Quadrant II- Transcript and Related Materials

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Module Name : Meristematic Tissues -Root Apical Meristem

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Notes:

MERISTEMATIC TISSUES

Tissue: is a group of cells which are similar or dissimilar in shape, have common origin and usually perform common function. Term was coined by Pro. N. Grew in the year 1682. Tissues are broadly divided into two types on the basis of dividing capacity:

1. Meristematic tissue: are made up of undifferentiated cells, cells have capacity to divide.
2. Permenant tissues: are made up of fully differentiated cells, cells donot have capacity to divide.

Meristematic in Greek means Meristos- divisible. Meristematic is the localized region in which active cell divisions occur. The term was coined by K. Nageli.

Characteristics Features:

1. Thin walled, living cells, continuously divide and hence they are composed of immature cells.
2. Meristematic cells are made up of primary cell wall which is thin flexible and composed of cellulose hence has dense protoplasm
3. Meristematic cells are in continuous division cycle, hence posses large and conspicuous nucleus

4. Cells are compactly arranged hence vacuole is absent and cells are in active state of metabolism
5. Cytoskeleton acts as a framework for the cell. Since meristematic cells are continuously dividing framework is not required.

Meristems are classified on the basis of following criteria's:

1. On the basis of origin they are divided into three types
    a. Promeristem- Also known as embryonic meristem, found in the apicells of shoot and root. It divides to produce primary meristem.
    b. Primary meristem- formed from the promeristem divided to form primary permanent tissue that forms primary plant body.
    c. Secondary meristem-develops from primary permanent tissue due to differentiation due to this Inter-fascicular cork cambium are formed.
2. On the basis of position, they are divided into three types
    a. Apical meristem: Present at the tip of root and shoot. Meristematic cells divide to produce primary permenant tissue and forms primary plant body. Shoot apex give rise to organs like leaves and flowers. Root apex give rise to rootlets
    b. Intercalary meristem: Does not occur in all plants. Mainly found in monocots. Here lower part of the apical meristem gets separated from its upper part due to development of permanent tissue in between. This lower part is called as intercalary meristem. It produces primary permenat tissue that increases length of the plant. E.g. In grasses found present above node. Even after grazed by animal grasses grow in length. In the pinus found at the base of leaf
    c. Lateral meristem: As the name suggests it is lateral in position. It is absent in the monocots. They divide to form secondary permanent tissue which increases the girth or thickness of the plant. e.g. Inter-fasicular, fasicular and cork cambium.
3. On the basis of functions they are divided into three types
    a. Protoderm: Outermost layer of that divide to form epidermal tissue system
    b. Ground meristem: thinwalled cells they divide to form fundamental tissue system (Ground tissue system)
    c. Procambium: Narrow elongated cells divide to form vascular tissue system.

Root apex: If we see the structure of root apex is present in the apical portion of the root. It is sub terminal in position due to presence of thimble like structure or cap called as root cap. This actually protects the root apex. This root apex then differentiates and gives rise to different zones of root

1. The region with root hairs is called zone of maturation
2. The region without root hairs is called zone of elongation
3. The region where meristematic cells are present is called zone of meristematic activity.

There are many theories that have been proposed but the most important one are:

1. Histogen theory: was proposed by Hanstein 1870. According to this theory root apex is composed of meristematic cells which divides to form promeristem. This promeristem then differentiates into three histogens (tissue builders) i.e Dermatogen- single layered outer part of meristem later divides to form epiblema (epidermis) of root. Inner to dermatogens is Periblem. It is middle layer, which latter differentiates into cortex and endodermis of root. Plerome is the innermost layer which differentiates into pericycle, pith and vascular tissue. Sometime in the centre of root apex some meristematic cells becomes inactive which are called as Quiscent centre, which acts as reservoir of active initials. This concept was given by Clowes in 1956 in Maize plant. Some meristematic cells in the root apex cuts off new cells on its outer edge called Calyptrogen which later forms calyptras or root cap.

2. Korper-Kappe Theory (Schuepp, 1917)

   Korper – Body and Kappe- Cap.

   Central and peripheral part of root apex exhibit difference in cell division. Peripheral cells undergo T shape division- Kappe.

- Central cells undergo ⊥ shape division – Korper.
- Kappe: Protoderm and root cap.
- Korper: Procambium and Ground tissue.
- Root apex also has quiescent centre.