

# Developmental Anatomy

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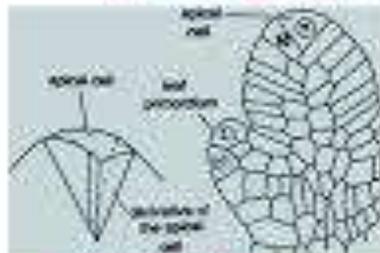
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## Organization of shoot apex

- Different theories have been put forward to explain the zonation of the shoot apices
- **1. Apical Cell theory** (Nageli,1858)- A single solitary cell has been found to form the growing point. But the presence of complex growing apices in higher plants cannot be explained by this theory.
- **2. Histogen theory** ( Hanstein,1868)- the major histogens(tissue builder) of stem and root are
  - 1. Dermatogen- gives rise to epidermis
  - 2.Plerome- vascular bundles
  - 3.Periblem- cortex
- These layers are not distinguished and have no morphological significance.

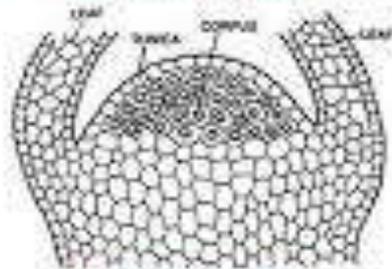
## Theories explaining Apical Meristem



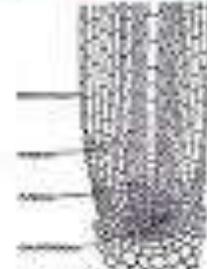
Apical cell theory



Histogen theory



Juncea Corpus theory



### 3. Tunica Corpus Theory

- Schmidt (1924) proposed this theory.
- The shoot apex can be differentiated into two regions
- A central core(corpus) with large cells dividing irregularly to result in volume growth.
- It is surrounded by an outer envelope( one to many layered) called the tunica. Tunica cells are smaller and divide mainly anticlinally (perpendicular to the surface)to result in surface growth.

## Cyto-histologic zonation



- Observed also in many angiosperms

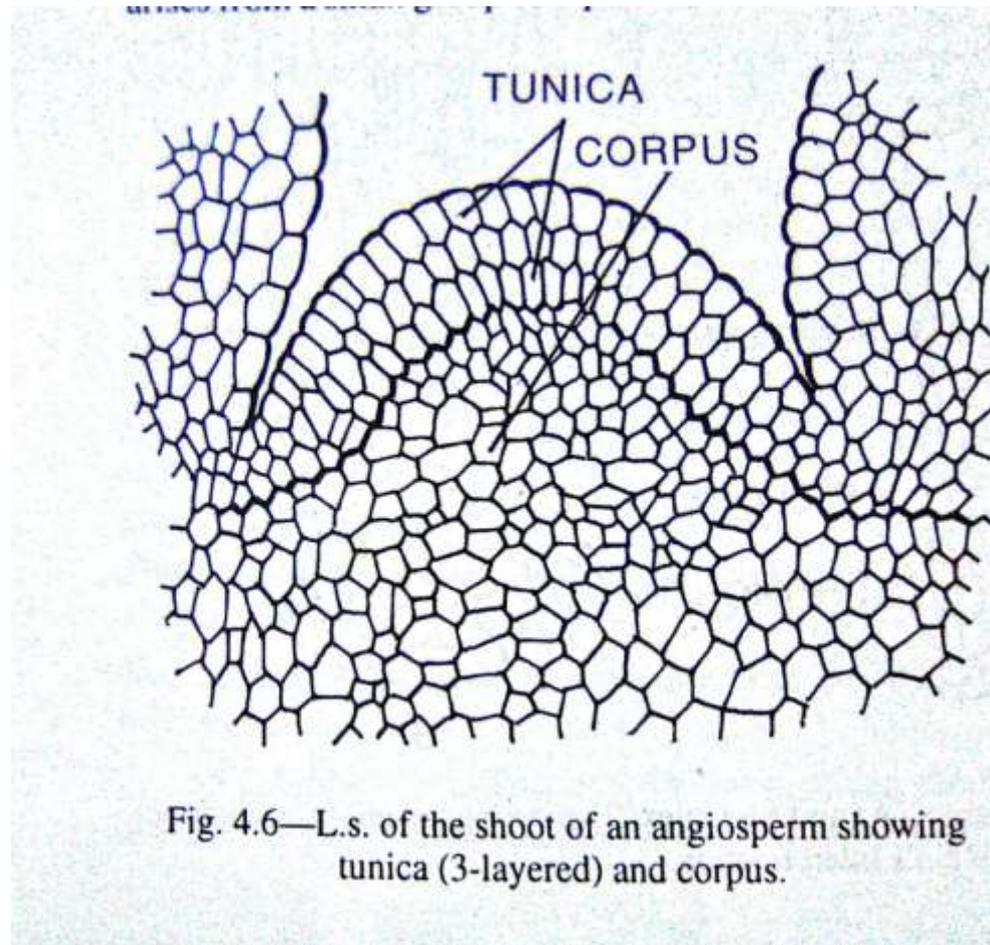


Fig. 4.6—L.s. of the shoot of an angiosperm showing tunica (3-layered) and corpus.

## Organization of Root apex

- This theory was given by Schuepp( 1917) and supported by Clowes(1961). This theory is similar to Tunica- Corpus theory of shoot apex and is based on differences in the planes of cell division.
- The cells in the root apex divide in a pattern which is termed T divisions.
- The outer region of the root apex constitute the Kappe. The cells of Kappe divide first transversely and next the lower daughter cell only divides longitudinally.
- Thus the planes of 2 divisions form a T in a L.S. of the root apex.
- The inner region forms the Korper and here the T gets inverted. As a result the longitudinal division of the upper daughter cell.

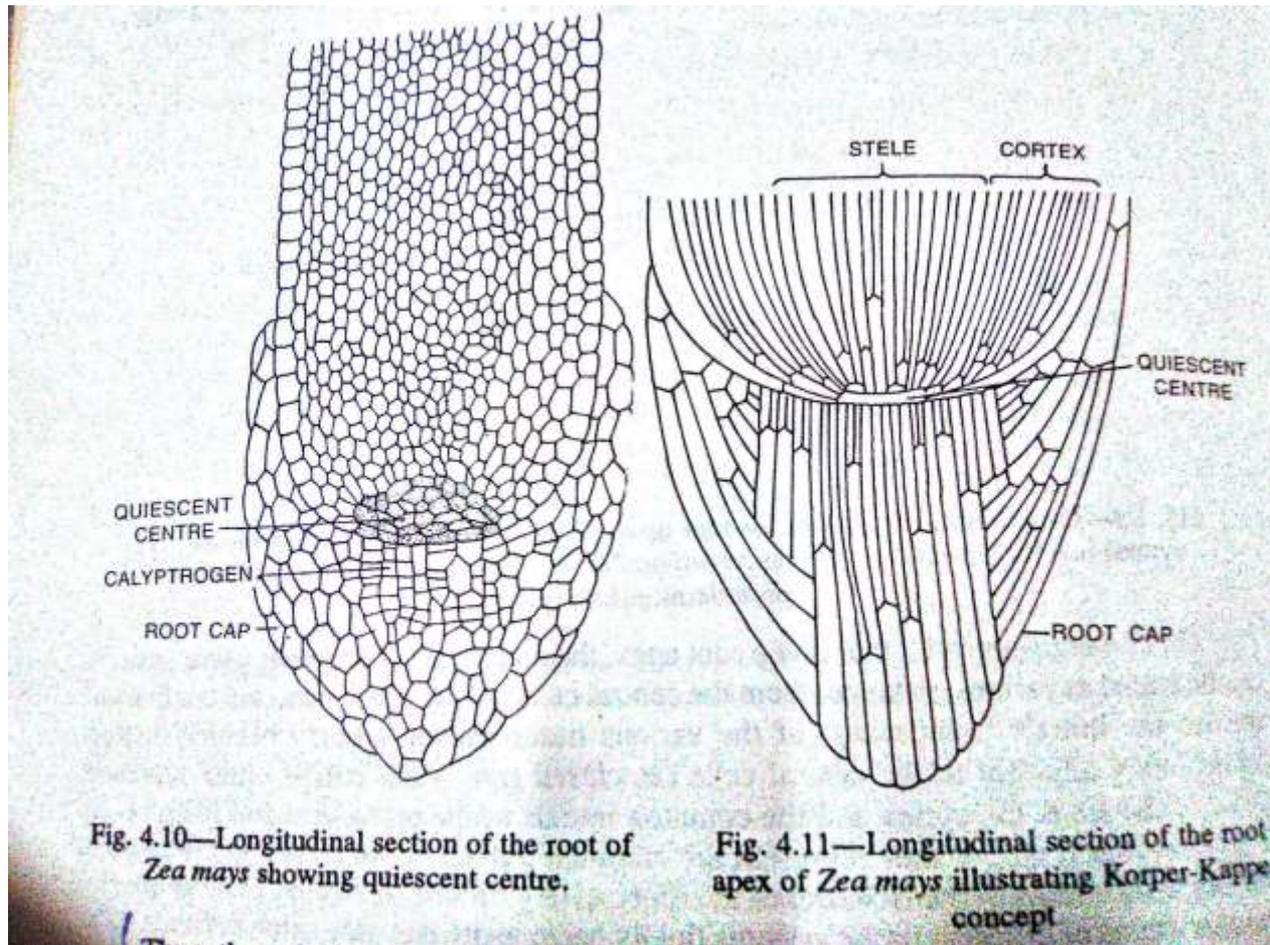


Fig. 4.10—Longitudinal section of the root of *Zea mays* showing quiescent centre.

Fig. 4.11—Longitudinal section of the root apex of *Zea mays* illustrating Korper-Kappe concept

- It is noted in the members of Gramineae and Fagaceae.
- Thus, the apical meristems of roots are discussed on the basis of 3 concepts
- 1. Histogen concept
- 2. Korper –Kappe concept
- 3. **Quiescent centre** of Clowes-
- On the root apex of *Zeamays* , Clowes(1961) showed a group of cells which appear in the shape of a hemisphere or a disc b/w the root cap and active meristematic zone. These cells have a very low mitotic activity and synthesize DNA slowly. These cells are called **quiescent centre**.
- Function- These cells divide during formation of secondary roots, cells below it give rise to root cap.

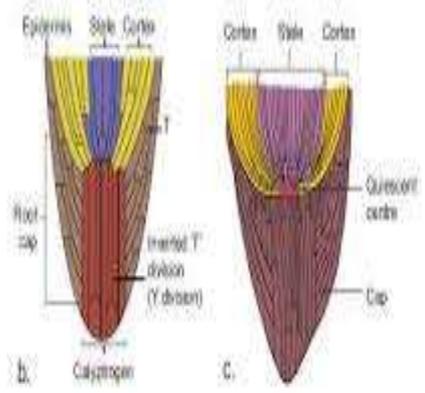
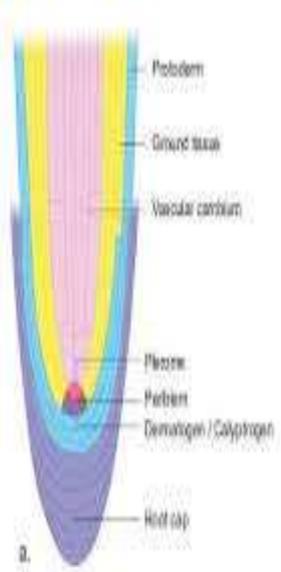


Figure 9.3: Root apical meristem  
 a) Histogen Theory, b) Körperkappe theory,  
 c) Quiescent Centre Concept

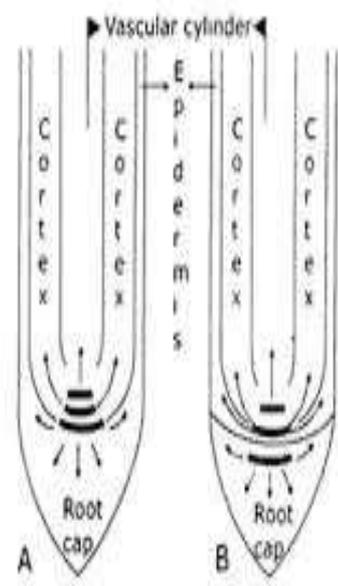


Figure 7.22  
 Schematic diagram of root apex based on Histogen theory. A. Root apex of *Raphanus sativa*. B. Root apex of *Zea mays* where root cap has its own histogen, i.e. Calyptrogen. Broad lines indicate histogens. Arrows indicate the direction of cell formation.

# Plastochrone

- As the tip of a plant shoot grows, new leaves are produced at regular time intervals if temperature is held constant. This time interval is termed the **plastochron** (or **plastochrone**). The **plastochrone index** and the leaf plastochrone index are ways of measuring the age of a plant dependent on morphological traits rather than on chronological age.
- The interval of time between the appearance of successive leaf primordia at the shoot apex or between other similar successive events is called plastochrone.

# Suggested References

- Plant Anatomy by B.P. Pandey
- Plant Anatomy by Pijush Roy
- A Textbook of Botany Vol II by Bhattacharya, Hait, Ghosh
- Studies in Botany Vol I by Mitra, Mitra, Choudhury.
- Plant Anatomy by Fahn