

TISSUES

CLASS-9TH CHAPTER-6TH

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- A group of cells with similar shape and function are termed as tissues.
- They form a cellular organizational level, intermediate between the cells and organ system.
- Organs are then created by combining the functional groups of tissues.
- The study of tissue is known as histology and study of disease-related to tissue is known as histopathology.
- The standard tools for studying tissues is by embedding and sectioning using the paraffin block.



Animal tissues are grouped into four types:

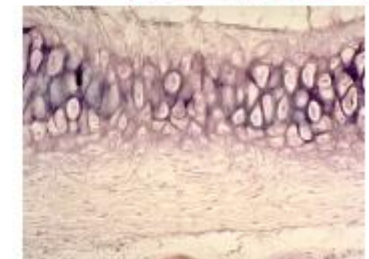
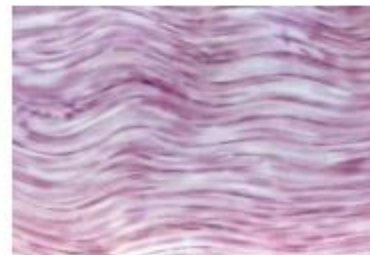
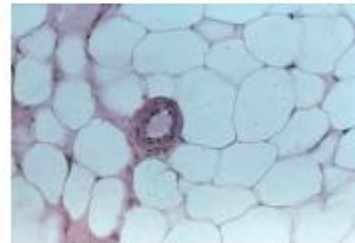
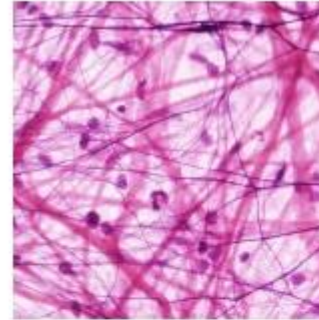
- Connective Tissue
 - Muscle Tissue
 - Nervous Tissue
 - Epithelial Tissue
-
- The collection of tissues are joined in structural units to serve a standard function of organs. The primary purpose of these four types of tissue differs depending on the type of organism.
 - For example, the origin of the cells comprising a particular tissue type also differs.



Connective Tissues

- They are the group of tissues made up of cells separated by non-living material, called as an extracellular matrix.
- This tissue provides shape to the different organs and maintains their positions. For example, blood, bone, tendon, adipose, ligament and areolar tissues

CONNECTIVE TISSUE



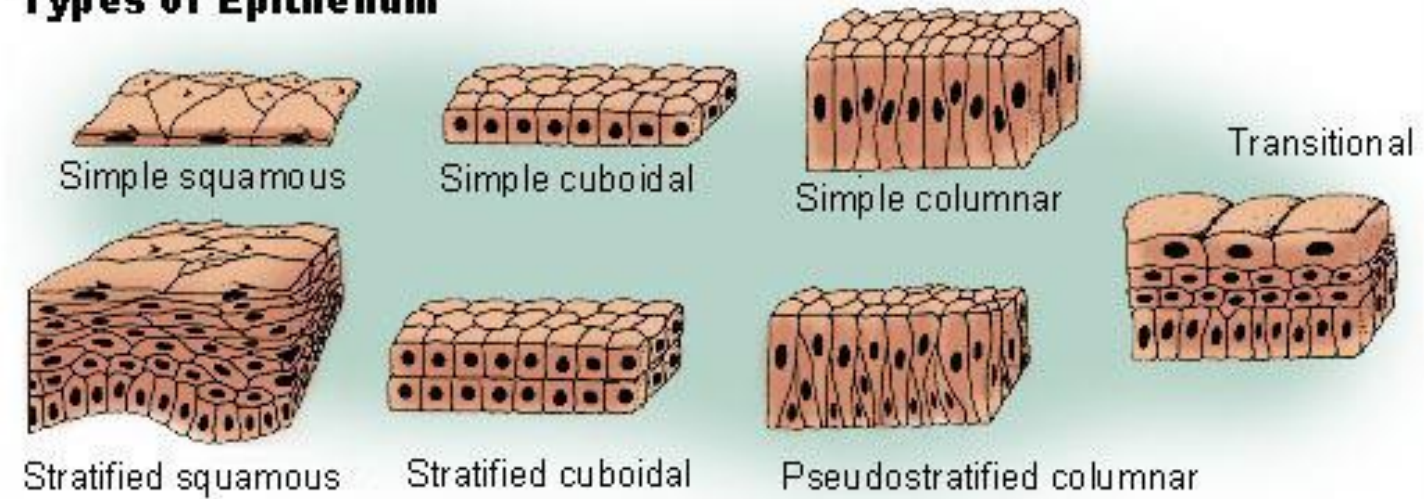
This type of tissue is the most abundant, widespread, and varied of all tissue types in the body. It also has the widest variety of functions.



Epithelial Tissue

- They are formed by cells which cover the external parts of the body organs and lines the organ surfaces such as the surface of the skin, the reproductive tract, the airways, and the inner lining of the digestive tract.

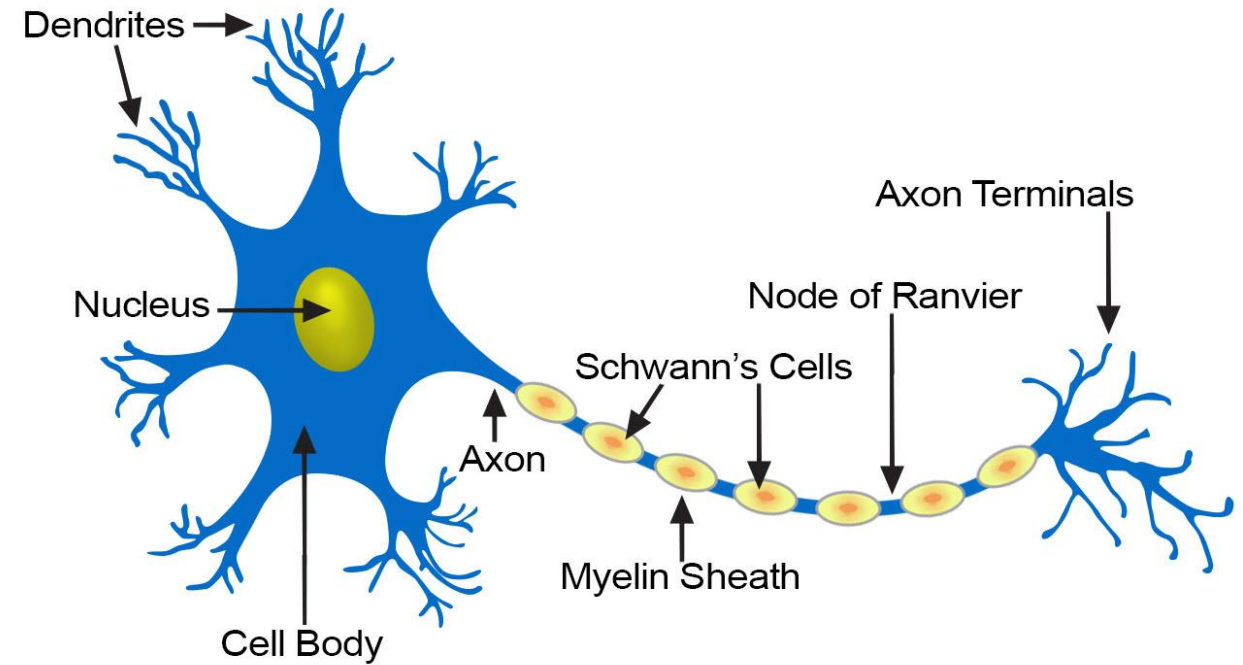
Types of Epithelium



Nervous Tissue


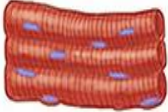
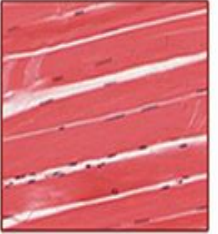

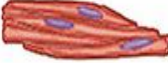



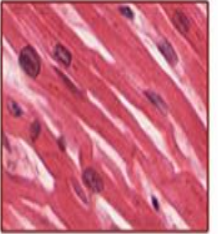
- They are the main tissue components of the brain and spinal cord in the central nervous system.
- While, in the peripheral nervous system, the neural tissue forms the cranial nerves and spinal nerves.

Structure of a Typical Neuron



Muscle Tissue

- They are involved in producing force and generating motion, either for the locomotion or for other body movements within internal organs.

	Main features	Location	Type of cells	Histology
Skeletal muscle	<ul style="list-style-type: none">- Fibers : striated, tubular and multi nucleated- Voluntary- Usually attached to skeleton			
Smooth muscle	<ul style="list-style-type: none">- Fibers : non-striated, spindle-shaped, and uninucleated.- Involuntary- Usually covering wall of internal organs.			
Cardiac muscle	<ul style="list-style-type: none">- Fibers : striated, branched and uninucleated.- Involuntary- Only covering walls of the heart.			



B. Animal tissues: Animal tissues are classified into four types based on the functions they perform:

- Epithelial
- Connective
- Muscular
- Nervous



Epithelial tissues: Form the covering of the external surfaces, internal cavities and organs of the animal body. Various types of epithelial tissues are:

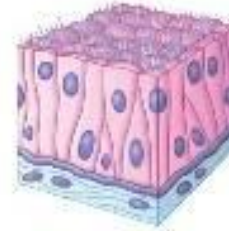
- **Simple squamous epithelium:** Single layer of flat cells.
- **Location in the human body:** Lining of the mouth, oesophagus, lung, alveoli, etc.
- **Cuboidal epithelium:** Consists of cube like cells.
- **Location in the human body:** Lining of the kidney tubules and ducts of the salivary glands. It's function is secretion and absorption.
- **Columnar epithelium:** Consists of elongated or column-like cells.
- **Location in the human body:** Inner lining of the intestine and gut. Its function is of secretion and absorption.



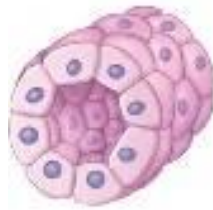
Epithelial Tissue



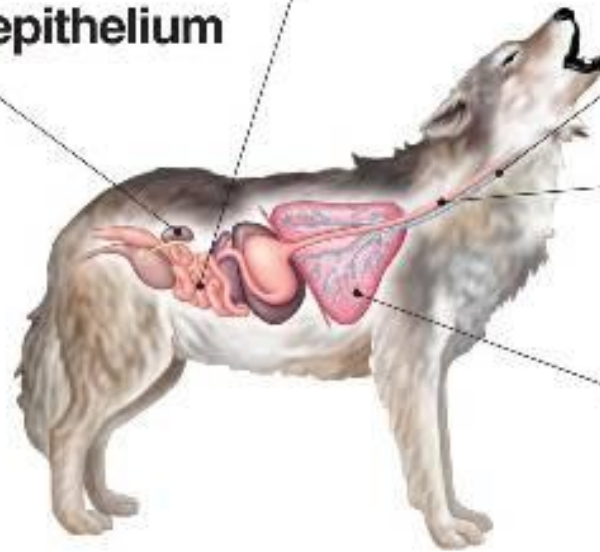
Simple columnar epithelium



Pseudostratified ciliated columnar epithelium



Cuboidal epithelium




Stratified squamous epithelium



Simple squamous epithelium



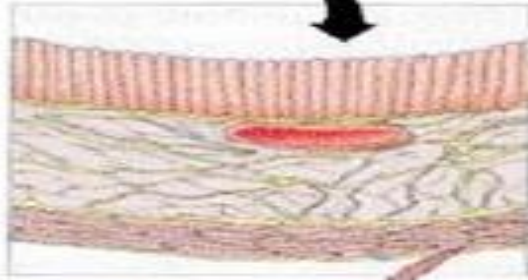
- The covering or protective tissues in the animal body are **epithelial tissues**.
 - Epithelium covers most organs and cavities within the body. It also forms a barrier to keep different body systems separate.
 - The skin, the lining of the mouth, the lining of blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue.
 - Epithelial tissue cells are tightly packed and form a continuous sheet.
 - They have only a small amount of cementing material between them and almost no intercellular spaces.
 - Obviously, anything entering or leaving the body must cross at least one layer of epithelium.
- 

- As a result, the permeability of the cells of various epithelia play an important role in regulating the exchange of materials between the body and the external environment and also between different parts of the body.
- Regardless of the type, all epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane.
- Differing structures that correlate with their unique functions.
- For example, in cells lining blood vessels or lung alveoli, where transportation of substances occurs through a selectively permeable surface, there is a simple flat kind of epithelium. This is called the simple squamous epithelium (squama means scale of skin).
- Simple squamous epithelial cells are extremely thin and flat and form a delicate lining.

- The oesophagus and the lining of the mouth are also covered with squamous epithelium.
- The skin, which protects the body, is also made of squamous epithelium.
- Skin epithelial cells are arranged in many layers to prevent wear and tear.
- Since they are arranged in a pattern of layers, the epithelium is called stratified squamous epithelium.
- Where absorption and secretion occur, as in the inner lining of the intestine, tall epithelial cells are present.
- This columnar (meaning 'pillar-like') epithelium facilitates movement across the epithelial barrier. In the respiratory tract, the columnar epithelial tissue also has cilia, which are hair-like projections on the outer surfaces of epithelial cells.
- These cilia can move and their movement pushes the mucus forward to clear it

- This type of epithelium is thus ciliated columnar epithelium.
- Cuboidal epithelium (with cube-shaped cells) forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support.
- Epithelial cells often acquire additional specialisation as gland cells, which can secrete substances at the epithelial surface.
- Sometimes a portion of the epithelial tissue folds inward, and a multicellular gland is formed. This is glandular epithelium.





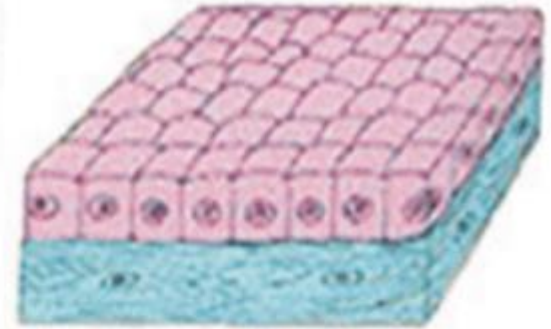
Smooth muscle fibres



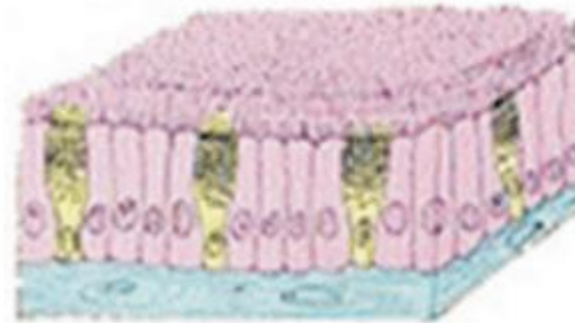
Location of muscle fibres



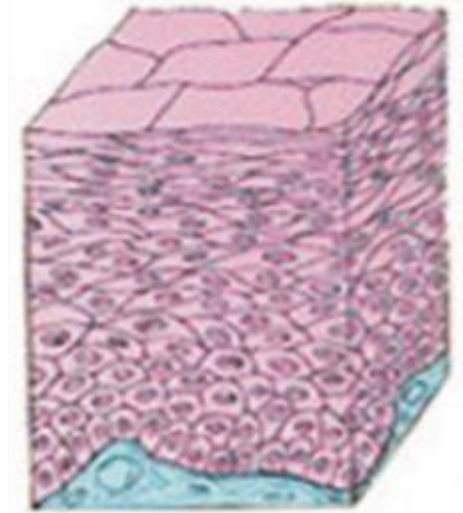
(A) Squamous



(B) Cuboidal



(C) Columnar (Ciliated)



(D) Stratified squamous

Different types of epithelial tissues

Connective tissues: Specialised to connect various body organs. Various types of connective tissues:, are:

- **Areolar tissue:** Found in the skin and muscles, around the blood vessels, nerves, etc.
- **Adipose tissue:** Acts as the storage site of fats; found between the internal organs and below the skin; acts as an insulator for the body.
- **Dense regular connective tissue:** Main components are tendons and ligaments; tendons connect muscles to bones, while ligaments connect two bones together.
- **Skeletal tissue:** Main components of skeletal tissues are cartilage and bone.
- **Fluid tissue:** Blood is the vascular tissue present in animals.



- The cells of connective tissue are loosely spaced and embedded in an intercellular matrix.
- The matrix may be jelly like, fluid, dense or rigid.
- The nature of matrix differs in concordance with the function of the particular connective tissue.
- Blood has a fluid (liquid) matrix called plasma, in which red blood corpuscles (RBCs), white blood corpuscles (WBCs) and platelets are suspended. The plasma contains proteins, salts and hormones.
- Bone cells are embedded in a hard matrix that is composed of calcium and phosphorus compounds.
- Two bones can be connected to each other by another type of connective tissue called the ligament.

- This tissue is very elastic. It has considerable strength. Ligaments contain very little matrix and connect bones with bones.
- Blood flows and transports gases, digested food, hormones and waste materials to different parts of the body.
- Bone is another example of a connective tissue. It forms the framework that supports the body.
- It also anchors the muscles and supports the main organs of the body. It is a strong and nonflexible tissue.
- Tendons connect muscles to bones and are another type of connective tissue.
- Tendons are fibrous tissue with great strength but limited flexibility.

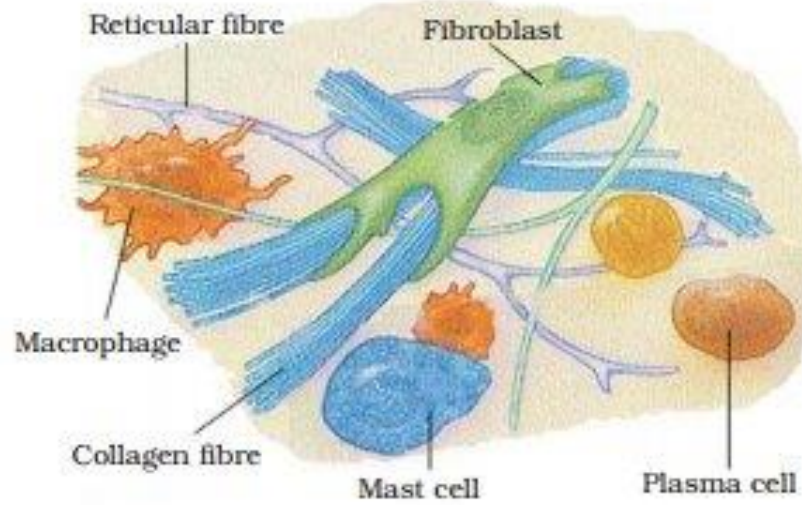


- Another type of connective tissue, cartilage, has widely spaced cells. The solid matrix is composed of proteins and sugars.
- Cartilage smoothens bone surfaces at joints and is also present in the nose, ear, trachea and larynx.
- The cartilage of the ears, but we cannot bend the bones in our arms.
- Areolar connective tissue is found between the skin and muscles, around blood vessels and nerves and in the bone marrow.

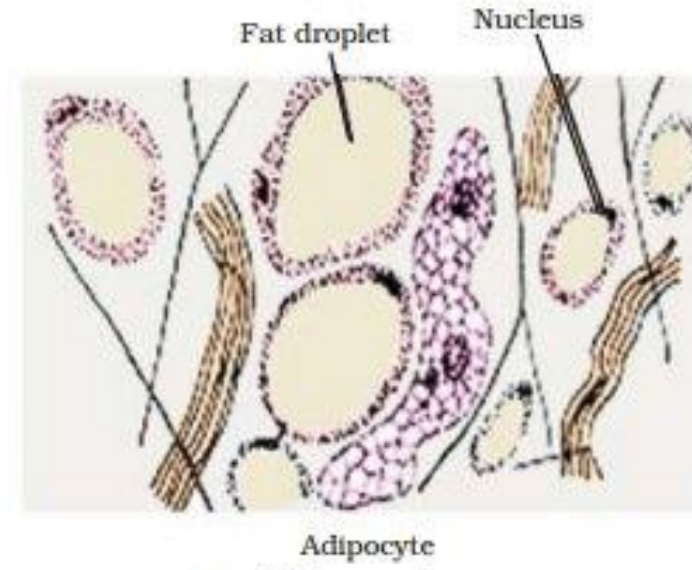


- It fills the space inside the organs, supports internal organs and helps in repair of tissues.
- Fat storing adipose tissue is found below the skin and between internal organs.
- The cells of this tissue are filled with fat globules. Storage of fats also lets it act as an insulator.

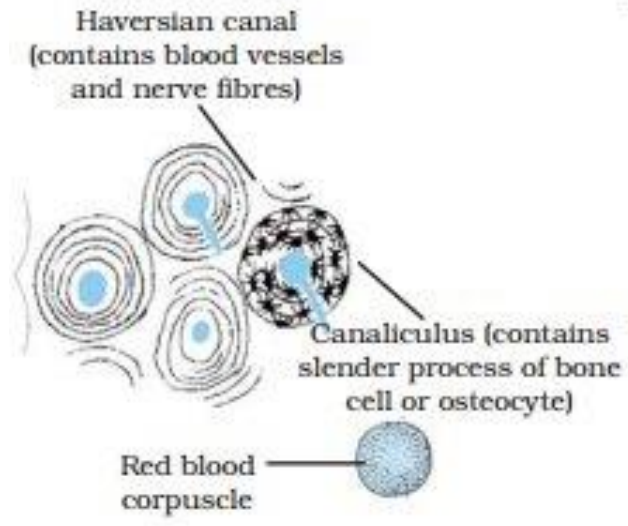




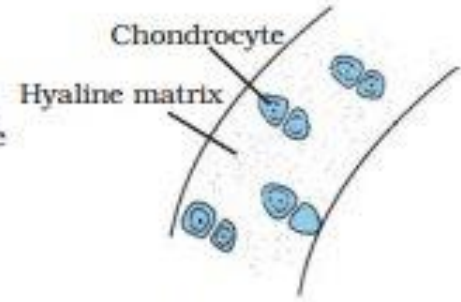
(a) Areolar tissue



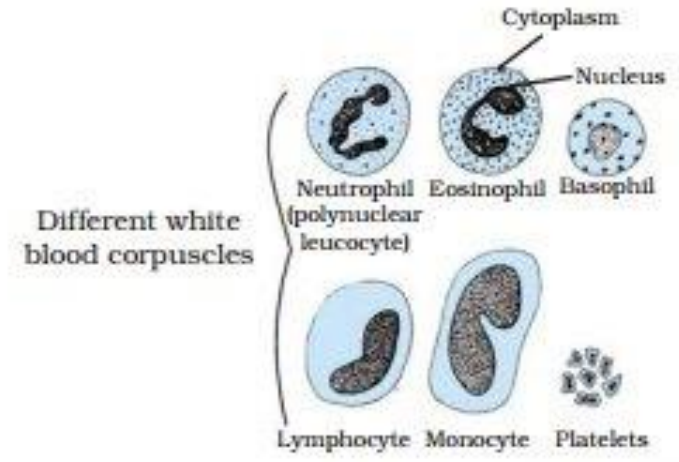
(b) Adipose tissue



(c) Compact bone



(d) Hyaline cartilage



(e) Types of blood cells

MUSCULAR TISSUE

- Muscular tissue consists of elongated cells, also called muscle fibres. This tissue is responsible for movement in our body.
- Muscles contain special proteins called contractile proteins, which contract and relax to cause movement.
- Some muscles by conscious will. Muscles present in our limbs move when we want them to, and stop when we so decide.
- Such muscles are called voluntary muscles These muscles are also called skeletal muscles as they are mostly attached to bones and help in body movement.

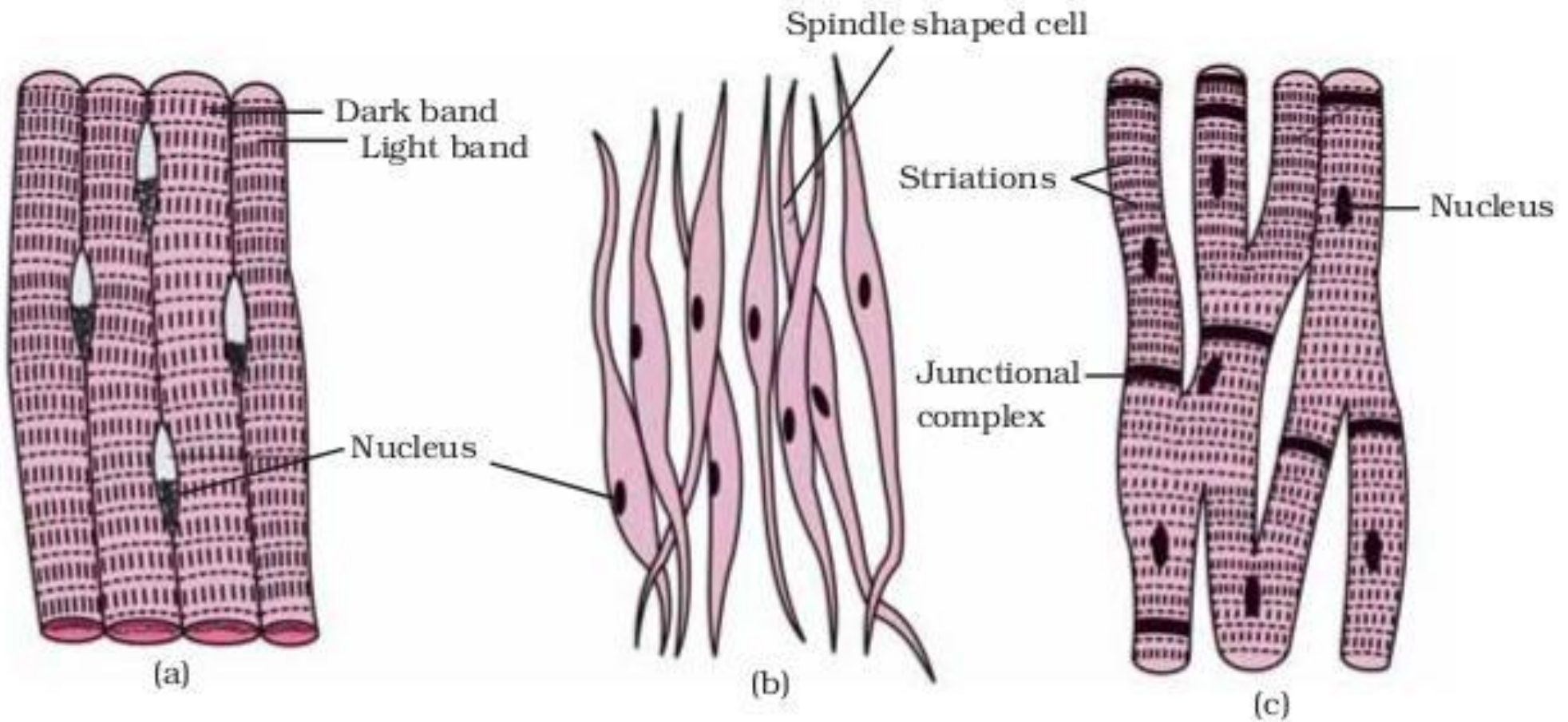


- Under the microscope, these muscles show alternate light and dark bands or striations when stained appropriately.
- Smooth muscles or involuntary muscles control such movements.
- They are also found in the iris of the eye, in ureters and in the bronchi of the lungs.
- The cells are long with pointed ends (spindle-shaped) and uninucleate (having a single nucleus). They are also called unstriated muscles .
- The muscles of the heart show rhythmic contraction and relaxation throughout life.



- These involuntary muscles are called cardiac muscles . Heart muscle cells are cylindrical, branched and uninucleate.
- As a result, they are also called striated muscles. The cells of this tissue are long, cylindrical, unbranched and multinucleate (having many nuclei).
- The movement of food in the alimentary canal or the contraction and relaxation of blood vessels are involuntary movements.





a) striated muscle, (b) smooth muscle, (c) cardiac muscle



Muscular tissues: Main function of muscular tissues is to provide movement to the body. Muscular tissues are of three types:

- **Striated muscles or skeletal muscles or voluntary muscles:** Cells are cylindrical, unbranched and multinucleate.
- **Smooth muscles or involuntary muscles:** Cells are long, spindle-shaped and possess a single nucleus.
- **Cardiac muscles or involuntary muscles:** Cells are cylindrical, branched and uninucleate.



Nervous tissues: Present in the brain, spinal cord and nerves.

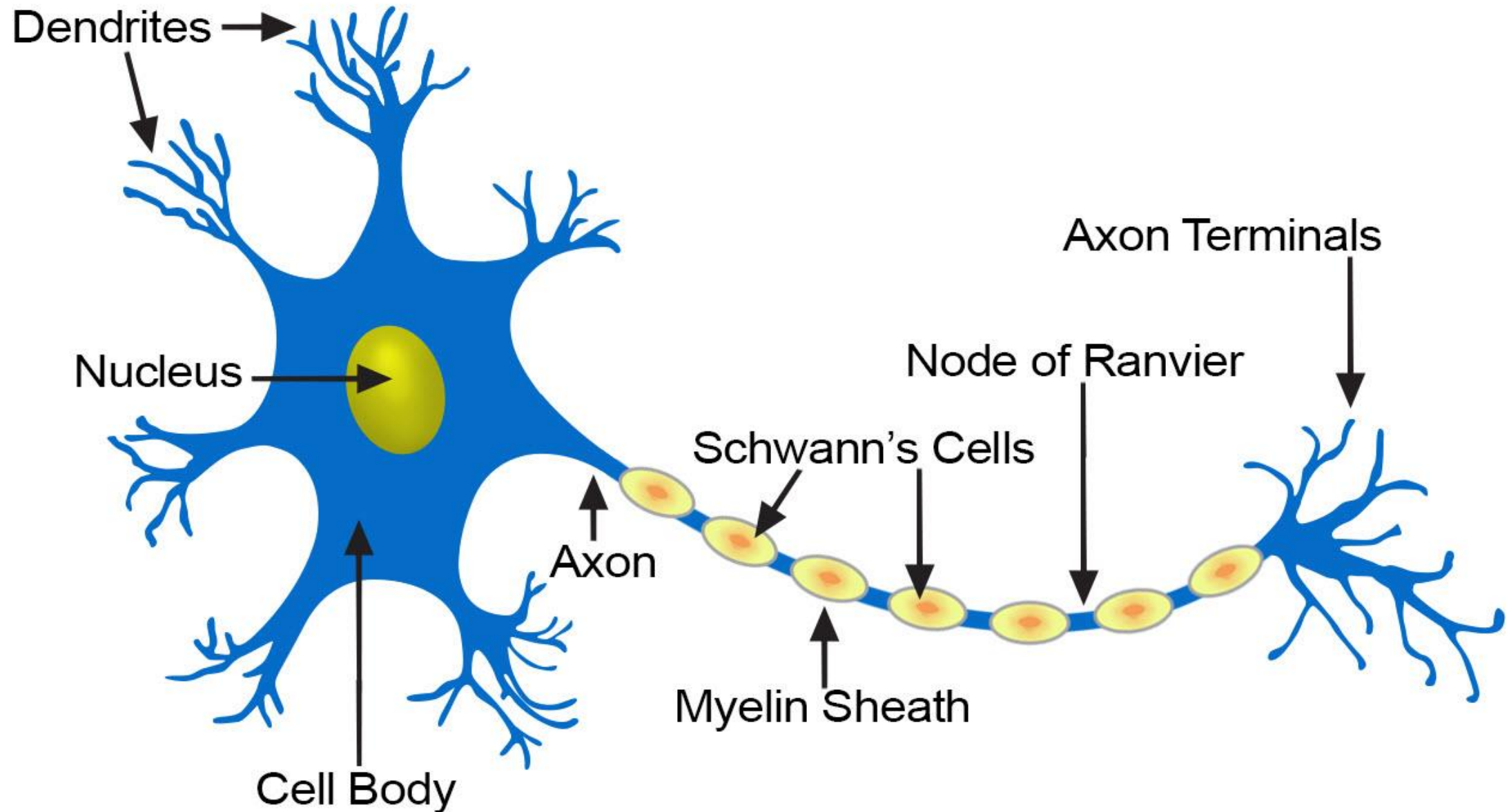
- **Neuron:** Cells of the nervous tissue.
- **A neuron:** consists of a cell body, an axon and a dendrite
- All cells possess the ability to respond to stimuli.
- However, cells of the nervous tissue are highly specialised for being stimulated and then transmitting the stimulus very rapidly from one place to another within the body.



- The brain, spinal cord and nerves are all composed of the nervous tissue.
- The cells of this tissue are called nerve cells or neurons. A neuron consists of a cell body with a nucleus and cytoplasm, from which long thin hair-like parts arise.
- Usually each neuron has a single long part (process), called the axon, and many short, branched parts (processes) called dendrites.



Structure of a Typical Neuron



- Usually each neuron has a single long part (process), called the axon, and many short, branched parts (processes) called dendrites.
- An individual nerve cell may be up to a metre long. Many nerve fibres bound together by connective tissue make up a nerve.
- The signal that passes along the nerve fibre is called a nerve impulse. Nerve impulses allow us to move our muscles when we want to.
- The functional combination of nerve and muscle tissue is fundamental to most animals. This combination enables animals to move rapidly in response to stimuli.

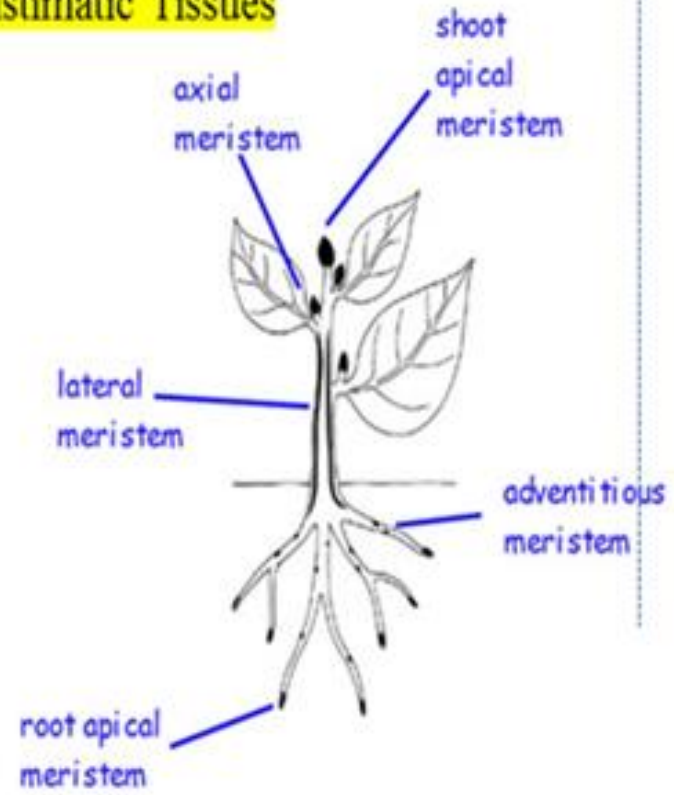


Plant tissues

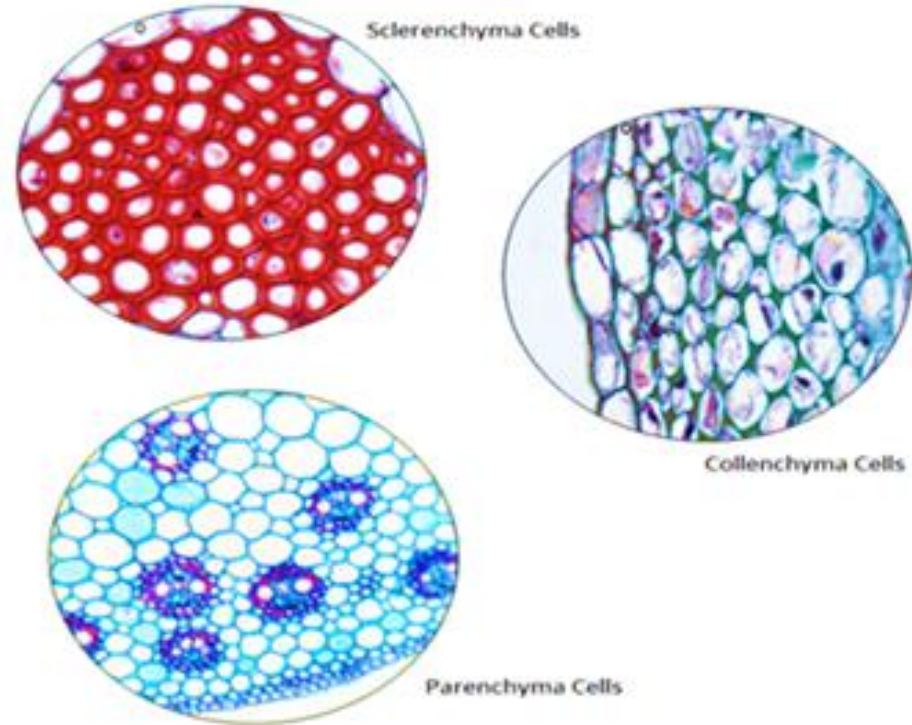
- Plant tissues are of various types and they are made up of similar types of cells.
- They are different from animal tissues since there are several differences between the animal and plant cell.
- On the basis of the dividing capacity, plant tissues are of two types:
 1. **Meristematic tissues:** Consist of actively-dividing cells. Meristematic tissues are of three types:
 - **Apical meristem:** Present at the growing tips of stems and roots. Important function: To increase the length of stems and roots.



Meristematic Tissues



Permanent Tissues



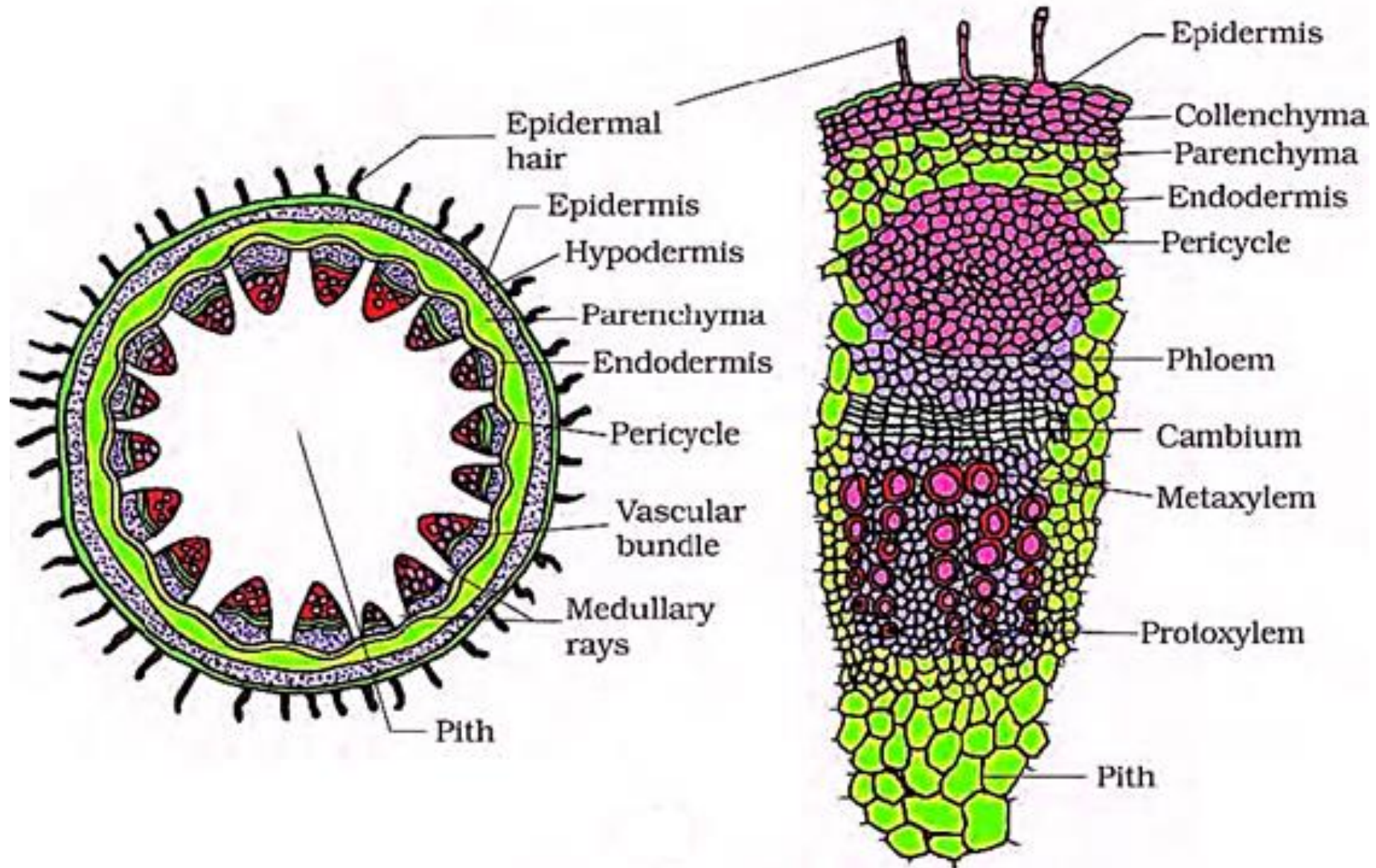
- **Intercalary meristem:** Present at the base of leaves or internodes.
Important function: For the longitudinal growth of plants.
- **Lateral meristem:** Present on the lateral sides of the stems and roots.
Important function: To increase the thickness of stems and roots.

2. Permanent tissues: Formed from meristematic tissues, the cells in the tissue lose the ability to divide. Permanent tissues are divided into two categories:

- **Simple permanent tissue:** Consist of only one type of cells.
- Types of simple permanent tissues:
- **Parenchyma:** Composed of unspecialized living cells with relatively thin cell walls, intercellular space, present in soft parts of the plant. Their main function is storage.



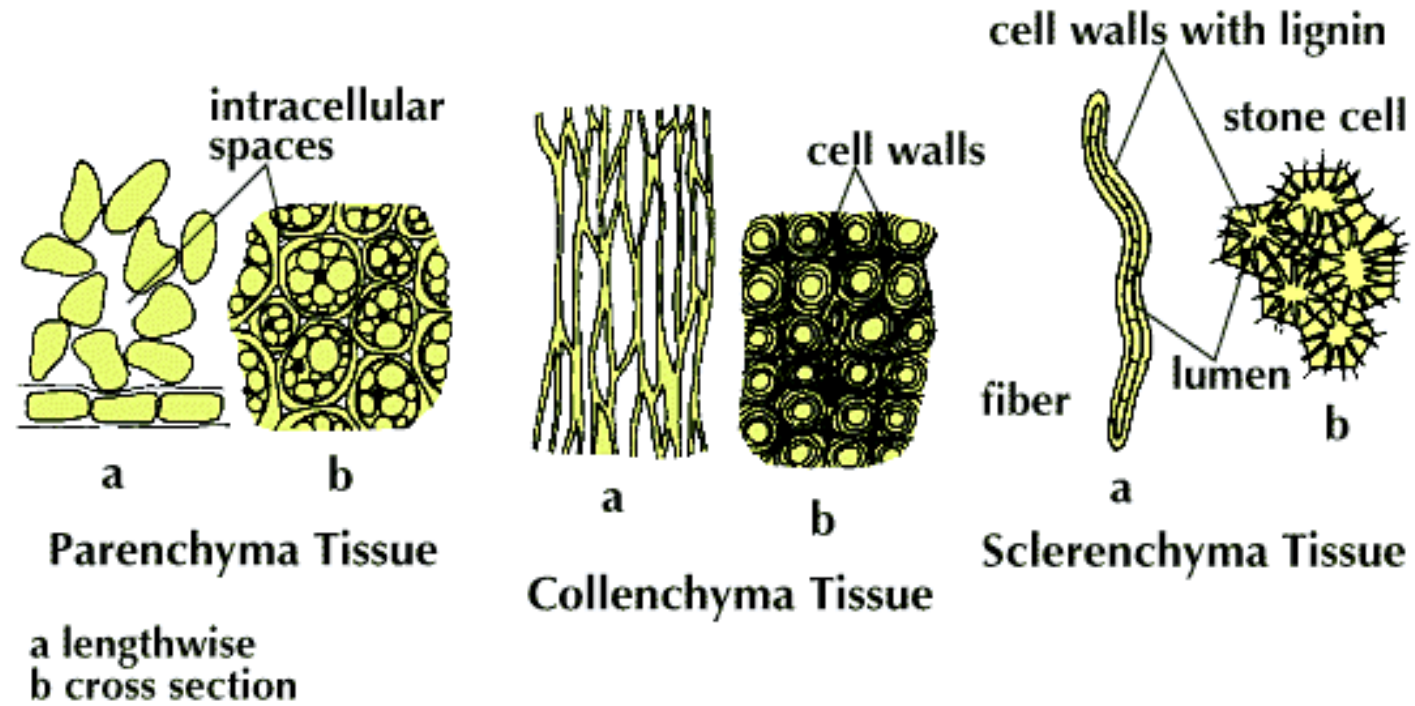
Section of a stem



- The flexibility in plants is due to another permanent tissue, collenchyma.
- It allows bending of various parts of a plant like tendrils and stems of climbers without breaking. It also provides mechanical support.
- The cells of this tissue are living, elongated and irregularly thickened at the corners. There is very little intercellular space.



THE THREE BASIC TYPES OF PLANT TISSUE



- It consists of relatively unspecialised cells with thin cell walls. They are living cells.
- They are usually loosely arranged, thus large spaces between cells (intercellular spaces) are found in this tissue.

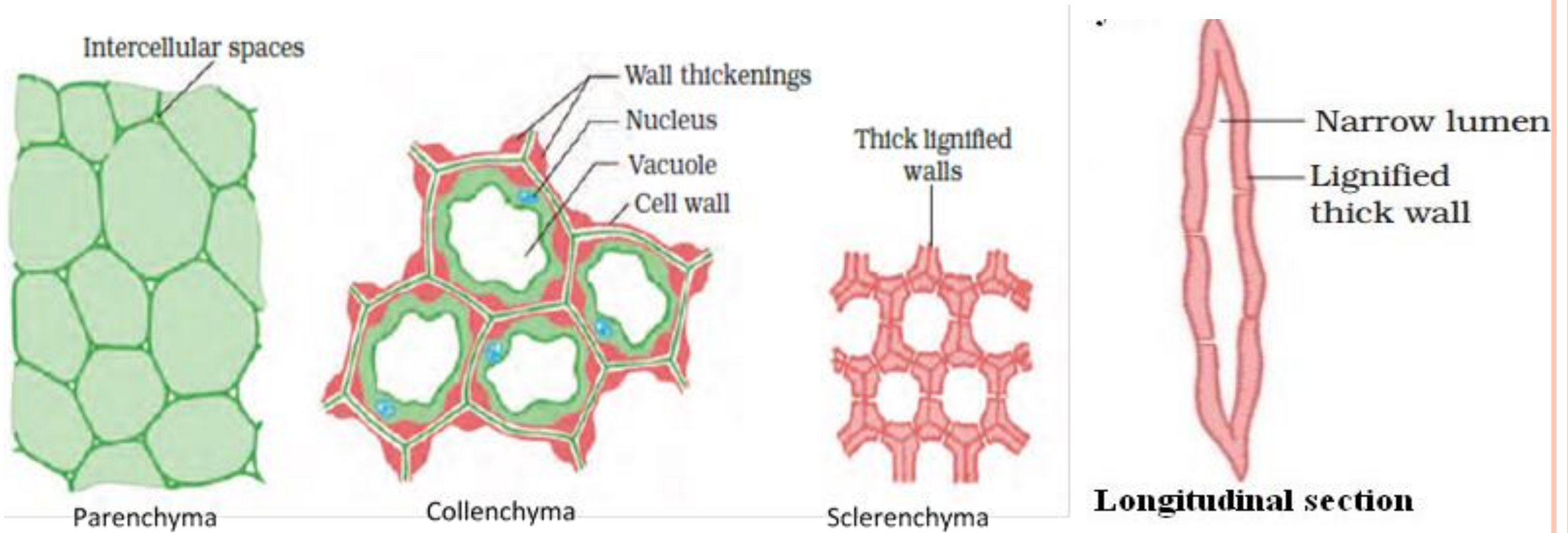
Collenchyma

- Composed of living and elongated cells with cell walls irregularly thickened at the corners.
- No intercellular space. It provides mechanical support and elasticity to plant. It helps in bending of leaves and stems.
- It contains chlorophyll and performs photosynthesis, and then it is called chlorenchyma.
- In aquatic plants, large air cavities are present in parenchyma to help them float. Such a parenchyma type is called aerenchyma

Sclerenchyma

- Composed of long, narrow, and thick-walled cells.
- This tissue is made up of dead cells and there are no intercellular spaces. Sclerenchyma cells are dead, present in seeds, nuts, the husk of a coconut, fibers of jute etc.
- Sclerenchyma It is the tissue which makes the plant hard and stiff. It is made of sclerenchymatous tissue. The cells of this tissue are dead.
- They are long and narrow as the walls are thickened due to lignin.
- Often these walls are so thick that there is no internal space inside the cell

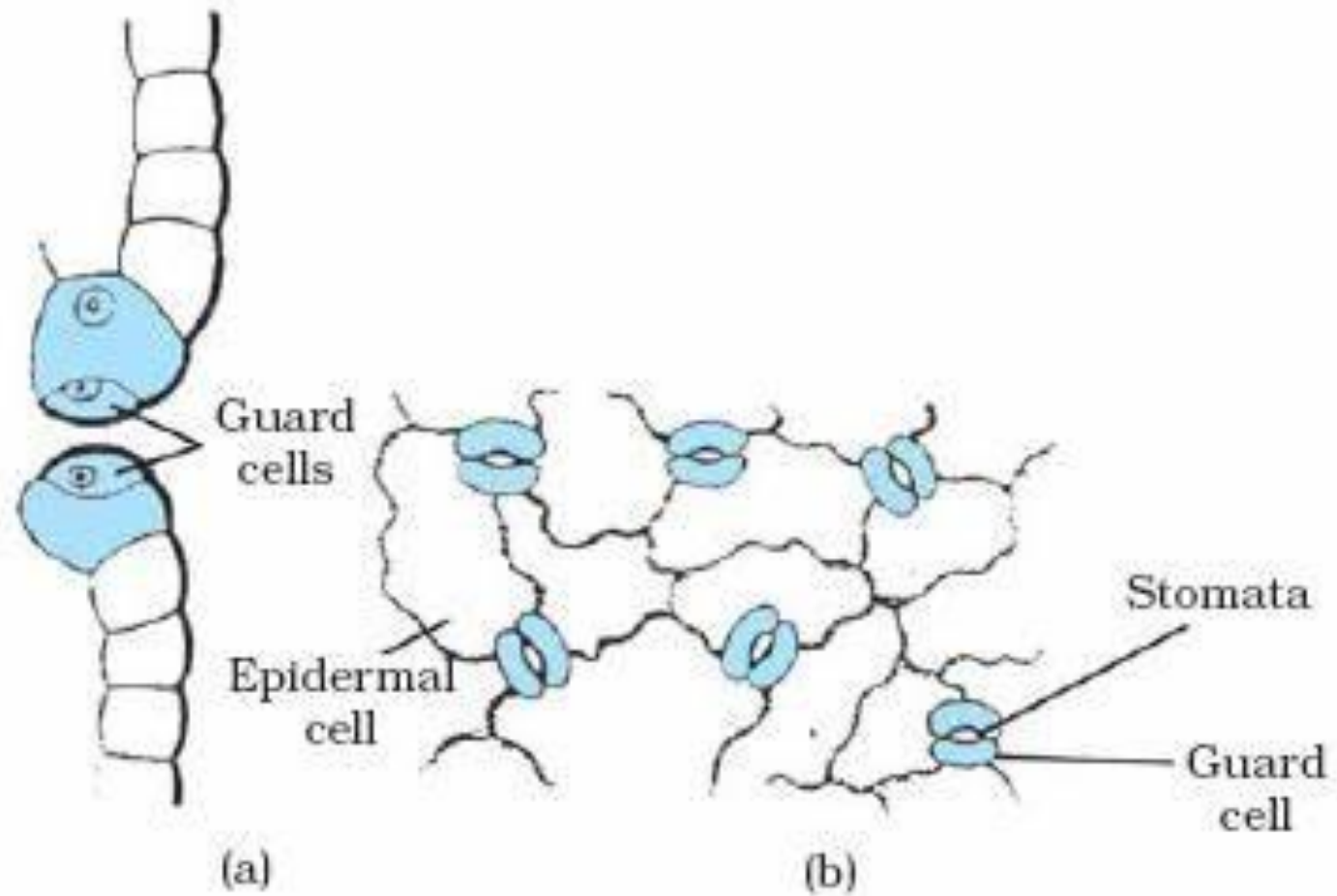




Various types of simple tissues: (a) Parenchyma (b) Collenchyma (c) Sclerenchyma (i) transverse section, (ii) longitudinal section.

- The epidermis is usually made of a single layer of cells.
- In some plants living in very dry habitats, the epidermis may be thicker since protection against water loss is critical.
- The entire surface of a plant has an outer covering epidermis.
- It protects all the parts of the plant. Epidermal cells on the aerial parts of the plant often secrete a waxy, water resistant layer on their outer surface.
- This aids in protection against loss of water, mechanical injury and invasion by parasitic fungi.
- Since it has a protective role to play, cells of epidermal tissue form a continuous layer without intercellular spaces.





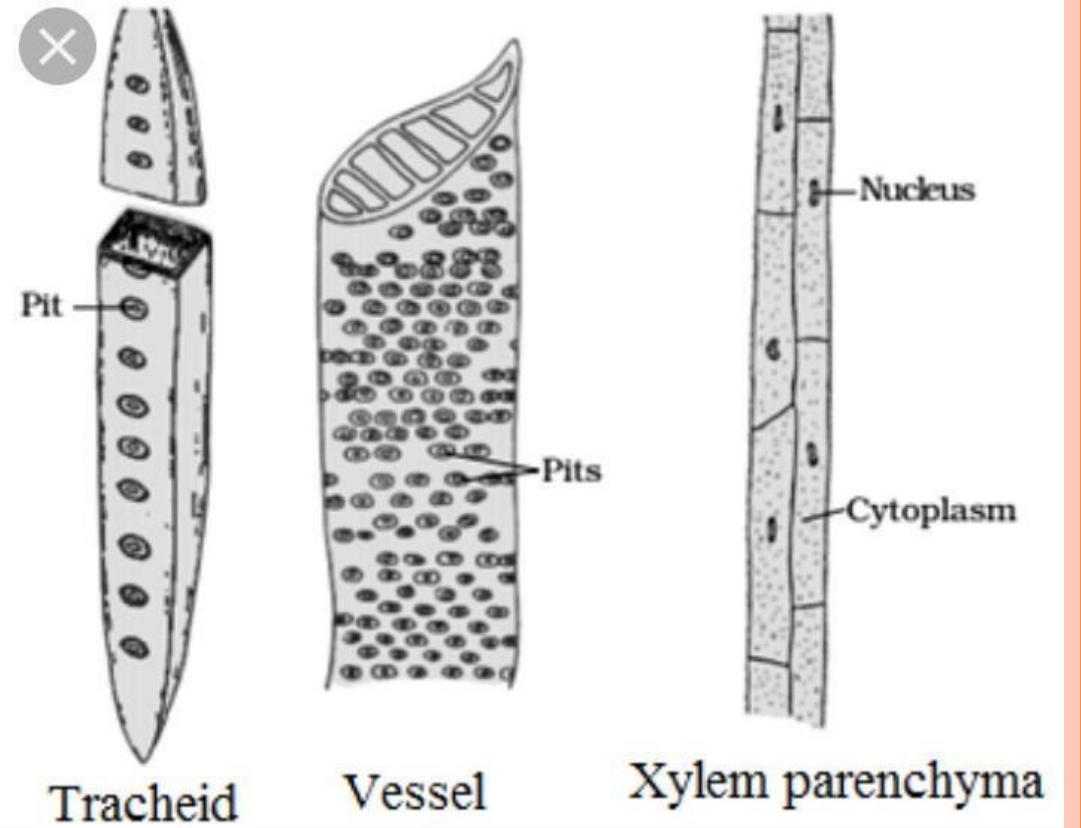
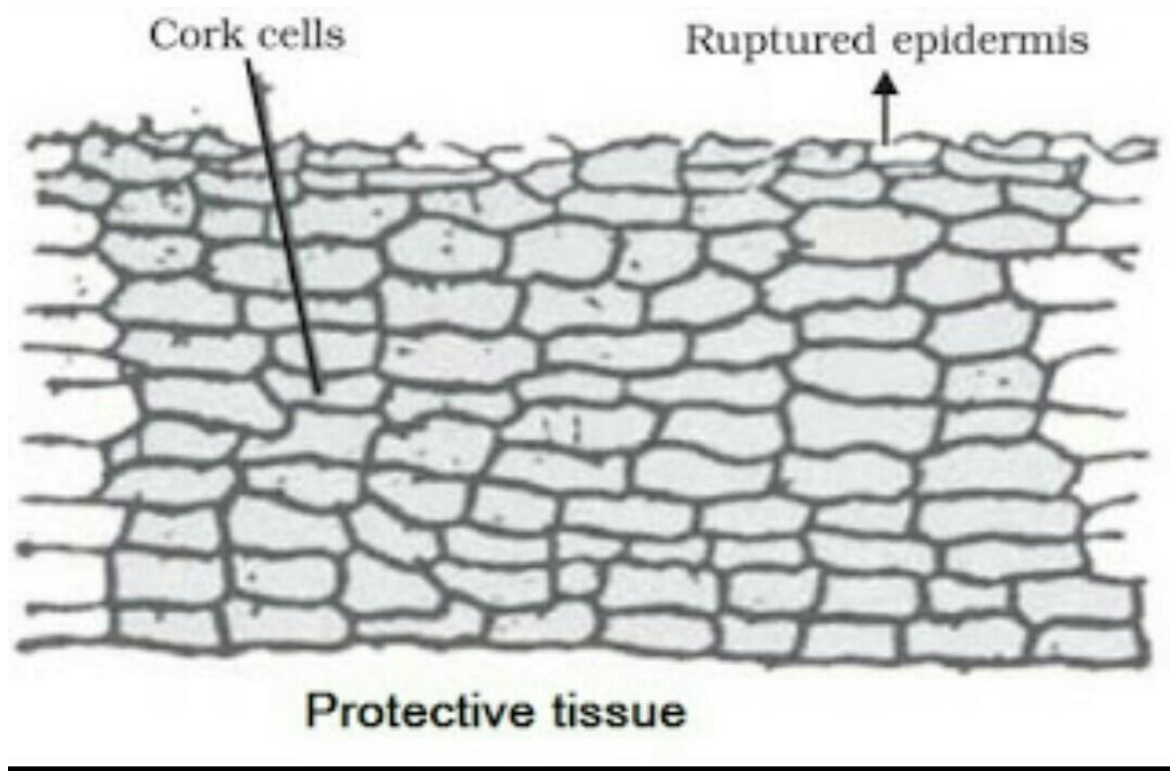
Guard cells and epidermal cells: (a) lateral view, (b) surface view



- Most epidermal cells are relatively flat. Often their outer and side walls are thicker than the inner wall.
- Small pores here and there in the epidermis of the leaf. These pores are called stomata.
- Stomata are enclosed by two kidney-shaped cells called guard cells.
- They are necessary for exchanging gases with the atmosphere. Transpiration (loss of water in the form of water vapour) also takes place through stomata.
- Epidermal cells of the roots, whose function is water absorption, commonly bear long hairlike parts that greatly increase the total absorptive surface area.
- In some plants like desert plants, epidermis has a thick waxy coating of cutin (chemical substance with waterproof quality)

- As plants grow older, the outer protective tissue undergoes certain changes.
- A strip of secondary meristem located in the cortex forms layers of cells which constitute the cork.
- Cells of cork are dead and compactly arranged without intercellular spaces. They also have a substance called suberin in their walls that makes them impervious to gases and water.





ii)Complex permanent tissue: Made up of more than one type of cells
(Conducting tissues.)

Types of complex permanent tissues:

Xylem: Conducts water and minerals from the roots to the different parts of the plant.

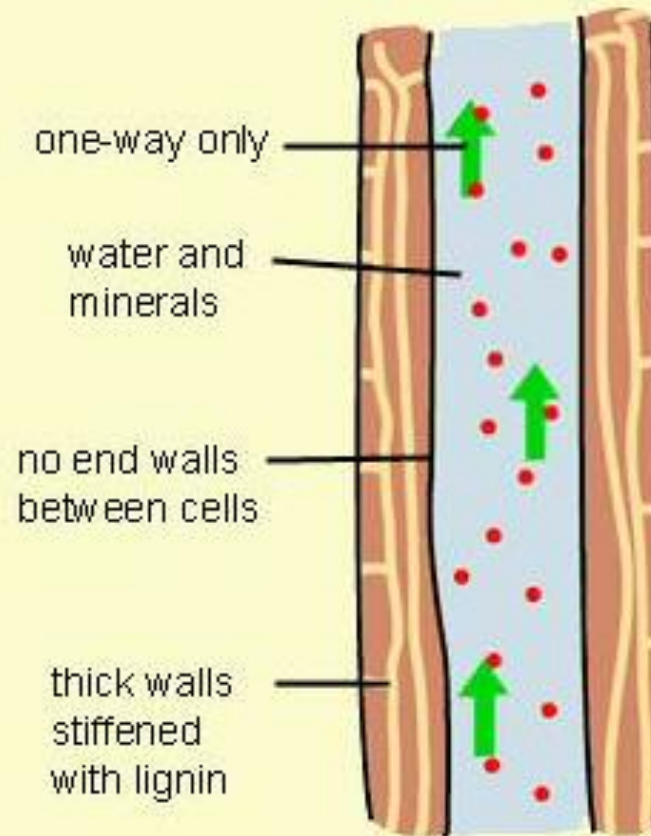
Composed of four different types of cells—tracheid's, vessels, xylem parenchyma and xylem fibres.

Phloem: Conducts food material from the leaves to the different parts of the plant.

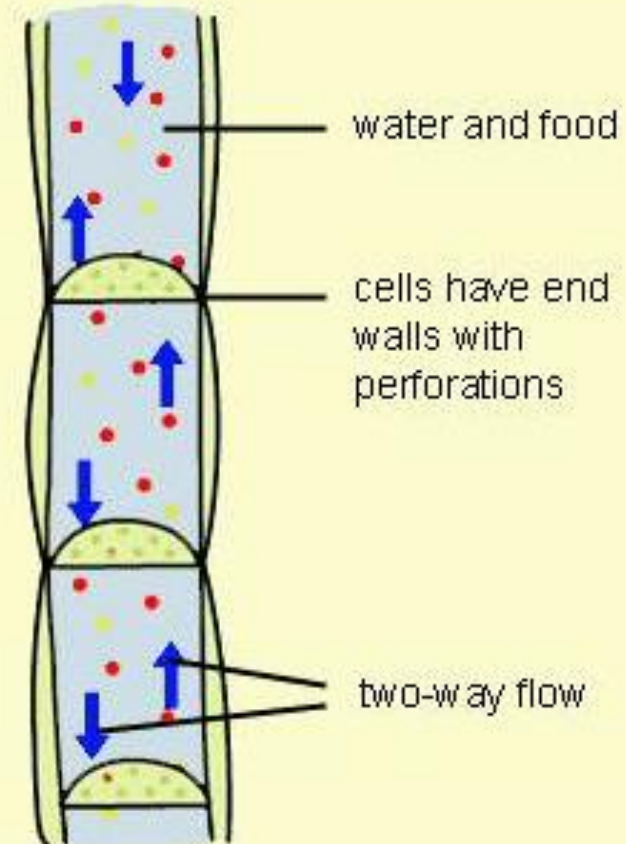
Composed of four different types of cells—sieve tubes, companion cells, phloem parenchyma and phloem fibres.

Protective tissue: It is made of a single layer of cells. E.g., epidermis. The epidermis of the leaf bears stomata.





xylem vessel



phloem vessel



THANKYOU...

