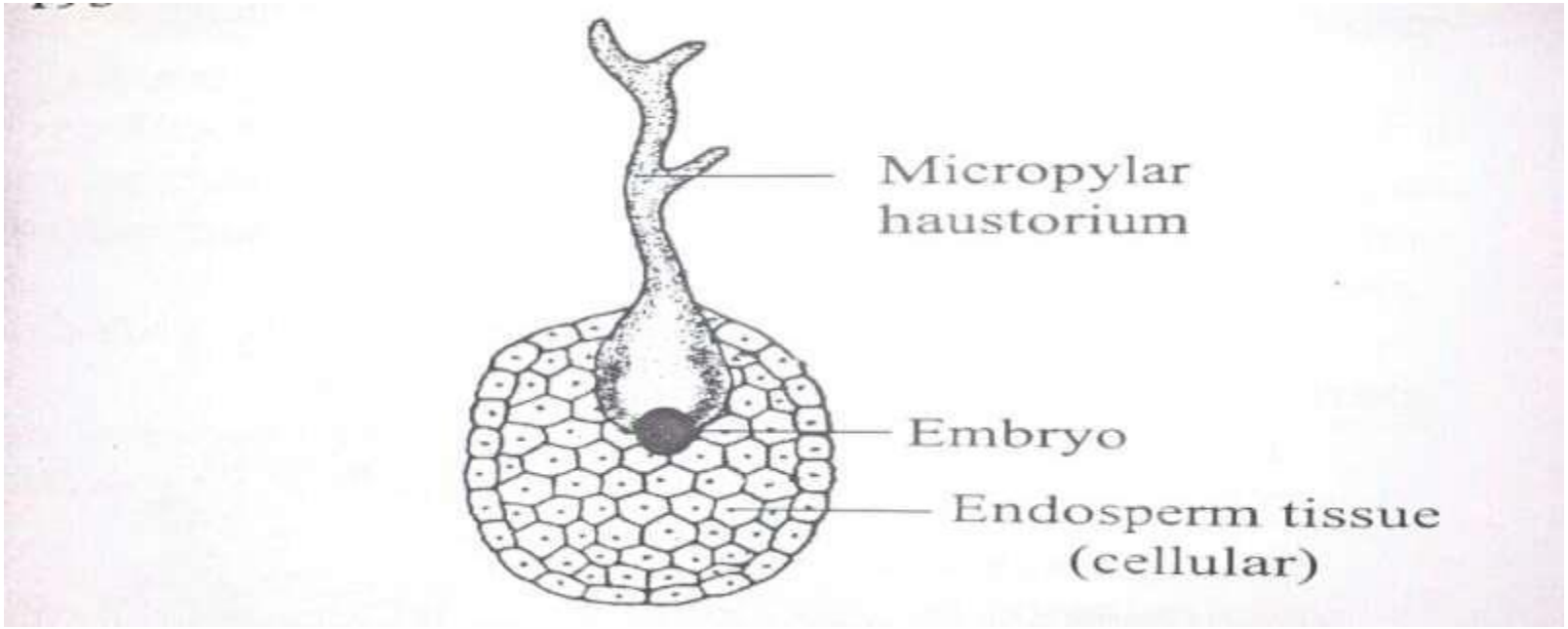

Figure: Micropylar haustorium in *Impatiens*

3. Helobial endosperm

✓ Development of helobial endosperm is intermediate between nuclear and cellular types.

✓The primary endosperm nucleus moves to the chalazal end of the embryo sac where it divides forming a large micropylar chamber and a small chalazal chamber.

✓ In the micropylar chamber, free nuclear divisions and cell formation, start at a much later stage.

✓ In the chalazal chamber, the nucleus either remains undivided or divides only a few times. If latter is the situation, the divisions are usually free- nuclear. Sometimes, in ***Phylidrum lanuginosum,*** it may become cellular.

✓ Helobial endosperm is more common in monocot.

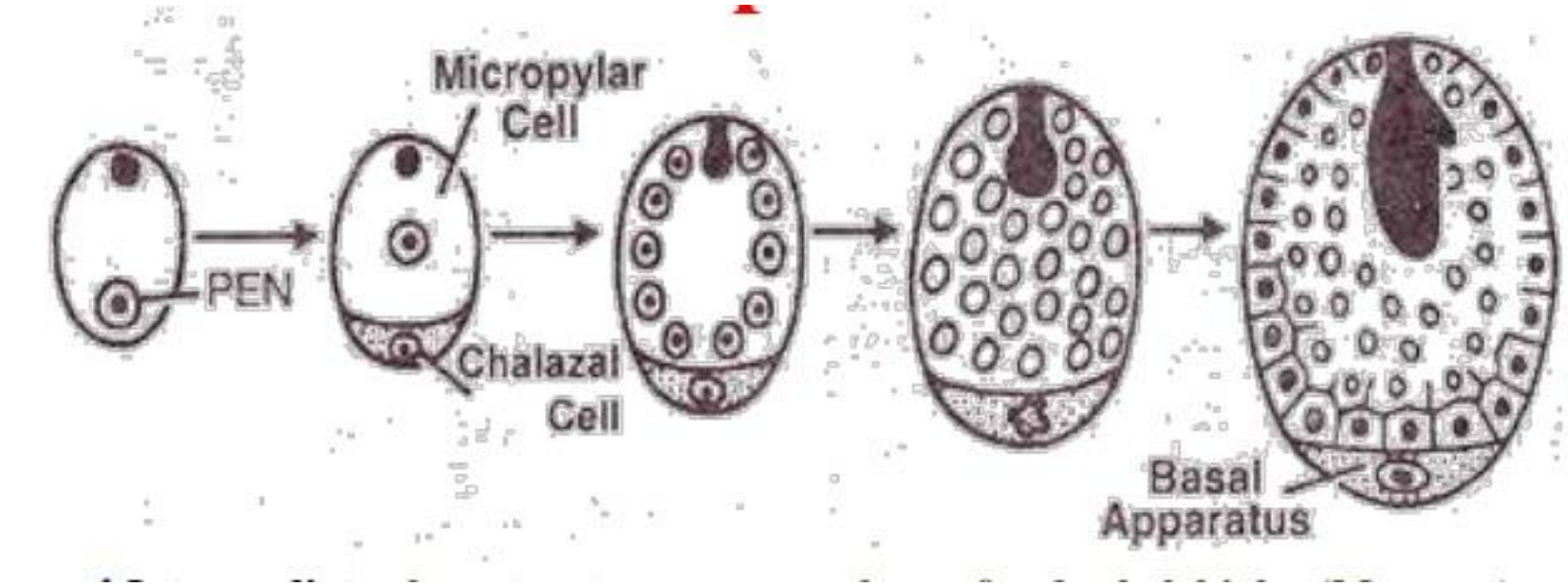

Figure: Stages in the development of Helobial type of endosperm.

Xenia :

✓The term xenia was used first time by Focke (1881) to demonstrate the direct effect of male parent (pollen grain) on fruits or seed.

✓Effect of pollens inside Embryosac on Endosperm (except Embryo)

Example: *Zea mays*

Metaxenia:

✓ Effect of pollen out side the Embryosac on seed coat or pericarp.

Ruminate Endosperm :

✓ Endosperm having irregular ridges and furrows on the surface.

Example: *Areca catechu*, *Myristica*

Mosaic Endosperm :

✓ In some plants the endospermic tissue lack uniformity.

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Thank You!!!