

## Semester II

### CC-3

#### Topic 7. Developmental anatomy: Organization of shoot apex and root apex

## Organization of root apex

### Korper-Kappe Theory:

The theory was put forward by Schuepp (1917). It is similar to the tunica-corpus theory of the shoot apex. It is based on differences in the planes of cell division. 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 analyzing the divisions in the derivatives of apical cell (Fig. 1).

The theory says that the cells in the root apex divide in a pattern called T-divisions. The outer region of the root apex is the Kappe. The cells of this region divide first horizontally. The lower daughter cell then divides longitudinally, i.e. at a right angle to the plane of the first division.

Thus the planes of the two divisions form a T in a median longitudinal section of the root. The inner region of the apex is the Korper. In this region the T is inverted, i.e. the second division takes place in the upper daughter cell. This type of division has been found among the members of Gramineae and Fagaceae.

### Root Apex Meristem

Root apices in angiosperms:

Dicots: Dicot root apices are of the following three types according to the number of initials present:

(a) Common type: This type is found in majority of dicotyledonous plants. In this type, three groups of initials are found at the apex – outer (dermatogen), middle (periblem), and inner

(plerome). The dermatogen forms the epidermis and the cap, the periblem forms the cortex, and the plerome gives rise to the central cylinder.

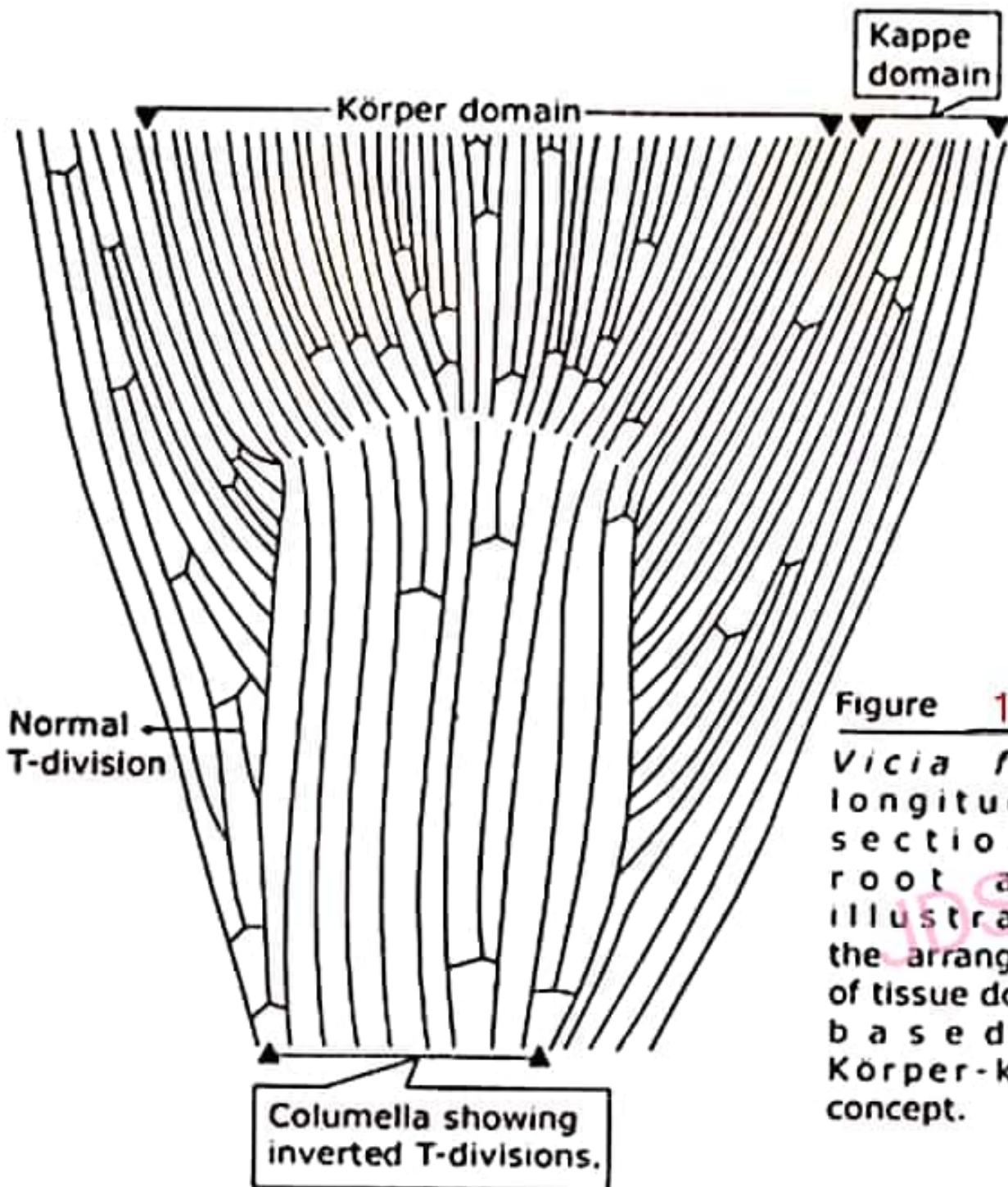
(b) Ranunculus type: The members of Ranunculaceae, Juglandaceae, Salicaceae, Casuarinaceae, Leguminosae etc. exhibit this type of root apex. In this type there is a single row of initials which, ultimately, gives rise to various zones of the root including the root cap. Some of the cells of the root cap differentiate into the epidermis.

(c) Casuarina type: This type of root apex development is evident in the members of the families Proteaceae, Casuarinaceae and in some members of Leguminosae. In this type, generally two rows of initials are observed at the apex. One of the layers gives rise to the stele and the other to the cortex and rootcap.

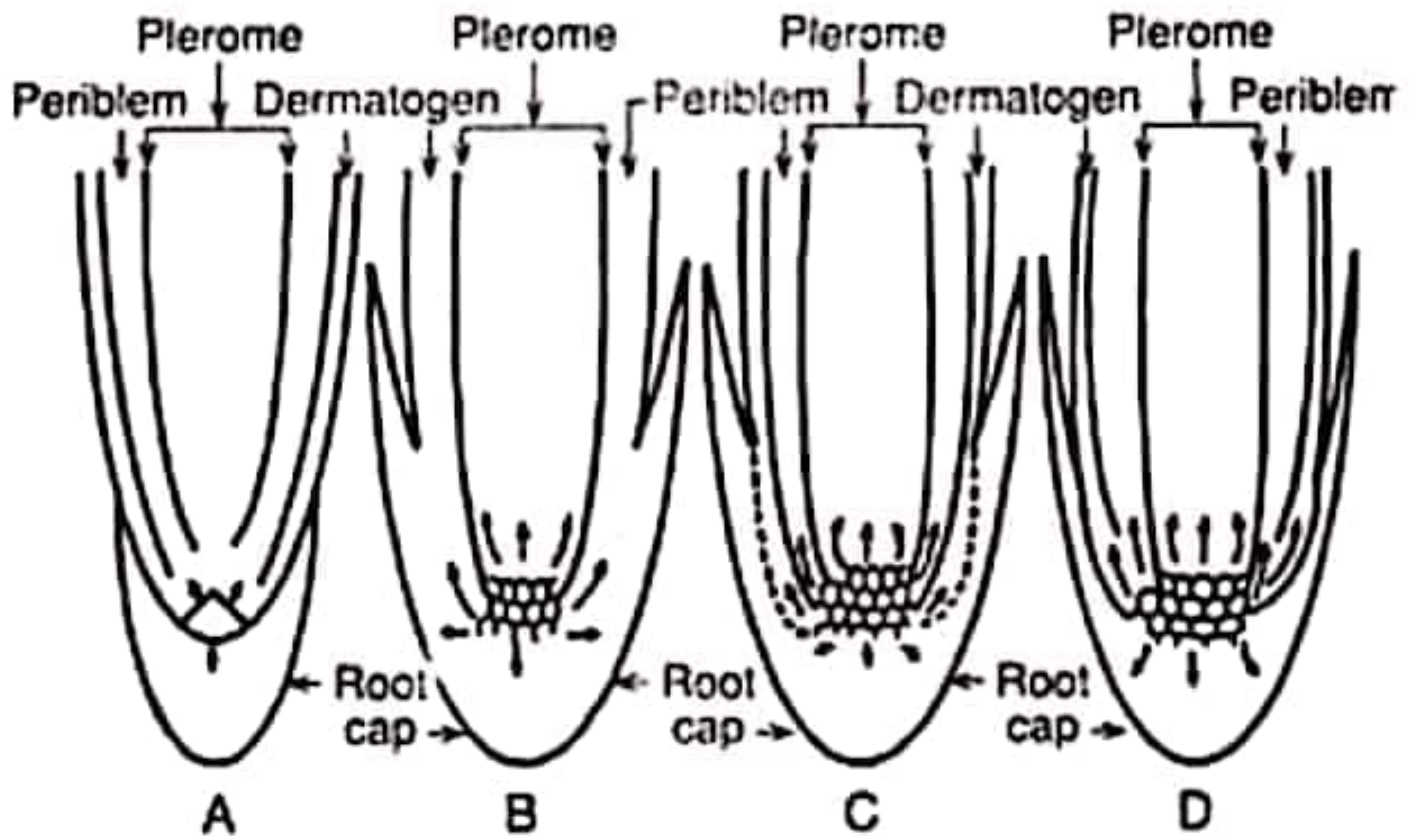
The epidermis develops from the outermost layer of the cortex. In certain members of the families Juglandaceae, Rosaceae, Leguminosae, Tiliaceae etc. one of these two rows of initials gives rise to the stele and the inner cortex, while the other gives rise to outer cortex and the root cap. The epidermis arises from the outermost layer of the cortex.

Monocots: In addition to the above discussed types in dicots there is a fourth type in monocotyledonous plants. The first type is found in *Zephyranthes* sp. The second type is very rare and found in *Allium sativum*, *Aloevera*, *Amaryllis*, *Eucharis* etc. The third type is found in *Haemanthus coccineus*.

In the fourth additional type, there are four rows of initials giving rise to the root cap, the epidermis, the cortex and the stele, independently. The root cap developing row of initials is called the calyptragen which produces layers of cells outside to form a cap-like structure. (Fig.2)



**Figure 1**  
*Vicia faba*:  
 longitudinal  
 section of  
 root apex  
 illustrating  
 the arrangement  
 of tissue domains  
 based on  
 Körper-kappe  
 concept.



**Fig 2** Diagrammatic representation of root apices :  
 A. Pteridophytic type with solitary apical cell.  
 B. As found in gymnosperms. C. Common dicotyledonous type. D. Monocot (maize) type