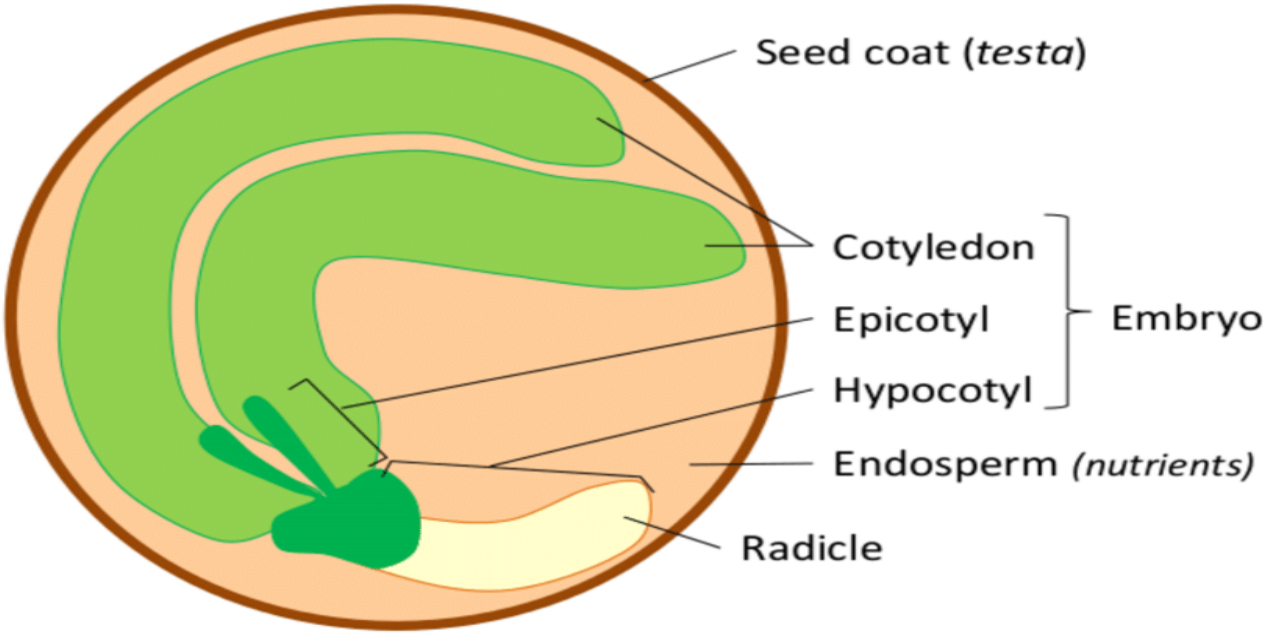
For B.Sc. Part II (Sub.) Group B (Anatomy and Embryology)

PLANT EMBRYO



Presented by:
Dr. Ankit Kumar Singh
Assistant Professor
Department of Botany
Marwari College
Lalit Narayan Mithila University
Darbhanga
ankitbhu30@gmail.com

Lecture No.38

Embryo

- In Angiosperm , after fertilization Zygote undergoes in resting phase. When the endosperm is formed, development of zygote starts. In the beginning it absorb food from the endosperm and increase in size then after a layer secreted by itself. Now it is called **Oospore.**
- Both dicotyledons and monocotyledons begin embryo development in the same way but, there is considerable difference in later differentiation.
- In all angiosperms the zygote divides to develop a two-celled proembryo.
- In most plants the first wall between the two cells is transverse while only in a few cases the first wall is more or less vertical (Piperad type).
- Among the two cells the one near the micropyle is termed the **basal cell** while the one pointing towards the centre of the embryo sac is called the **apical** or **terminal cell**.

➢ From this two celled stage till the differentiation of organs the embryo is called **proembryo.**

➢The diversity in the embryogeny of dicotyledons and monocotyledons is largely due to further development of the basal and apical cell.

➢ Fertilized egg or zygote is the mother cell of sporophytic generation. It gives rise to an embryo by a number of predetermined divisions.

➢The process of development of embryo from the zygote is called embryogenesis.

➢The dicotyledonous embryo has two cotyledons attached to an embryonal axis. The terminal part of the axis above the level of cotyledons, is known as epicotyl and it form the plumule.

➢The part of the embryonal axis below the levels of cotyledons is called hypocotyl and it develops into radical.

➢The development and structure of monocotyledonous embryo is different from that of dicotyledonous embryo as it has only single cotyledon.

Development of Embryo in Dicotyledons

➢ In most of the dicotyledons the apical cell of the two- celled proembryo divides longitudinally or transversely and basal cell remain undivided or further divide transversely.

➢ On the basis of cellular configuration of the embryo at four celled stage and part played by each of these cell in organogenic development, Schnarf (1929), Johansen (1945) and Maheshwari (1950) have recognized five types of embryo development in dicotyledons.

1. The terminal cell of the two-celled pro-embryo divides by longitudinal wall.

(i) Crucifer type:

Basal cell plays little or no role in the development of the embryo.

(ii) Asterad type:

Basal and terminal cells play an important role in the development of the embryo.

II. The apical or terminal cell of the two-celled proembryo divides by a transverse wall,

(a) Basal cell plays a little or no role in the development of the embryo.

(i). Solanad type:

Basal cell usually forms a suspensor of two or more cells.

(ii). Caryophyllod type:

Basal cell does not divide further and the suspensor if present is always derived from the terminal cell.

This type of embryo is found in Crassulaceae, Caryophyllaceae, etc.

(b) Chenopodiad type:

Both basal and terminal(apical) cells take part in the development of the embryo.

e.g. Chenopodiaceae and Boraginaceae, etc.

Development of dicot embryo (Crucifer or onagrad type)

✓The embryogeny of *Capsella bursa-pastoris* has been extensively studied.

✓ It is a classixcal example of dicotyledonous embrogeny.

✓The zygote divides transversely forming two cells, a **apical cell** and **basal cell**. The cell towards the micropylar end of the embryo sac is the **suspensor** cell (i.e., basal cell) and the other one makes to the **embryo** cell (i.e., apical cell). The terminal cell by subsequent divisions gives rise to the embryo while the basal cell contributes the formation of suspensor.

✓ The apical cell divides by a vertical division forming a 4-celled 1-shaped embryo.

✓ In certain plants the basal cell also forms the hypocotyl (i.e., the root end of the embryo) in addition of suspensor.

✓The terminal cells of the four-celled pro-embryo divide vertically at right angle to the first vertical wall forming four cells.

✓ Now each of the four cells divides transversely forming the octant stage (8-celled) of the embryo.

✓The four cells next to the suspensor are termed the hypo-basal or posterior octants while the remaining four cells make the epibasal or anterior octants.

✓The epibasal octants give rise to plumule and the cotyledons, whereas the hybobasal octants give rise to the hypocotyl with the exception of its tip.

✓ Now all the eight cells of the octant divide periclinally forming outer and inner cells.

✓The outer cells divide further by anticlinal division forming a peripheral layer of epidermal cells, the dermatogen.

✓The inner cells divide by longitudinal and transverse divisions forming periblem beneath the dermatogen and plerome in the central region.

✓ The cells of periblem give rise to the cortex while that of plerome form the stele.

✓At the time of the development of the octant stage of embryo the two basal cells divide transversely forming a 6-10 celled filament, the suspensor which attains its maximum development by the time embryo attains globular stage. The suspensor pushes the embryo cells down into the endosperm.

✓The distal cell of the suspensor is much larger than the other cells and acts as a haustorium. The lowermost cell of the suspensor is known as hypophysis.

✓ By further divisions, the hypophysis gives rise to the embryonic root and root cap.

✓ With the continuous growth, the embryo becomes heart-shaped which is made up of two primordia of cotyledons. The mature embryo consists of a short axis and two cotyledons. Each cotyledon appears on either side of the hypocotyl. In most of dicotyledons, the general course of embryogenesis is followed as seen in *Capsella bursa-pastoris*.

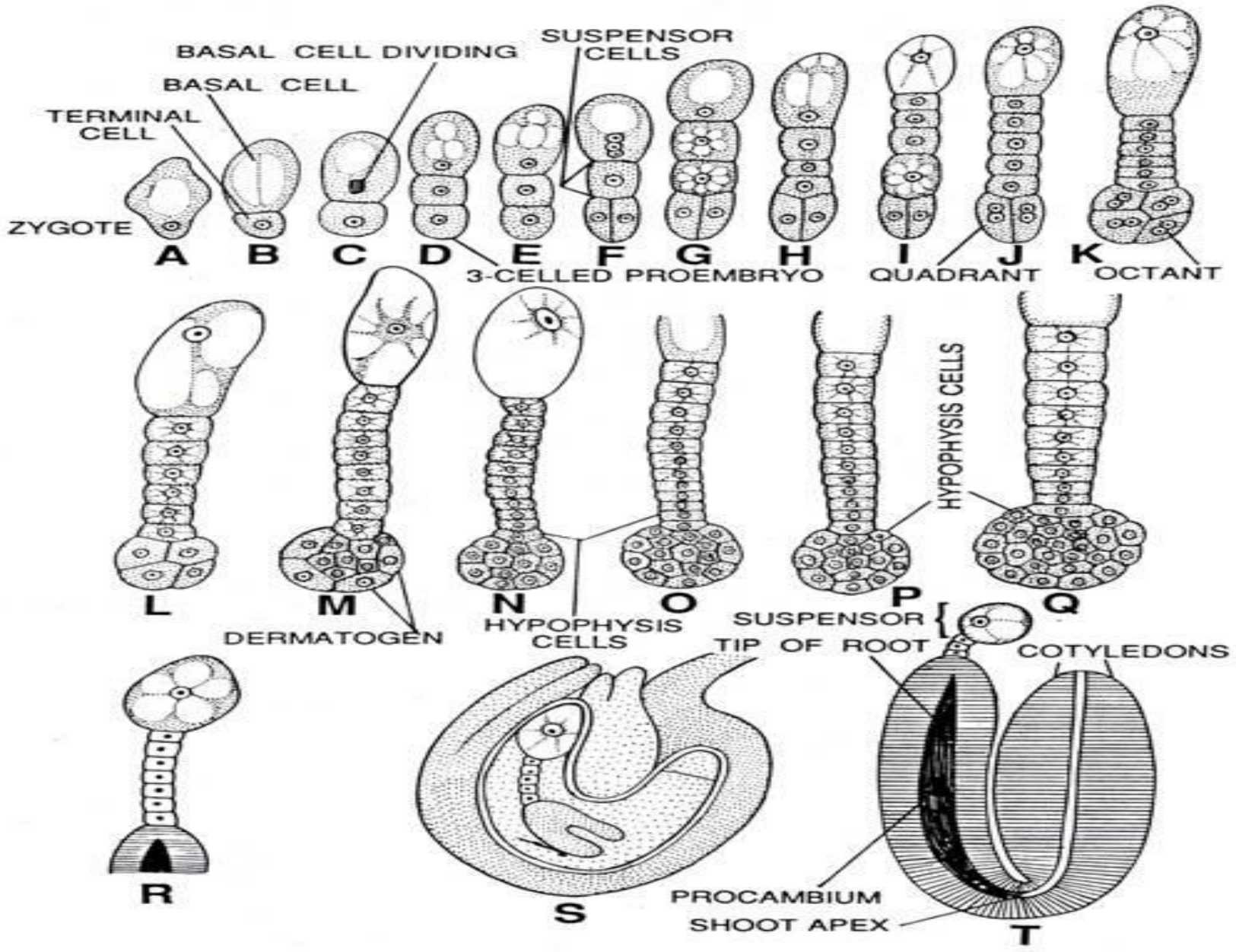


Figure: Stages in the development of typical dicot embryo in *Capsella bursa-pastoris*

Development of monocotyledonous Embryo

✓ In monocotyledonous embryo, the embryonal axis has a single cotyledon at it apex in contrast to dicotyledons where two cotyledons occupy lateral position.

✓Due to this organographic difference the two types of embryo can be easily distinguished.

✓ There is no significant difference between the monocotyledons and the dicotyledons regarding the early cell divisions of the proembryo, but the mature embryos are quite different in two groups.

✓ Here the embryogeny of *Sagittaria sagittifolia* has been considered one of the examples.

✓The zygote divides transversely forming the terminal(apical) cell and the basal cell. The basal cell, which is the larger and lies towards the micropylar end, does not divide again but becomes transformed directly into a large vesicular cell. The terminal cell divides transversely forming the two cells. of these, the lower cell divides vertically forming a pair of juxtaposed cells, and the middle cell divides transversely into two cells.

✓In the next stage, the two cells once again divide vertically forming quadrants. The cell next to the quadrants also divides vertically and the cell next to the upper vesicular divides several times transversely.

✓ The quadrants now divide transversely forming the octants, the eight cells being arranged in two tiers of four cells each.

✓ With the result of periclinal division, the dermatogen is formed.

✓ Later the periblem and plerome are also differentiated. All these regions, formed from the octants develop into a single terminal cotyledon afterwards.

✓ The lowermost cell L of the three-celled suspensor divides vertically to form the plumule or stem tip.

✓The cells R form radicle.

✓The upper 3-6 cells contribute to the formation of suspensor.

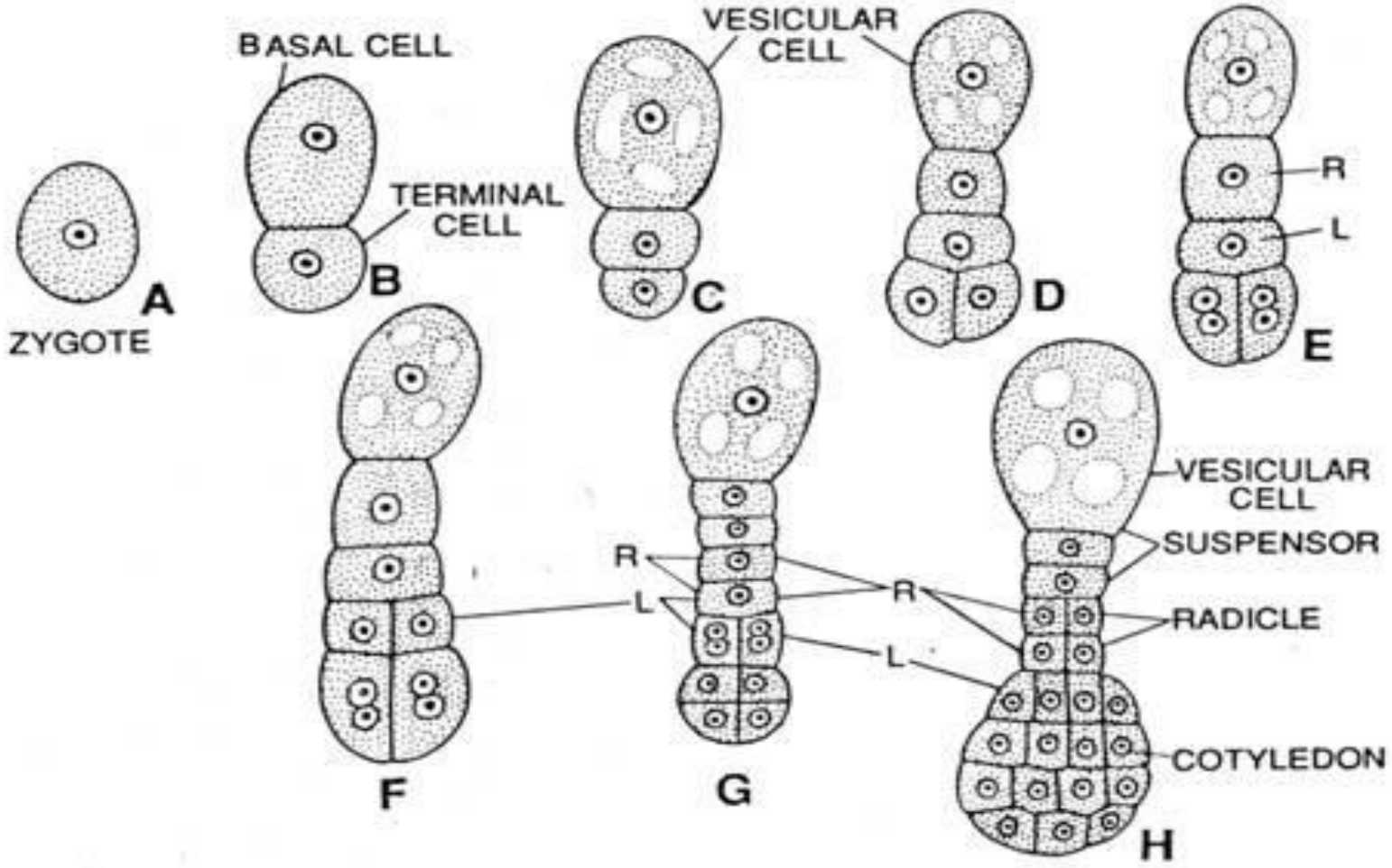


Figure: Stages in the development of monocot embryo in *Sagittara.*

Dr. Ankit Kumar Singh
Assistant Professor
Department of Botany
Marwari College
Lalit Narayan Mithila University
Darbhanga
ankitbhu30@gmail.com

Thank You!!!