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Lecture no. 21

Embryo in Flowering Plants: Structure, Types and Development

Embryogeny is the sum total of changes that occur during the development of a mature embryo from a zygote or oospore.

Embryogeny in Dicots:

In a typical dicot (Fig. 2.30) the zygote elongates and then divides by a transverse wall into two unequal cells (Schulz and Jensen, 1969).

The larger basal cell is called suspensor cell. The other towards the antipodal end is termed as terminal cell or embryo cell. The suspensor cell divides transversely a few times to produce a filamentous suspensor of 6-10 cells. The suspensor helps in pushing the embryo in the endosperm.

The first cell of the suspensor towards the micropylar end becomes swollen and functions as a haustorium. The haustorium has wall ingrowths similar to transfer cells (Schulz and Jensen, 1969). The last cell of the suspensor at the end adjacent

to the embryo is known as hypophysis. Hypophysis later gives rise to the radicle and root cap.

The embryo cell undergoes two vertical divisions (quadrant stage) and one transverse division to form eight cells arranged in two tiers (octant stage) epibasal (terminal) and hypobasal (near the suspensor). The epibasal cells eventually form the two cotyledons and the plumule. The hypobasal cells produce the hypocotyl except its tip.

The eight embryonic cells or octants divide periclinally to produce an outer layer of protoderm or dermatogen. The inner cells differentiate further into procambium (= plerome) and ground meristem (= periblem). Protoderm forms epidermis, procambium gives rise to steal or vascular strand and ground meristem produces cortex and pith.

Initially the embryo is globular and undifferentiated. Early embryo with radial symmetry is called proembryo. It is transformed into embryo with the development of radicle, plumule and cotyledons.

Two cotyledons differentiate from the sides with a faint plumule in the centre. At this time the embryo becomes heart-shaped. The rate of growth of the cotyledons is very high so that they elongate tremendously while the plumule remains as a small mound of undifferentiated tissue.

Structure of Dicot Embryo:

A typical dicotyledonous embryo (Fig. 2.30 H) consists of an embryonal axis and two cotyledons. The part of embryonal axis above the level of cotyledons is called epicotyl. It terminates with the stem tip, called plumule (future shoot). The part

below the level of cotyledons is called hypocotyl which terminates in the root tip called radicle (future root). The root tip is covered with a root cap (calyptra).

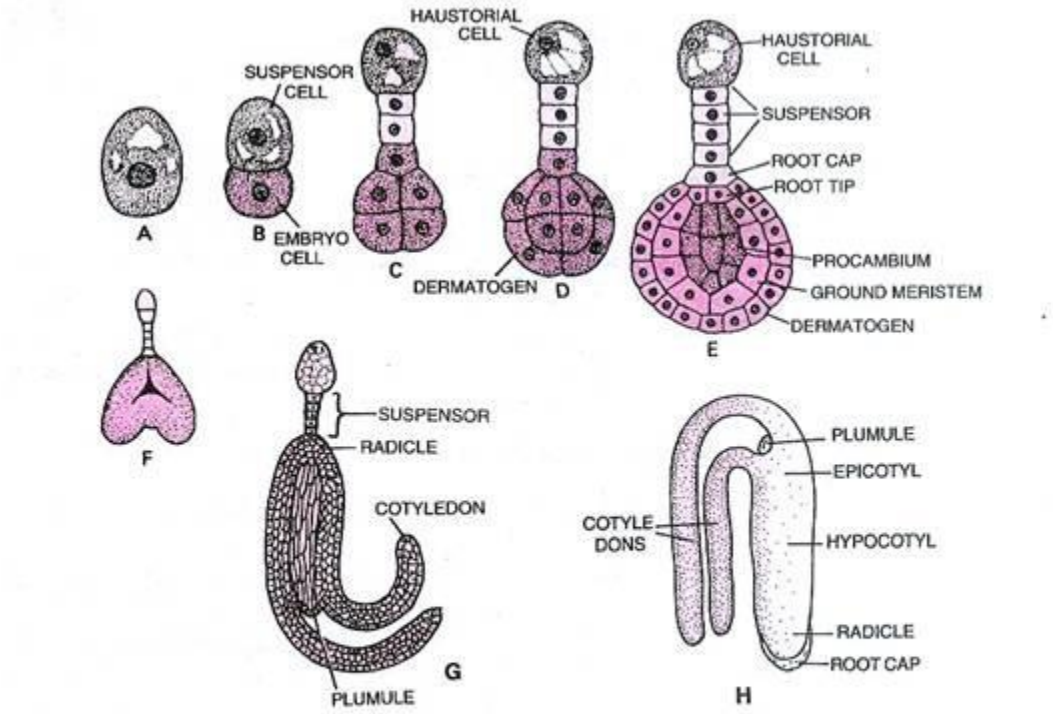


Fig. 2.30. Stages in the development of a dicot embryo. A, Zygote or oospore. B, Division of zygote into suspensor and embryo cells. C, Formation of suspensor and embryo octant. D, Periclinal divisions of embryo octants to form outer dermatogen. E, Globular embryo showing regions of radicle, procambium,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

In Capsella bursa-pastoris, the elongating cotyledons curve due to the curving of the ovule itself. With the growth of embryo, the ovule enlarges. Its integuments ultimately become hard to form protective coverings.

Now the embryo undergoes rest and the ovule gets transformed into seed. In some plants the embryo remains in the globular or spherical form even at the time of seed shedding without showing any distinction of plumule, radicle and cotyledons, e.g., Orobanche, Orchids, Utricularia.

(b) Embryogeny in Monocots:

The zygote or oospore elongates and then divides transversely to form basal and terminal cells. The basal cell (towards micropylar end) produces a large swollen, vesicular suspensor cell. It may function as haustorium. The terminal cell divides by another transverse wall to form two cells.

The top cell after a series of divisions forms plumule and a single cotyledon. Cotyledon called scutellum, grows rapidly and pushes the terminal plumule to one side. The plumule comes to lie in a depression.

The middle cell, after many divisions forms hypocotyl and radicle. It also adds a few cells to the suspensor. In some cereals both plumule and radicle get covered by sheaths developed from scutellum called coleoptile and coleorhiza respectively.

Structure of Monocot Embryo:

The embryos of monocotyledons (Fig. 2.31 H) have only one cotyledon. In grass family (Gramineae), this cotyledon is called scutellum. It is situated towards lateral side of embryonal axis. This axis at its lower end has radicle and root cap enclosed in a sheath called coleorhiza.

The part of axis above the level of attachment of scutellum is called epicotyl. It has as shoot apex and few leaf primordia enclosed in a hollow foliar structure called coleoptile. Epiblast represents rudiments of second cotyledon.

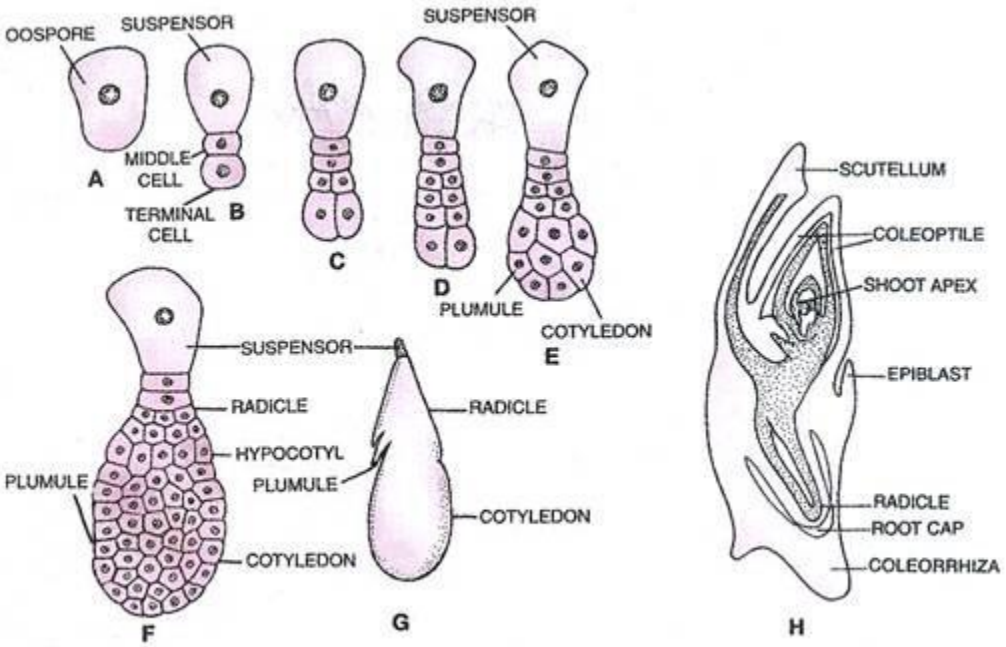
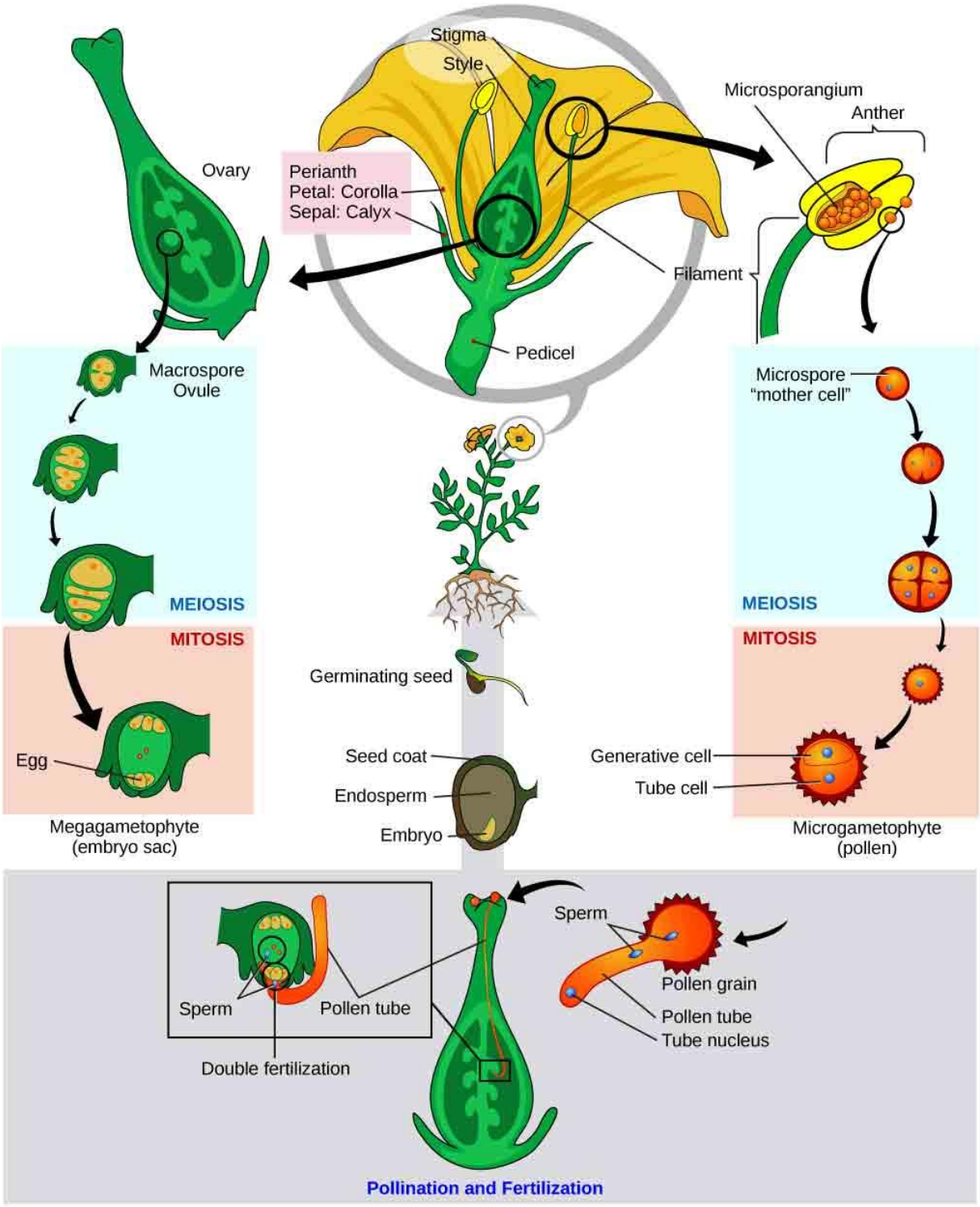


Fig. 2.31. A–G; Stages in development of a monocot embryo. H, a monocot embryo of a grass.



This Fig shows entire process of microspore and megaspore development and the process of Fertilization (not drawn in the exams, only for the proper knowledge.).