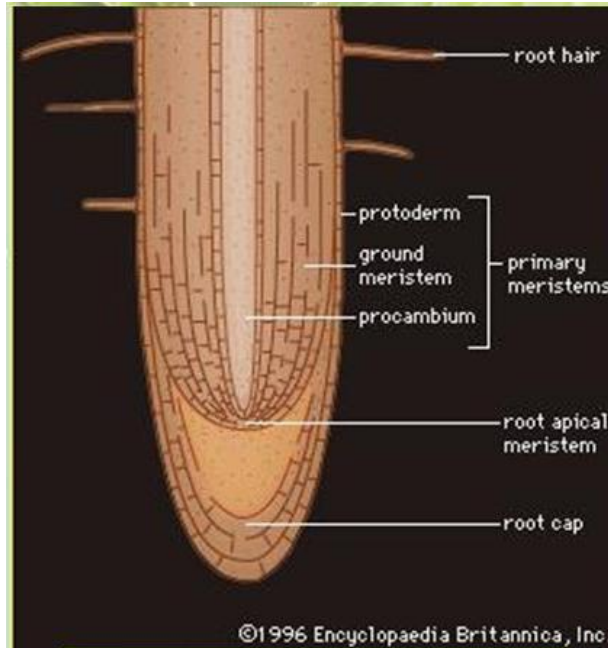




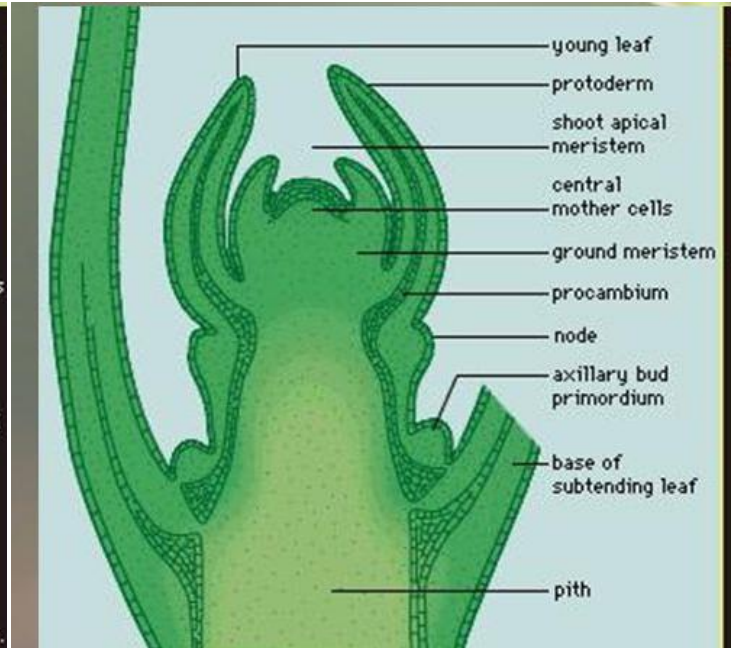
Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. II- Root-Shoot Apical Meristem



Root Meristem



Shoot Meristem

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Plant Tissues

- Collection of cells that are alike in structure, region and function
- From the study point of view, the tissues may be grouped into three principal groups;
 - a) Meristematic tissues
 - b) Permanent tissues
 - c) Secretory tissues

Meristem/ Meristematic tissues

- Meristem is a ‘Geek word Meristosis’ meaning to divide.
- A meristemic tissue consists of a group of cells which remain in a continuous state of division or they retain their power of division.



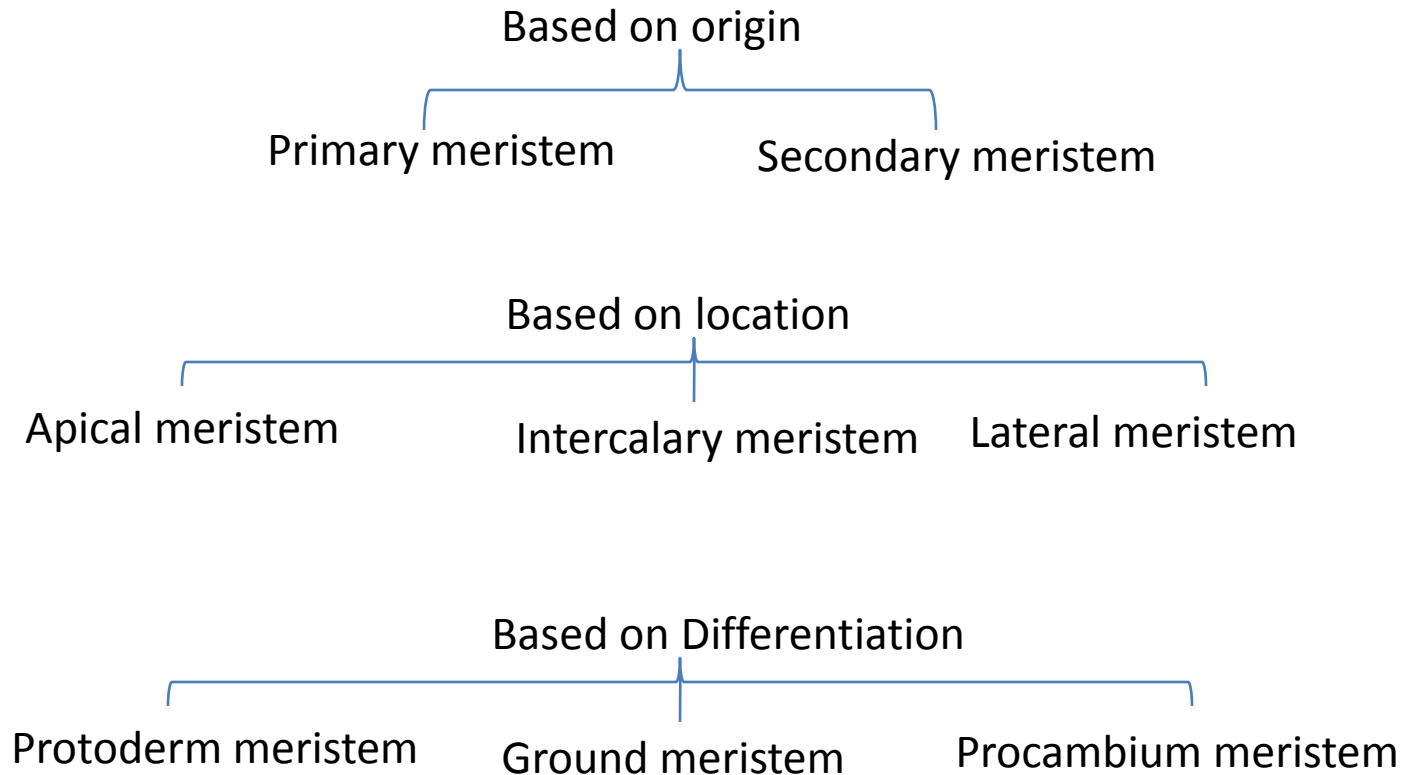
Meristem

Characteristic of Meristem

- Composed of immature cells which are state of division and growth.
- Cells are rounded, oval or polygonal in shape.
- Cells are always living and thin walled.
- Each cells has abundant cytoplasm and one or more nuclei.
- Nuclei are may quite small or absent.
- The cells are capable of regular, continuous mitotic division.

Classification of Meristem

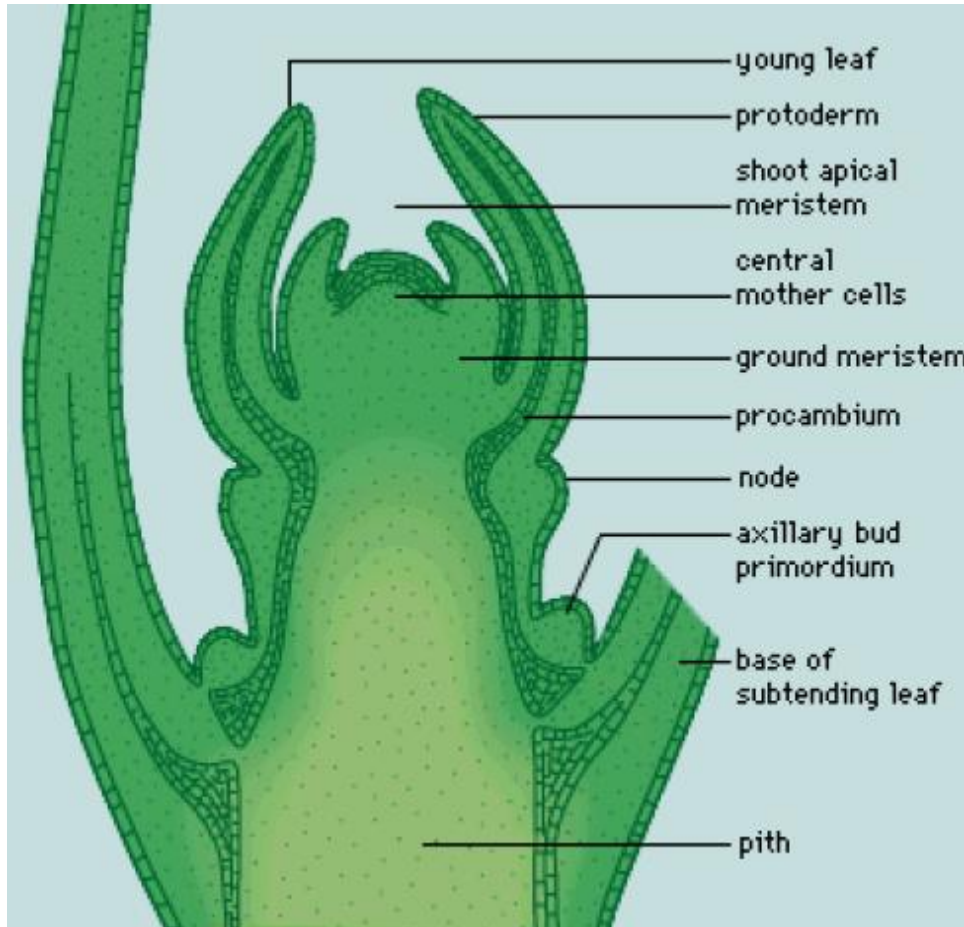
- The meristematic tissue is classified on the basis of origin, location in the plant body and differentiation.



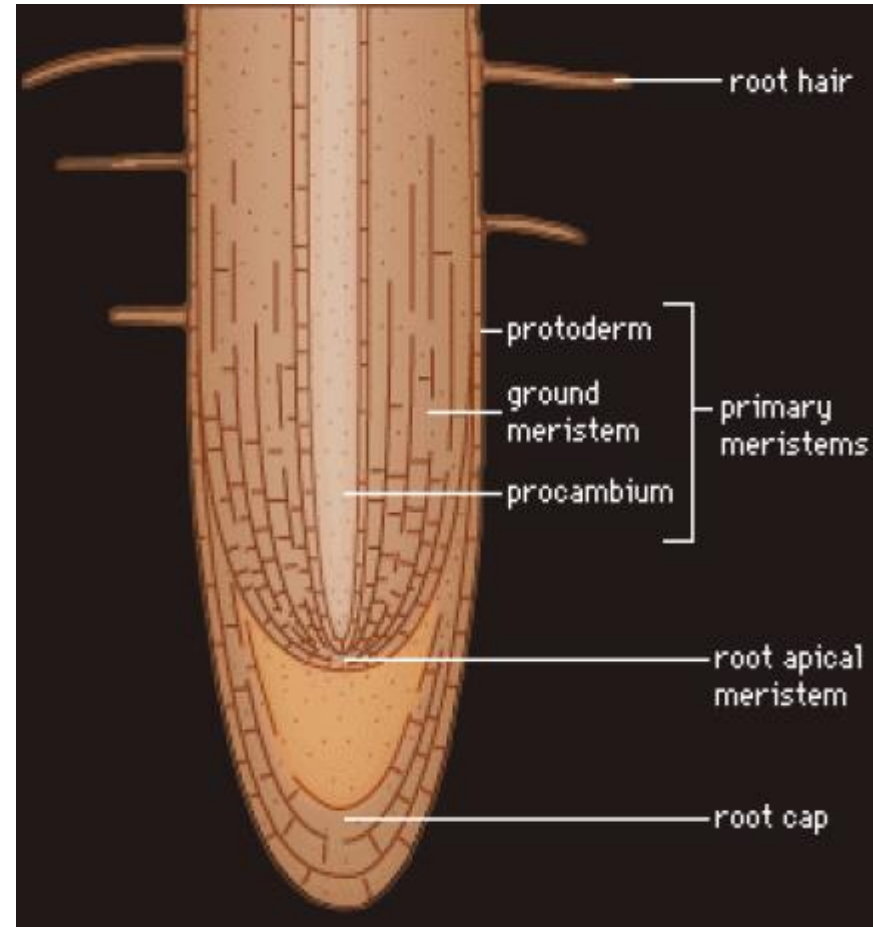
Apical Meristem

- It is the meristem present at the tip of the root and stem, commonly called as root apex and shoot apex respectively
- Such meristems constitute the actively growing regions in the plant body.
- Due to the activity of apical meristem the plant body keeps increasing in its length.

Shoot and Root Apical Meristem

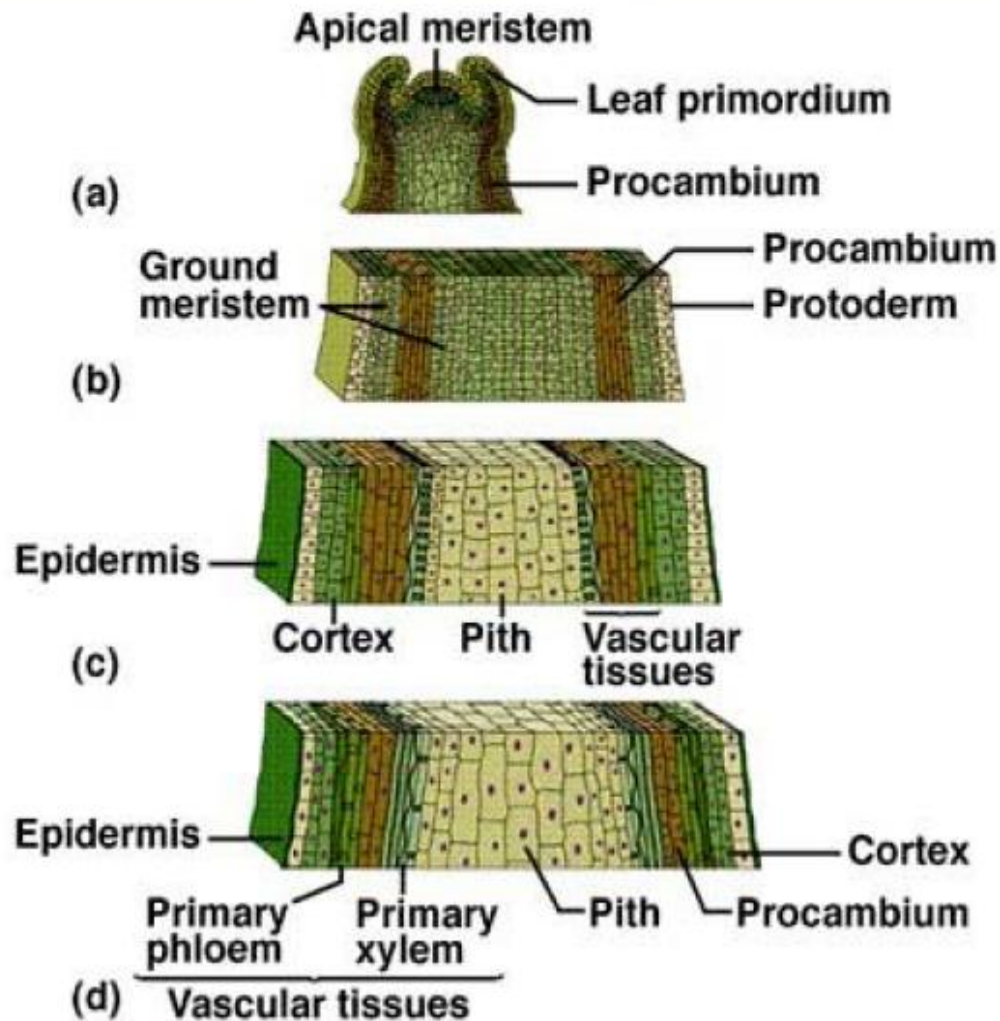


Shoot apical meristem



Root apical meristem

Shoot Apical Meristem



Tissue zones in shoot apical merstemi

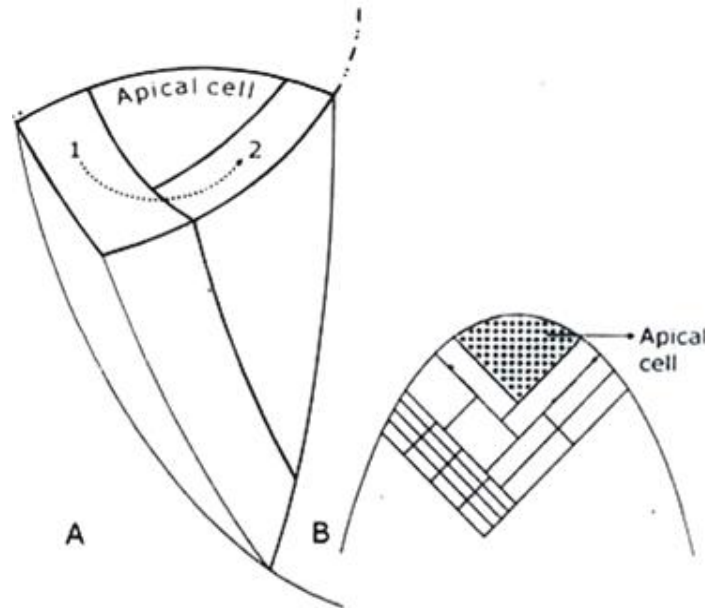
•Three zones are-

- a) Protoderm- gives rise to the epidermis of the plant.
- b) Procambium- gives rise to vascular tissue (xylem and phloem)
- c) Ground meristem- give rise to endodermis, pericycle, cortex, medulla and pith

Theories for organization of shoot apical

□ Apical cell theory (Nageli- 1944)

- According to this theory the apical meristem consists of a single apical cell (also called apical initial) and this cell is interpreted as the ‘structural and functional unit of apical meristem’. The cell is very large and is shaped like an inverted pyramid.
- The apical cell is tetrahedral in shape and has three or four cutting faces among which single face is directed upward and the rest points downward. The side of apical cell that is directed upward is triangular or square in shape and forms a part of the outer surface of the shoot apex



□ Histogen Theory (Nageli- 1944)

- Hanstein in 1868 put forward histogen theory (histogen means tissue builder).
- According to this theory the tissues of a plant body originate from a mass of meristem where the following three (histogens) can be distinguished-
- (a) Dermatogen: It is the outermost layer of the meristem. **It gives rise to epidermises of root and stem.**
- (b) Periblem: This region occurs internal to dermatogen but peripheral to plerome. This histogen is destined to **form cortex of root and shoot and inner tissues of leaves.** It surrounds plerome.
- (c) Plerome: This region gives **rise to vascular cylinder of stem and root including pith.** It is the central core of stem and root and the cells composing this zone are very irregular. This region is enveloped by a variable number of mantle-like layers which are represented by dermatogen and periblem

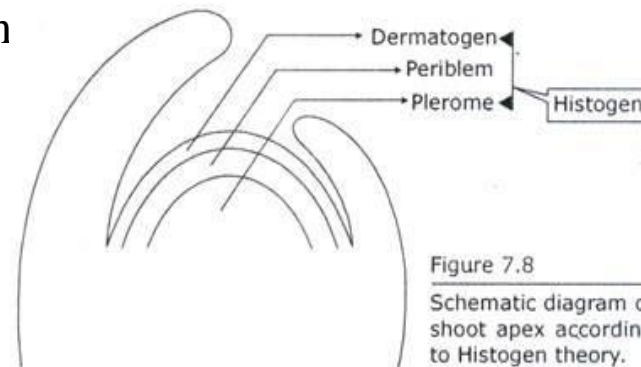


Figure 7.8
Schematic diagram of shoot apex according to Histogen theory.

□Tunica-Corpus Theory:

▪Schmidt in 1924 postulated tunica- corpus theory on the basis of studies of shoot apices of angiosperm. This theory is concerned with planes of cell division in the apex. In contrast to apical cell theory and histogen theory tunica-corporus theory is applicable only to shoot apex and not to root. Schmidt distinguishes two tissue zones in the shoot apex and termed them as tunica and corpus.

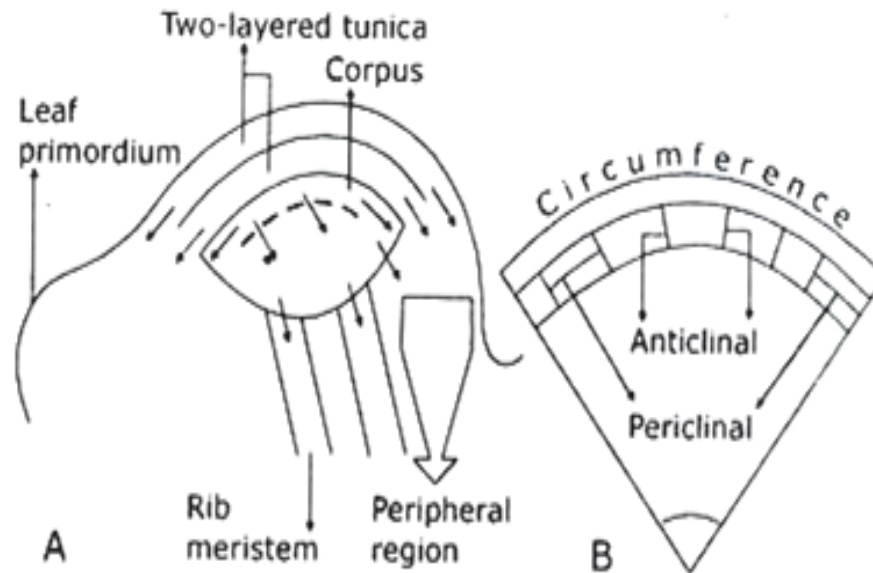
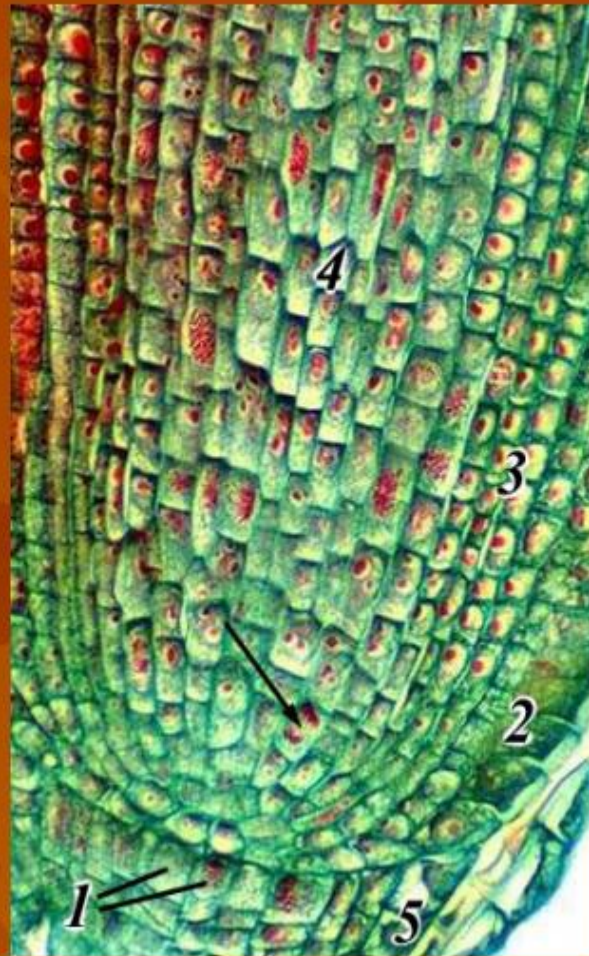


Diagram of shoot apex based on Tunica-Corpus theory

- Tunica is the peripheral tissue zone of shoot apex. It consists of one or more peripheral layers of cells. Dicotyledons exhibit one to five layers of cells in tunica; two layers of cells are represented by largest number of species.
- Corpus is the inner tissue zone of shoot apex. It consists of cells that are several cell layers deep. Tunica overarches corpus. Meristematic tissues composing this zone are larger than tunica.

Root Apical Meristem

1. Root cap initials
2. Protoderm
3. Ground meristem
4. Procambium
5. Root cap



Tissue zones in shoot apical merstemi

- Four important zones are-

- a) Root cap initial- gives rise to root cap

- b) Protoderm- gives rise to the epidermis of the plant.

- c) Procambium- gives rise to vascular tissue (xylem and phloem)

- d) Ground meristem- give rise to endodermis, pericycle, cortex, medulla and pith

Theories for organization of root apical

▪ 1. Apical Cell Theory (Nageli):

- This theory was proposed by Nageli who drew the attention to the occurrence of a single apical cell or apical initial that composes the root meristem.
- A single apical cell is present only in vascular cryptogams, e.g. Equisetum, Adiantum and Polypodium etc. The apical initial is tetrahedral in shape and generates root cap from one side.
- The other three sides donate cells to form epidermis, cortex and vascular cylinder.
- In other words all tissues that compose a mature root including root cap are the derivatives of a single apical cell.

▪ 2. Histogen Theory:

- Hanstein in 1868 advocated the theory. According to Hanstein root apical meristem consists of three cell-initiating regions called histogens.
- The histogens are called dermatogen, periblem and plerome that respectfully form epidermis, cortex and vascular cylinder that are present in a mature root.

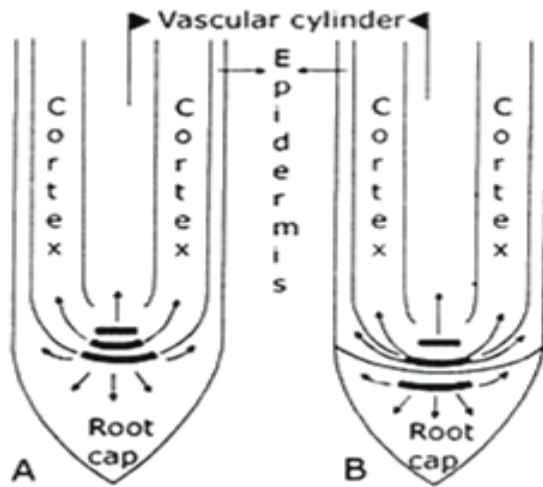


Diagram of root apex based on Histogen theory

▪ Histogen theory explains both root and shoot apical meristem. This theory attributes specific destinies to the derivatives of the three histogens. Though histogen theory is abandoned to explain shoot apex, Eames and MacDaniels illustrated the root apical meristem on the basis of histogen concept.

3. Korper-Kappe Theory:

▪ This theory of root meristem was proposed in 1917 by Schiepp who regarded the occurrence of two systems of cell seriation that characterize the root apex with reference to planes of cell division in its parts.

▪ Korper-kappe concept is also referred to as body-cap concept (Korper = body and kappe = cap) and the concept illustrates distinct type of cell wall pattern formation during cell division. The body-cap concept is illustrated below on analyzing the divisions in the derivatives of apical cell

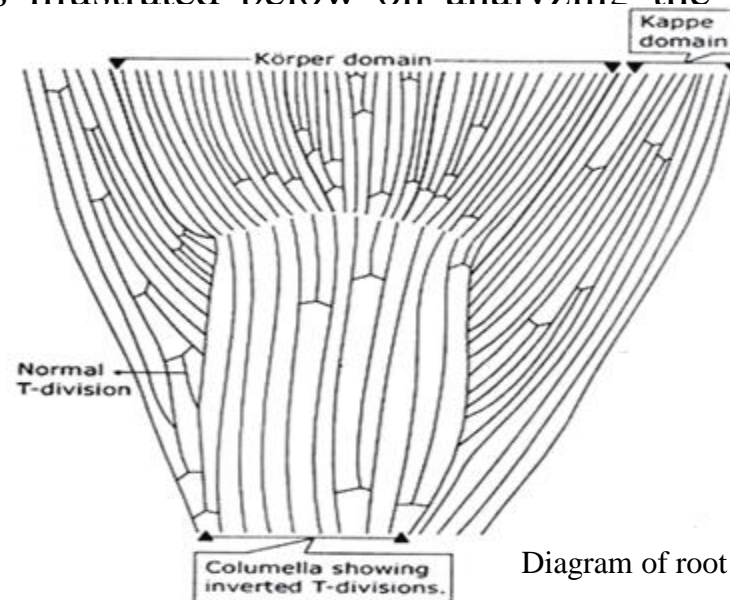


Diagram of root apex based on Korper-kappe theory

THANK YOU