Embryogeny

Embryo Development

in

Dicot & Monocot Plant

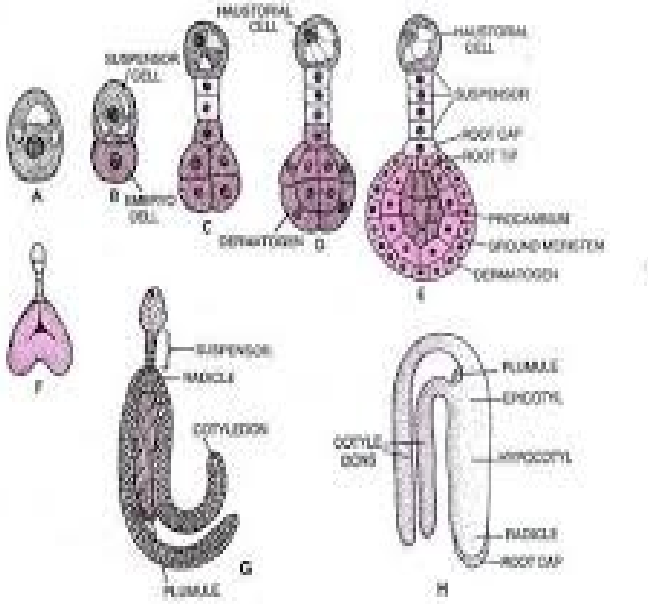
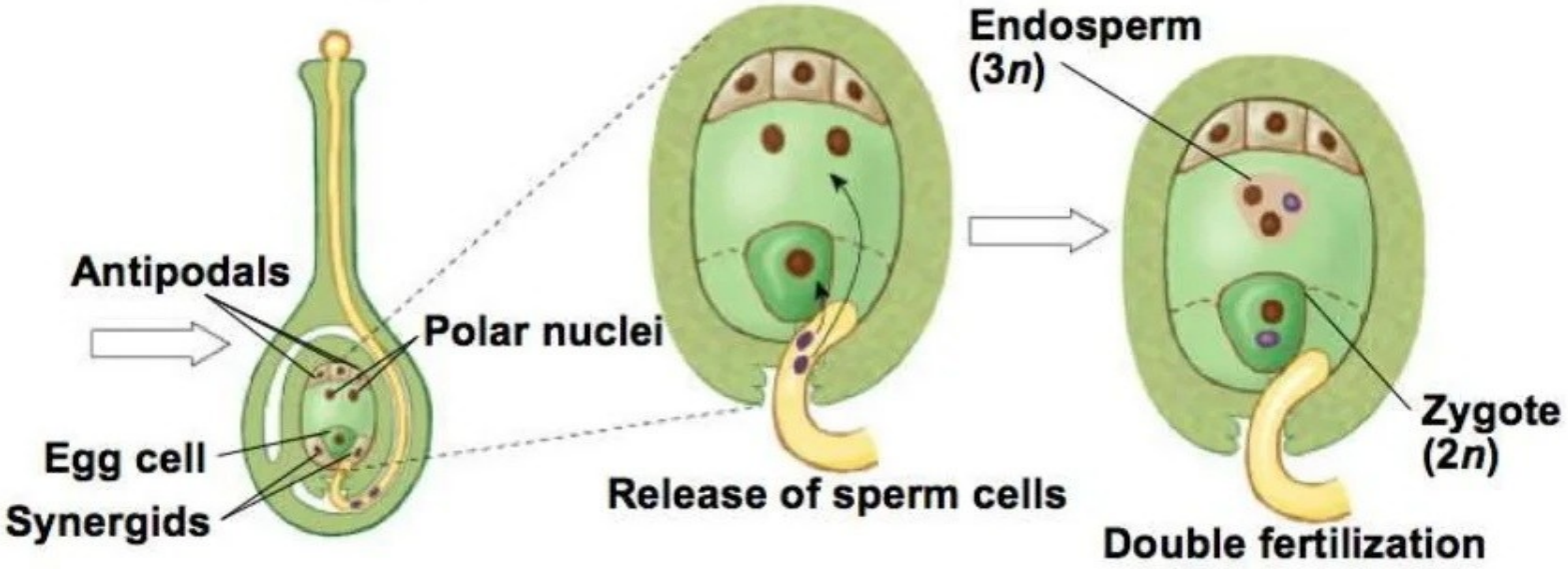


Fig. 2.30. Stages in the development of a dicot embryo. A, Zygote or oospore. B, Division of zygote into suspensor and embryo cells. C, Formation of suspensor and embryo octant. D, Periclinal divisions of embryo octants to form outer dermatogen. E, Globular embryo showing regions of radicle, procambium, ground meristem and dermatogen. F, Heart-shaped embryo. G, Mature dicotyledonous embryo. H, a typical dicot embryo.

Double Fertilization



➢The process of development of embryo from a zygote is called as embryogenesis. The zygote is located at the micropylar end of the embryo sac. It’s basal or micropyle end is attached to the embryo sac wall, while the apical part or chalazal part projects in the central cell.

➢The zygote undergoes a resting phase after its formation. The resting period varies with the species and depends upon the environmental conditions. With the passage of time, cell wall is formed all around the zygote and the cytoplasm shows a more polarized appearance. The micropylar part becomes vacuolated while the chalazal part shows presence of prominent nucleus.

➢ In most of the angiosperms, the division in the zygote is transverse resulting in formation of a small apical cell and a large basal cell. In some angiosperms groups the division is vertical or oblique. In a two-celled proembryo the basal cell (towards the micropylar end) remains undivided or undergoes transverse
division to form two cells. The apical cell divides vertically or transversely,

- In the linear four-celled proembryo, the two apical daughter cells undergo two vertical divisions at right angles to each other to give rise a quadrant and then to an octant having two superposed tiers of four cells each.. Generally the octant possesses two superposed tiers of four cells each.

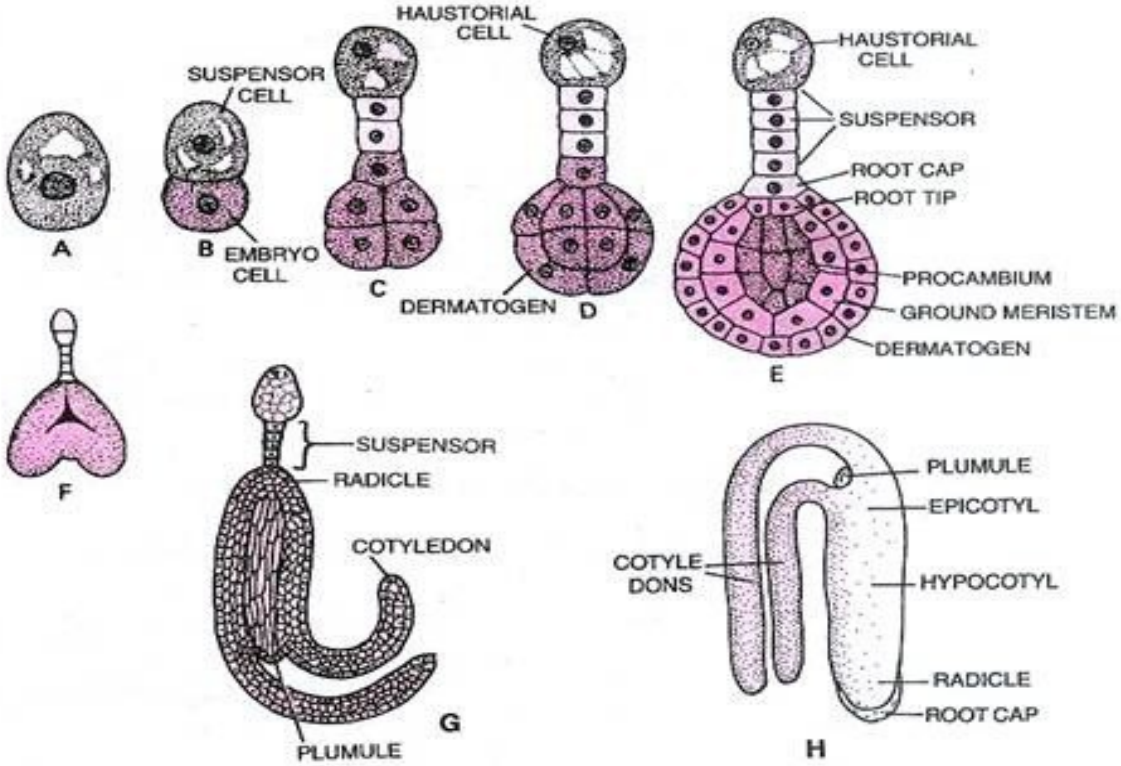
- The basal cell usually divides transversely, and some of its derivatives give rise to the suspensor which connects the embryo to the embryo sac wall.
- Tangential divisions in the cells of the octant lead to differentiation of three wall layers. The outer **dermatogen layer which forms the epidermis, middle periblem which gives rise to cortex of the stem and root, and inner plerome** which gives rise to vascular tissue and pith.

- The process of differentiation of cell layers is called as **histogenesis.** Organogenesis or differentiation of organs begins in the globular stage of the proembryo so that cotyledons (form leaves), epiphysis (form stem apex) and hypophysis (forms root cap and root cortex) are produced.

- At this stage the embryo is globular in shape. By this stage derivative of the basal cells or its micropylar derivatives form a row of 6 to 10 suspensor cells. The upper part of the suspensor becomes vesicular, forming finger-like ingrowths typical of cells involved in absorption of nutrients. It thus attains a haustorial function and provides nutrition to the developing embryo.

- The lower most cells placed between the suspensor and embryonal mass is referred as hypophysis. Hypophysis undergoes a transverse division followed by two longitudinal divisions at right angles to each other forming a group of eight cells. Out of these eight cells, inner four cells give rise to initials of the
root cortex while the outer give rise to root cap and root epidermis.

- The stage at which the development of cotyledons is initiated is referred as **cordate or heart shaped. A wedge group of cells is cut off** between the two cotyledons. The cotyledons and the hypocotyls enlarge to form a **torpedo shaped embryo.**



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Types of Embryogeny-On the basis of the plane of division of the zygote and of the cells of the 2-celled proembryo, and also taking into account the relative contributions of the cells of the 4-celled proembryo to the mature embryo, six cheif types of embryogeny have been recognised (Johansen, 1950; Maheshwari, 1950)

- Division of the zygote is vertical - Piperad type (e.g.. Loranthaceae, Piperaceae).
- Division of the zygote is transverse.

- Apical cell of the 2 celled proembryo divides vertically to form a T-shaped, 4-celled proembryo.

- Basal cell plays no role at all or only an insignificant role in subsequent development of the proembryo-(Crucifer or Onagrad type (e.g., Ranunculaceae, Brassicaceae).

- Apical cell of 2-celled proembryo divides transversely so that the 4-celled proembryo is usually linear.

- Basal cell does not participate or only contributes a little to development of embryo proper.

- Basal cell usually forms a suspensor - Solanad type (e.g., Solanaceae, Linaceae).

- Basal does not divide further and the suspensor, if present, is derived from the apical cell - Caryophyllad type (e.g., Caryophyllaceae, Crassulaceae).

- Basal cell and apical cell both divide and contribute to formation of the embryo - Chenopodiad type (Chenopodiaceae, Boraginaceae).

Question Hours

1) The stage of the development of cotyledons in embryo is ..... .
ii) The fertilised embryo is located at the ..... end of the embryo sac.
iii) The division of the zygote by traverse wall results in formation of small ..... cell and large ..... cell.
iv) In Loranthaceae and Piperaceae, the division of the zygote is ..... .
v) Root cap and root apex are formed from .....
vi) Organogenesis or differentiation of organs begins in the ..... stage of the proembryo.
vii) ..... is the study of the development of embryo from a zygote.

i) ..... cell forms the entire embryo.
ii) The basal cell undergoes a series of transverse divisions to form a structure called ..... .
iii) The ..... stage is crucial stage in embryo development and regulates many morphogenetic processes.
iv) The uppermost cell of the suspensor gets specified as .....
v) ..... surrounds the embryo and provides it with nutrition during its development.

Define the followings

1) Dermatogen
ii) Histogenesis
iii) Suspensor