CLASSIFICATION OF MERISTEMS

Various systems of classifying meristems have been proposed by many eminent workers which are based on the characteristics such as stage of development, position in plant body, origin, function and topography. No system is exclusive and rigid. A few important types have been discussed here:

1. Meristems Based on Stage of Development

Promeristem or primordial meristem. Promeristem is the region of new growth in a plant body where the foundation of new organs or parts of organs is initiated. Sometimes, it is also called *primordial meristem*, *urmeristem* and *embryonic meristem*. From the view point of its structure, this region consists of the initials and their immediate derivatives. The cells of this region are isodiametric, thinwalled, vacuolate, with active cytoplasm and early stages of pits. Prominent nuclei and inconspicuous intercellular spaces may be seen. As soon as the cells of this region begin to change in size, shape, and character of wall and cytoplasm, setting off the beginning of tissue differentiation, they are no longer a part of typical meristem; they have passed beyond that earliest stage.

2. Meristems Based on Origin of Initiating Cells

Primary and secondary meristems. The meristems are classified as *primary* and *secondary*, on the basis of type of tissue in which origin occurs.

The primary meristems are those that build up the primary part of the plant and consist in part of promeristem. In primary meristems, promeristem is always the earliest stage. The possession of promeristem continuously from a early embryonic origin is characteristic of primary meristems. The main primary stems are the apices of roots, stems, leaves and similar appendages.

The secondary meristem appears later at a stage of development of an organ of a plant body. Secondary meristems always arise in permanent tissues and they are always found lying lateral along the side of the stem and root. Sometimes, some of the primary permanent tissues acquire the power of division and become meristematic. These tissues build up the secondary meristem. Secondary meristems are so called because they arise as new meristems in tissue which is not meristematic. The most striking example of secondary meristem is phellogen or cork cambium. It is formed from mature cells — cortical, epidermal or phloem cells.

The primary meristems build up the early and structurally and functionally complete plant body. The secondary meristems later add to that body forming supplementary tissues that functionally replace the early formed tissues or serve in protection and repair of wounded regions.

3. Meristems Based on Position in Plant Body

As regards their position in plant body, the meristems may be classified into three groups — *apical meristem*, *intercalary meristem* and *lateral meristem*.

Apical meristem. The apical meristem lies at the apex of the stem and the root of vascular plants. Very often they are also found at the apices of the leaves. Due to the activity of these meristems, the organs increase in length. The initiation of growth takes place by one or more cells situated at the tip of the organ. These cells always maintain their individuality and position and are called '*apical cells*' or '*apical initials*'. Solitary apical cells occur in pteridophytes, whereas in higher vascular plants they occur in groups which may be terminal or terminal and sub-terminal in position.

Intercalary meristems. The intercalary meristems are merely portions of apical meristems that have become separated from the apex during development by layers of more mature or permanent tissues and left behind as the apical meristem moves on in growth. The intercalary meristems are internodal in their position. In early stages, the internode is wholly or partially meristematic, but later on some of its part, becomes mature more rapidly than the rest and in the internode a definite continuous sequence of development is maintained. The intercalary meristems are found lying in between masses of permanent tissues either at the leaf base or at the base of internode. Such meristems are commonly found in the stems of grasses and other monocotyledonous plants and horsetails, where they are basal. Leaves of many monocotyledons (grasses) and some other plants, such as *Pinus*, have basal meristematic regions. These meristematic regions are short living and ultimately disappear, ultimately, they become permanent tissues.

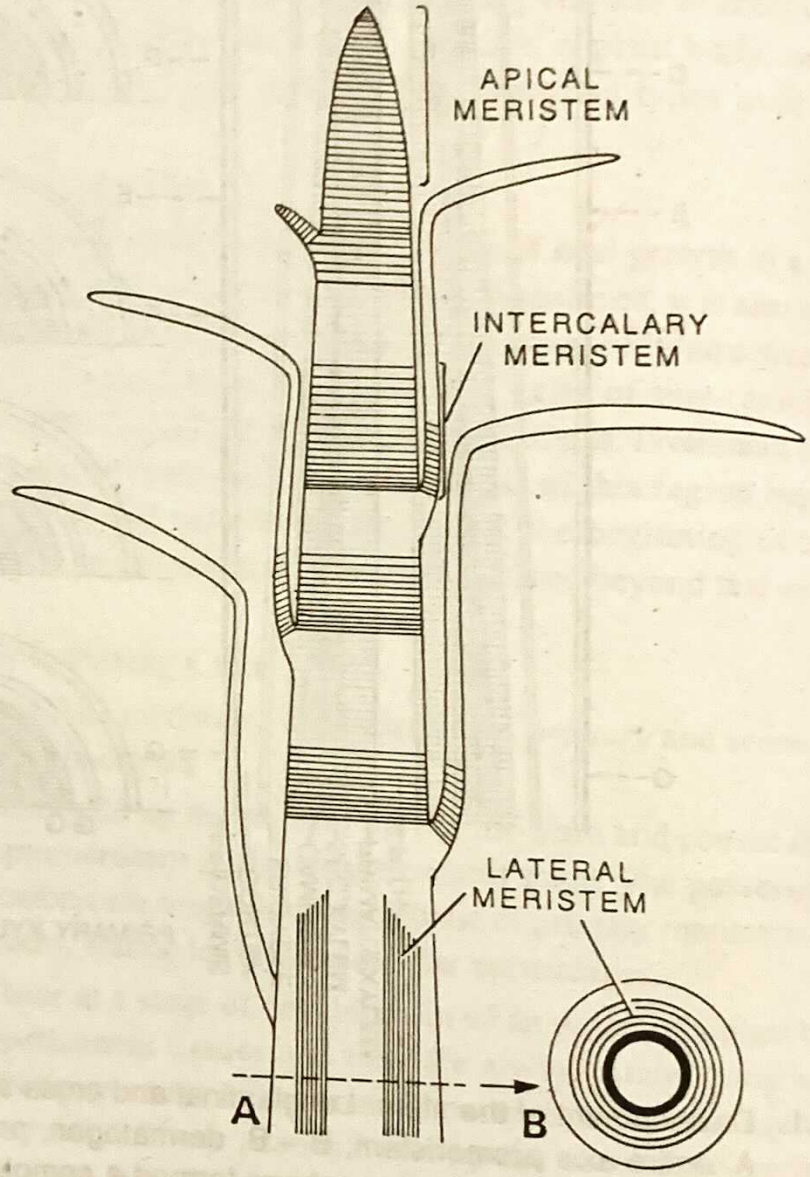

Fig. 5.2. Position of meristems. A, longitudinal view; B, cross-section.

Lateral meristems. The lateral meristems are composed of such initials which divide mainly in one plane (periclinally) and increase the diameter of an organ. They add to the bulk of existing tissues or give rise to new tissues. These tissues are responsible for growth in thickness of plant body. The cambium and the cork cambium are the examples of this type.

4. Meristems Based on Function

As regards their function a system of classification of meristems was proposed by Haberlandt in the end of nineteenth century. He suggested that the primary meristem at the apex of the stem and root is distinguished into three tissues — *protoderm*, *procambium* and *ground* or *fundamental meristem*. The protoderm is the outermost tissue which develops into epidermis. The procambium develops into primary vascular tissue. It forms isolated strands of elongated cells very near to the central region; in cross-section each procambium appears as a small group of cells in the ground or fundamental meristem, but in longitudinal section the cells appear to be long and pointed. The ground or fundamental meristem develops into ground tissue and pith; the cells of this region are large, thin walled, living and isodiametric. In later stages, they become differentiated into hypodermis, cortex, endodermis, pericycle, pith rays and pith.