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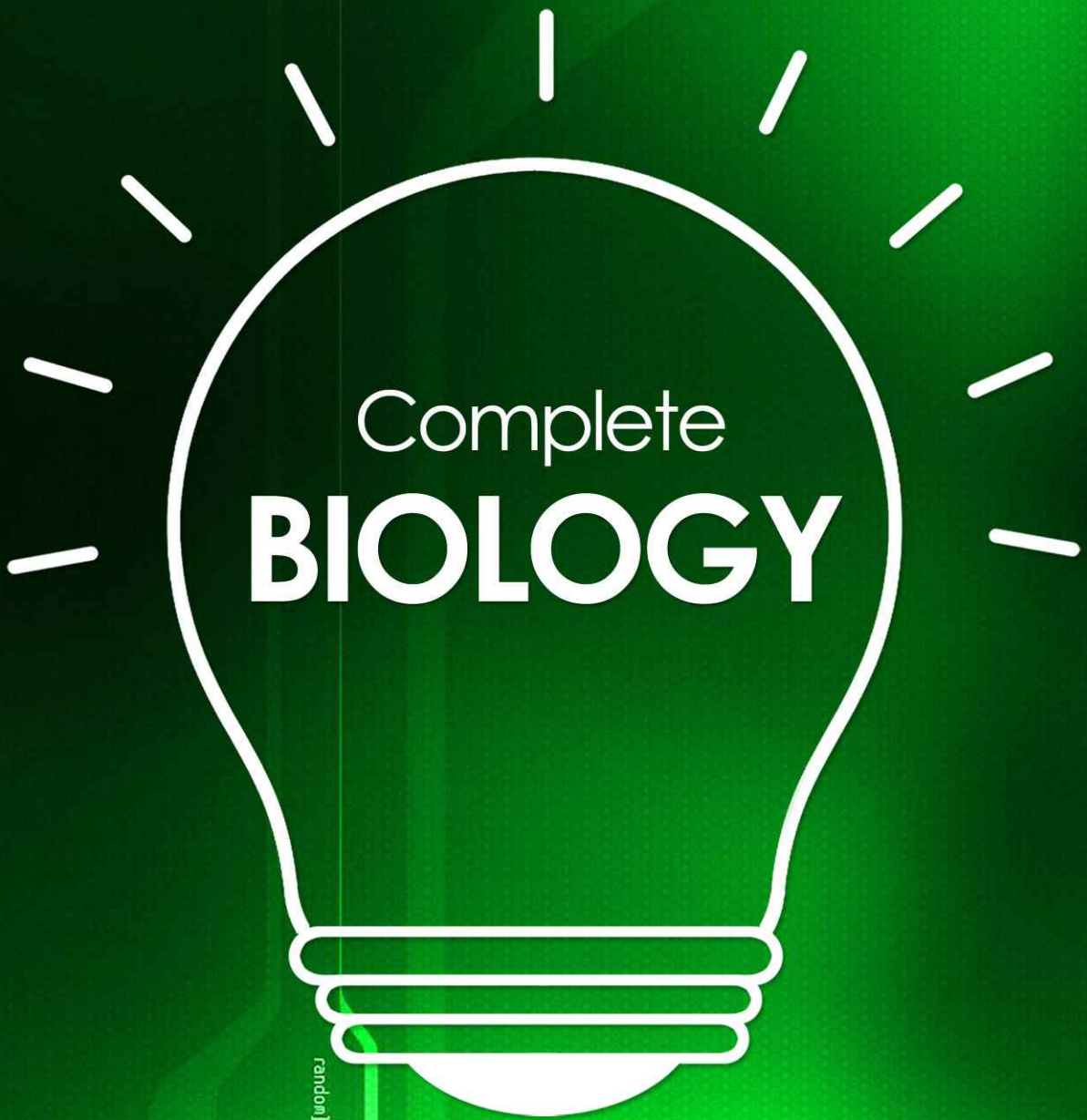

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CLASS 11th

Anatomy of Flowering Plants

01. Plants Tissues

Tissue is a group of similar or dissimilar cells of common origin that perform or help to perform a common function. The study of tissues is called **Histology.** Plant tissues can be categorised into following three groups for the convenience of study.

(i) Meristematic tissues (ii) Permanent tissues (iii) Secretory tissues

Meristematic tissues

The term 'Meristem' (Gk. *Meristos* − divisible) was introduced by Nageli (1858). A meristem is a group of cells having the ability to divide continuously.

The characteristic features of meristematic cells are

(a) These cells are undifferentiated small and can be variously shaped, e.g. isodiametric, round, oval, polygonal or rectangular.
(b) Absence of intercellular spaces.
(c) Their cell walls are thin, elastic and made up of cellulose.
(d) They are densely cytoplasmic and contain a large nucleus.
(e) They do not store reserve food material because these are always in the active state of metabolism.
(f) They take deep stain.
(g) These have small endoplasmic reticulum, simple mitochondria, immature plastids and very small or no vacuoles.
(h) These cells are totipotent and divide mitotically.

Classification of meristematic tissue

(i) On the basic of origin and development

(a) **Promeristem or Primordial meristem** It originates from the embryonic cells. A promeristem represents the early primary stage of meristematic cells. These are present in a small region of shoot and root apex. Promeristem differentiates into primary meristem.

(b) **Primary meristem** Cells of primary meristem are always in active state of division. It is found below promeristem at root and shoot apex. It is also present in **intercalary parts** and **intrafascicular cambium.** It gives rise to primary permanent tissues. Due to primary meristem, plants increase lengthwise and widthwise.

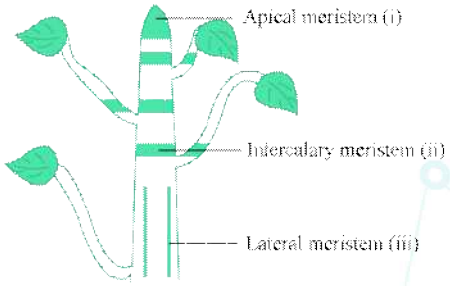
(c) **Secondary meristem** The meristem develops from the primary permanent tissues by dedifferentiation. It is always lateral in position. Such meristem develops during later stages of plant growth. They give rise to secondary permanent tissues, e.g. interfascicular cambium, cork cambium.

(ii) On the basis of position in the plant body

(a) **Apical meristem** These are found at the apices of shoots and roots. This tissue is responsible for the growth in length of roots and shoots. This kind of growth is called as primary growth. All primary tissues of the plant body originate from apical meristem.

(b) **Intercalary meristem** These meristem lie in between the permanents tissues. They may be present at the base of the internodes, e.g. in stem of various gasses and wheat. They can also be found at the base of a leaf, e.g. *Pinus* or at the base of a node, e.g. mint − *Mentha arvensis.* They also add to the length of the plant or its organs.

(c) **Lateral meristem** This meristem is present along the lateral sides of stems and roots. They are especially present in the mature regions of roots and shoots and responsible for the growth in girth of a plant.
Thus, these are in fact the secondary meristems of plants responsible for secondary growth in them.



(iii) On the basis of function

(a) **Protoderm** It is the outermost layer of young growing region. It develops into epidermis, stomata and hairs, i.e. epidermal tissue system.

(b) **Procambium** It is composed of narrow, elongated cells. These cells develop into primary vascular tissue, i.e. phloem xylem and cambium.

(c) **Ground meristem** These cells are large and thin − walled. This system produce hypodermis, cortex, endodermis pericycle, pith and medullary rays.

Shoot apex organisation

Shoot apex is a dome−shaped structure. It is present above the young leaf primordium on shoot. It also occurs in the inactive state in the axil of leaves as lateral buds. It remains covered by young leaves. *Following theories have been given to explain its organisation*

(i) Apical cell theory

This theory was given by Hofmeister (1857) and Nageli (1858). It states that, a single apical cell is the structural and functional unit of apical meristem. This apical cell governs the complete process of primary growth. This theory is applicable to lower plants like algae, bryophytes and pteridophytes only.

(ii) Histogen theory

This theory was given by Hanstein (1870). According to this, shoot apex has following three zones

(a) **Dermatogen** It is outermost layer or histogen, that form epidermis and epidermal tissue system.

(b) **Periblem** It is middle layer, that forms cortex and endodermis.

(c) **Plerome** It is innermost layer, that form pith, vascular bundles, pericycle and medullary rays. Histogen is the generalised term used for these layers separately

(iii) Tunica – corpus theory

This theory was proposed by Schmidt (1924). It is based on plane of division of cells. According to this theory the shoot apex consists of followings two layers

(a) **Tunica** It is a single outer layer, that forms epidermis. Cells of this layer are smaller then that of other layer.

(b) **Corpus** It is the central core of shoot apex. It has larger cells then tunica, It can divide in all planes (i.e. anticlinal or periclinal) to form cortex and stele of shoot.

Root Apex Organisation

The root apex is dome − shaped structure. It is subterminal because it is covered by root cap. *Following theories are given to understand the organisation of root apex*

(i) Histogen theory

According to this theory, the root apex consists of four histogens, e.g. dermatogen, periblem, and plerome and calyptrogen. In case of root apex, dermatogen forms epiblema and calyptrogen gives rise to root cap in monocots.

(ii) Korper-kappe theory

This theory was given by Schuepp (1917). It states that a root system is formed by differentiation of 2 zones, namely Korper and Kappa. Out of these, the Korper zone forms the body and Kappe forms the cap. This theory is comparable to tunica − corpus theory of shoot apex.

(iii) Quiescent centre theory

It was given by Clowes in maize. According to this theory root apex consists of a quiescent centre. It is an invented cup – like structure located between calyptrogen and dermatogen. It has low DNA, RNA and proteins. Cell division are very few in quiescent centre.

Permanent tissues

These tissues are formed as a result of division and differentiation in meristematic tissues. They lose their ability to divide. They become structurally and functionally specialised.

Permanent tissues are of following types

(a) Simple permanent tissue
(b) Complex permanents tissue

Simple permanent tissues

These tissues have one type of cells only. These cells are structurally and functionally similar. They coordinate with each other to perform similar function.

These tissues are further classified as

(a) Parenchyma
(b) Collenchyma
(c) Sclerenchyma

(i) Parenchyma (*GK. Para* – beside)

Parenchymatous cells are thin − walled. Their cell walls are cellulosic. They can be oval, round, polygonal or isodiametric. Parenchymatous cells do not loose their protoplasm during differentiation. Hence, they are living cells. They possess a distinct nucleus. These cells usually have large intercellular space in between them

Parenchymatous cells are modified to following types to perform specialised takes

(a) **Chlorenchyma** It is the chloroplast containing paranchymatous tissue.
(b) **Aerenchyma** It is the air space containing parenchymatous tissue. These spaces allow gaseous exchange in aquatic plants (*e.g. Hydrilla*).
(c) **Prosenchyma** These are elongated parenchymatous cells that provide strength. Prosenchyma are found in the pericycle of roots.
(d) **Idioblasts** These are non-living parenchymatous cells. They store tanins, oils, crystals, etc.