WE ARE RABINDRANATH WORLD SCHOOL

Class 9th

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Tissues

May, 2021

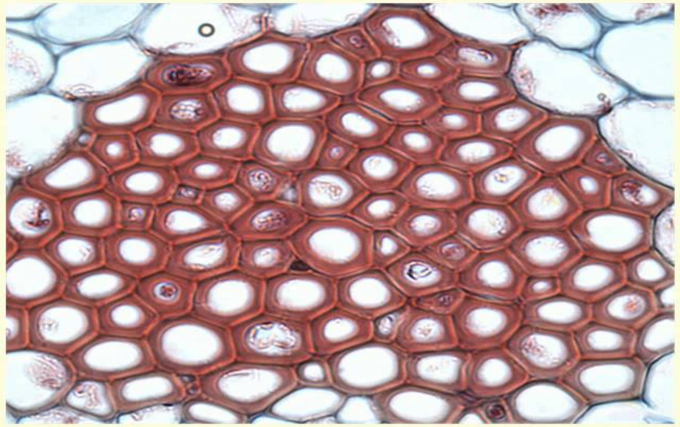
What is Tissue?

In multicellular organisms, there is division of labour where different groups of cells take up different functions.

Tissue can be defined as a group of cells that have a common origin, shape and structure.

They work together to achieve a common function.

Tissue (biology)

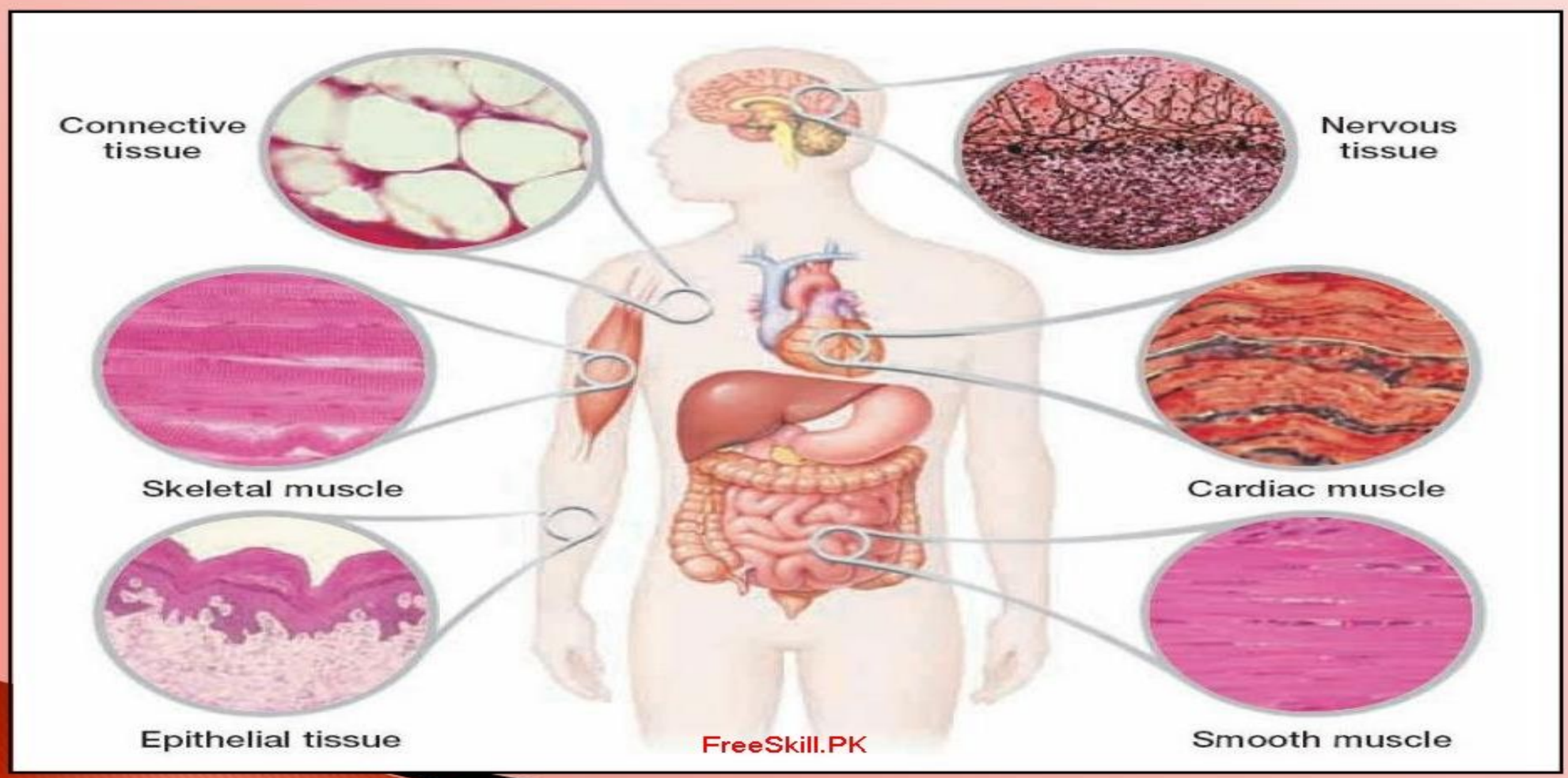


https://en.wikipedia.org/wiki/File:Plant_cell_type_sclerenchyma_fibers.png

Importance of Tissues

- Formation of tissues has resulted in division of labour in multicellular organisms.
- Tissues become organized to form organs and organs further get organized into organ system.
- Origin of tissues has reduced the work load of individual cells.
- Due to improved organization and higher efficiency of tissues, multicellular organisms have higher survival.

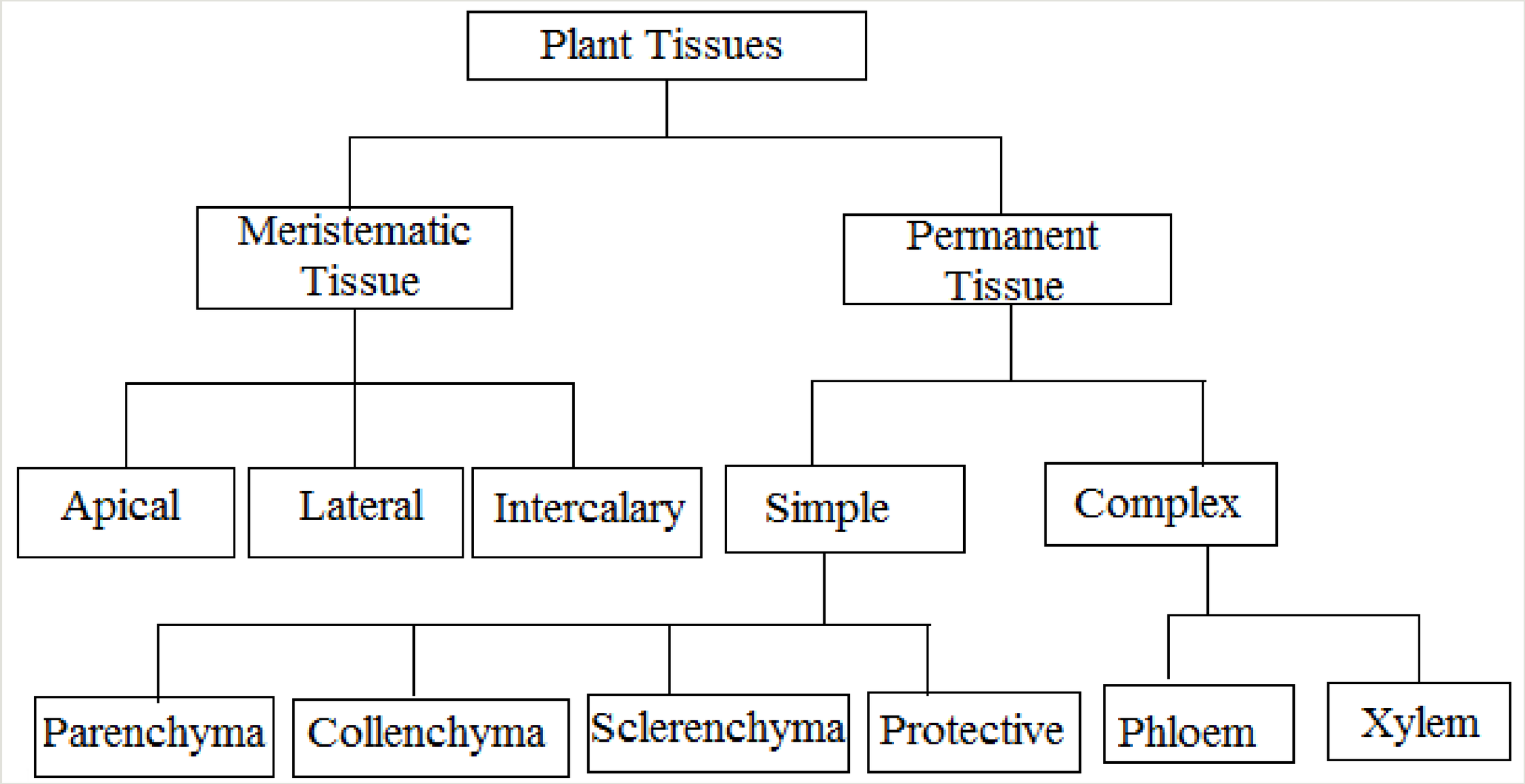
Human Body Tissues



Are Plants and animals made of same type of Tissues ?

There are noticeable differences between plant and animal tissues. Like

- **Most plant tissue are supportive and provide mechanical strength but animal tissues carry out different functions.**
- **In plants , most of the tissues are dead, whereas in animals tissues are living.**
- **In plants, the growth is limited to certain regions but in animals it is uniform in all cells.**
- **There is clear demarcation in dividing and non dividing tissues in plants but in animals it is absent.**
- **Tissue organization in plants is simple but in animals, it is complex.**
- **Due to the activity of meristematic tissues plants grow throughout life but animals do not show growth after reaching maturity.**


Plant Tissues
Meristematic Tissue
Permanent Tissue
Apical
Lateral
Intercalary
Simple
Complex
Parenchyma
Collenchyma
Sclerenchyma
Protective
Phloem
Xylem

Meristematic Tissues

These are formed of young , compactly arranged undifferentiated living cells that keep on dividing and add new cells throughout the life of plant. They are present in the growing regions of plant like tips of root, shoot and branches.

Characteristics of Meristematic Tissues

1. They are small, undifferentiated and thin walled.
2. They are compactly arranged without intercellular spaces.
3. They may be of spherical, oval, polygonal in shape.
4. Cytoplasm is dense, vacuoles are small or absent.
5. Nucleus is prominent and centrally located.

Types of meristematic Tissues

Based on their location in the plant body, they are:

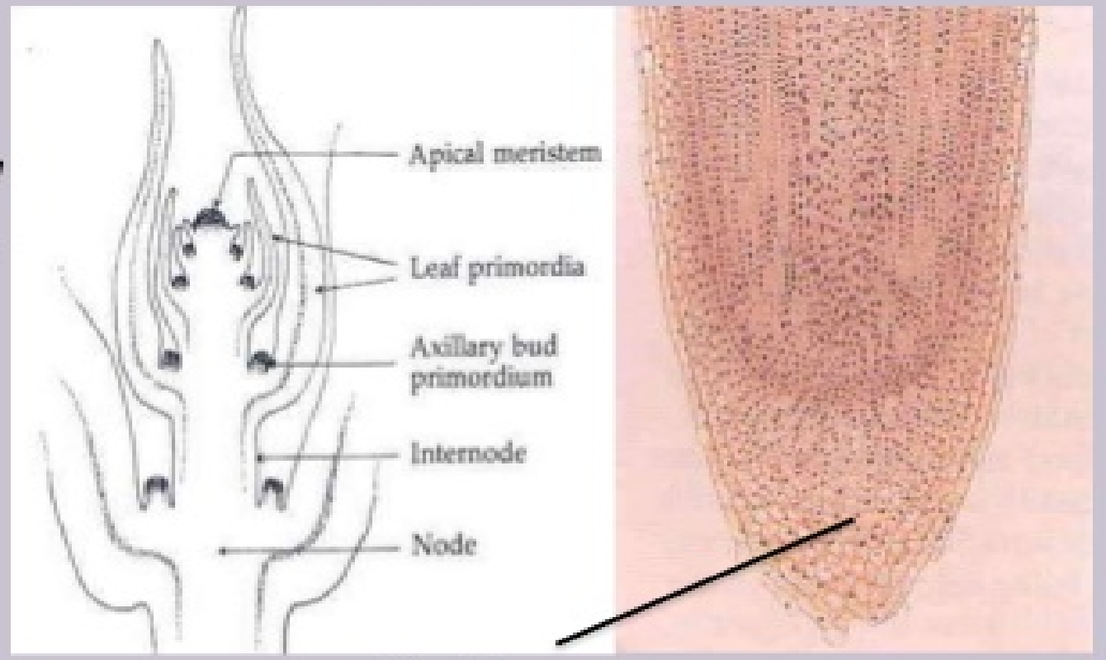
Apical Meristem

Intercalary Meristem

Lateral Meristem

APICAL MERISTEM

- These are situated at the growing tip of the dicot stems and roots i.e. *at shoot apex and root apex.* Apical meristems are also found in the apices of the leaves.
- In plants belonging to the MONOCOT class, apical meristems are located ONLY in the root tips.



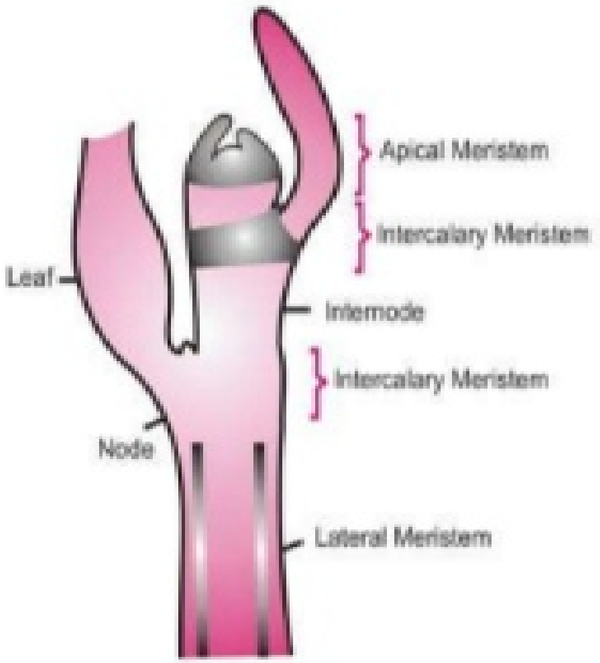
Apical Meristem in a Root Tip

- As cells in apical meristems *divide* and *elongate,* shoot tips and root tips grow longer. This increase in length is called ***primary growth.***

INTERCALARY MERISTEMS

- These are located at the base of the nodes, internodes, leaves etc.
- They are also present in between the permanent tissue.
- It produce an increase of length of organ.

- E.g…***stems of grasses or other monocots.***



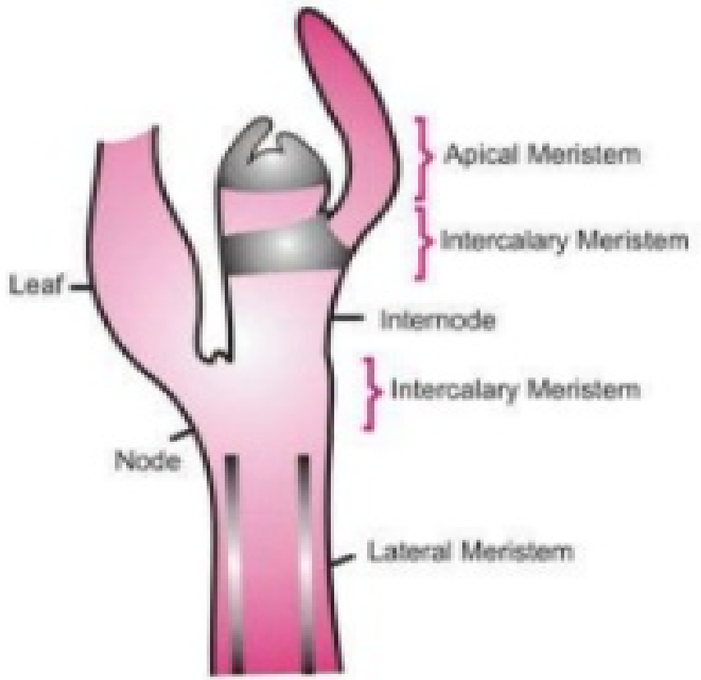
The functions of different types of meristematic tissues are :

(a) Apical meristem – They are meant for linear growth of plant organ (roots and shoots).

(b) Lateral Meristem – They are meant for increase in diameter (girth) of plant parts (root and stem).

(c) Intercalary meristem – They are involved in growth in length.

LATERAL MERISTEM



This tissue lies on the sides of the plant body.

It lies under the bark of the plant in form of cork cambium.

It gives the plant it's width or girth.

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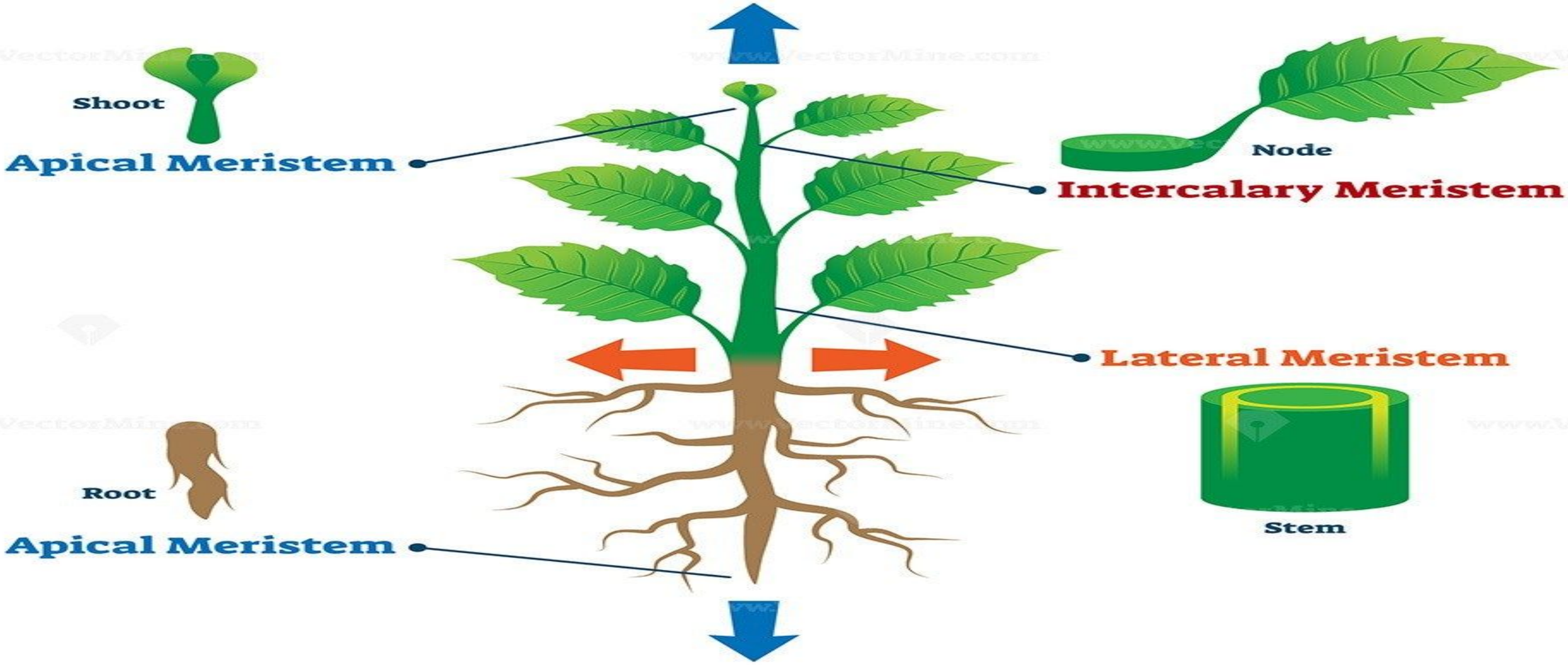
MERISTEMATIC TISSUE



Permanent Tissues

They are formed of cells that have lost their capacity to divide. Though derived from meristematic tissues. They form the bulk of plant body.

Characteristics of Permanent Tissues

1. The cells of permanent tissues are differentiated and have definite shape.
2. The cells may have thin or thick cell wall.
3. The intercellular spaces may or may not be present.
4. The cells may be living or dead.
5. The vacuole may be present or absent.
6. Cells of permanent tissues do not divide.

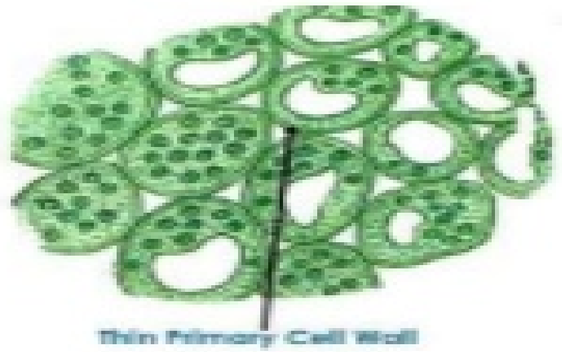
Permanent tissues are of two types:

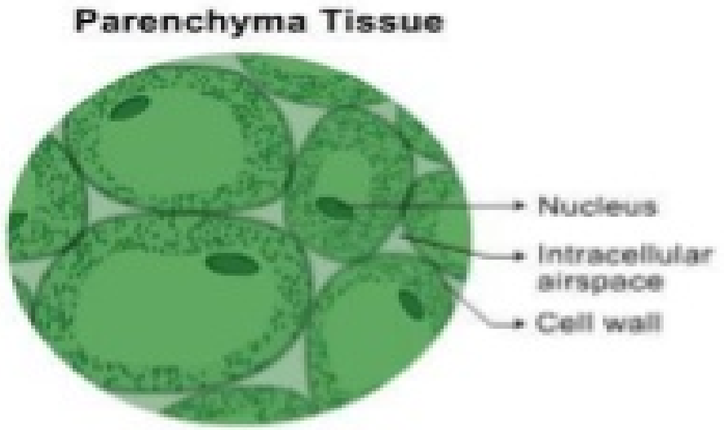
Simple Permanent Tissues: They are structurally and functionally similar cells .They are either supportive or protective in nature. Supportive tissues are Parenchyma, Collenchyma, Sclerenchyma. Protective tissues are Epidermis and Cork.

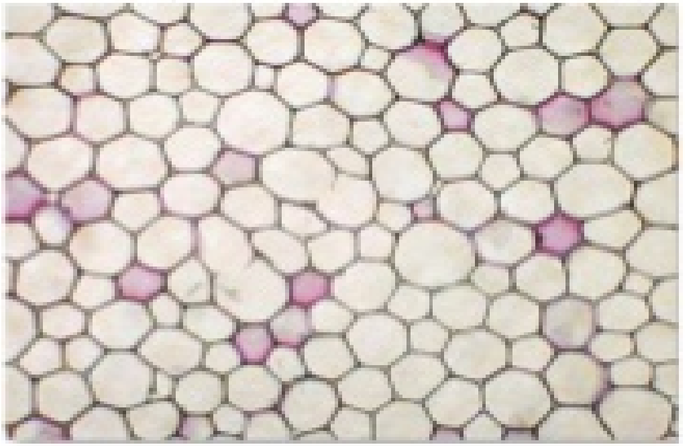
Complex Permanent Tissues: A complex Permanent tissue consist of different types of living and dead cells which work together to perform a function. Xylem and Phloem are two types of complex Tissues.

Parenchyma cells

- They are the most abundant of the cell types in plants
- They are less spherical, cubical, or elongated in shape
- Have very large vacuoles and are frequently found in all **roots**, **stems**, **leaves** and **fruits**
- Have thin primary cell wall
- Serve as space-fillers and structural components





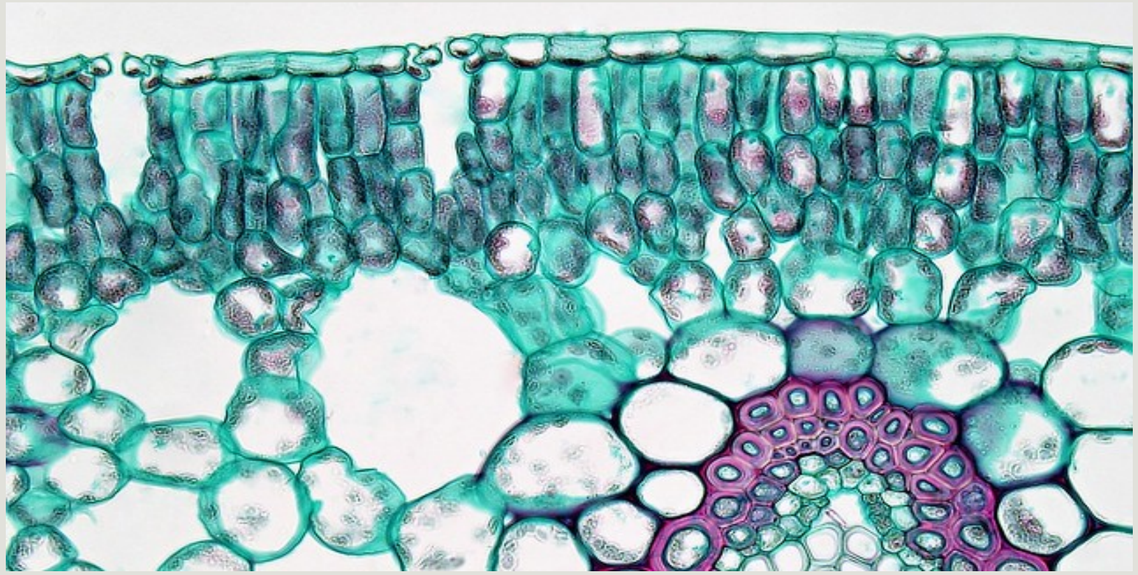


Functions of parenchyma :

a) To store materials such as starch, proteins, hormones etc and waste products such as gum, tannin, resin etc.
b) Parenchyma cells perform the metabolic activities of the plant.
c) Forms the packaging tissue between the specialized tissue.
d) By providing turgidity , they provide mechanical strength.
e) Chlorenchyma helps in performing photosynthesis.

Specialized Types of Parenchyma

1. **Chlorenchyma** – Parenchyma cells with chloroplasts form Chlorenchyma. They manufacture food for the plant by photosynthesis.
2. **Palisade Chlorenchyma** – In palisade Chlorenchyma, Parenchyma cells are elongated and are arranged under the upper epidermis of leaves.
3. **Aerenchyma** – In aquatic plants, large air cavities are present between the parenchyma cells. Such a parenchyma is called Aerenchyma . It helps aquatic plants in floating.

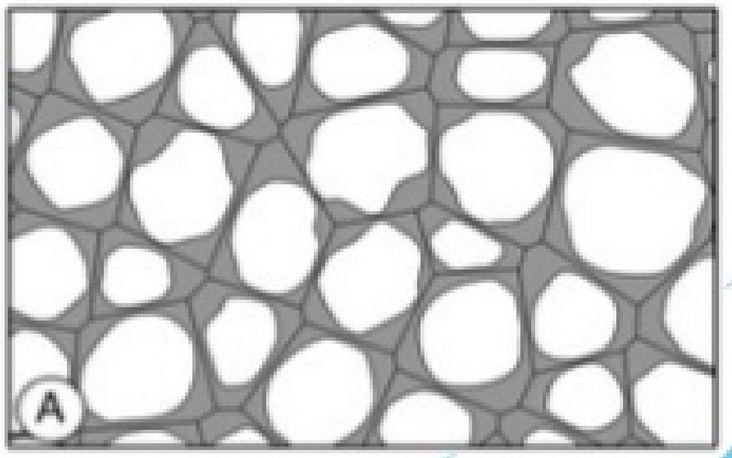


STRUCTURE COLLENCYMA TISSUE ~

- Polygonal in shape and elongated
- The end of cell wall may be tapered
- The cells are closely packed together with very small or no intercellular air space
- The cell wall are unevenly thickened with deposits of cellulose(primary wall), pectin and hemicellulose
- The thickenings usually occur at corners of the cell walls

(angular collenchyma)

- Pits are present in the walls



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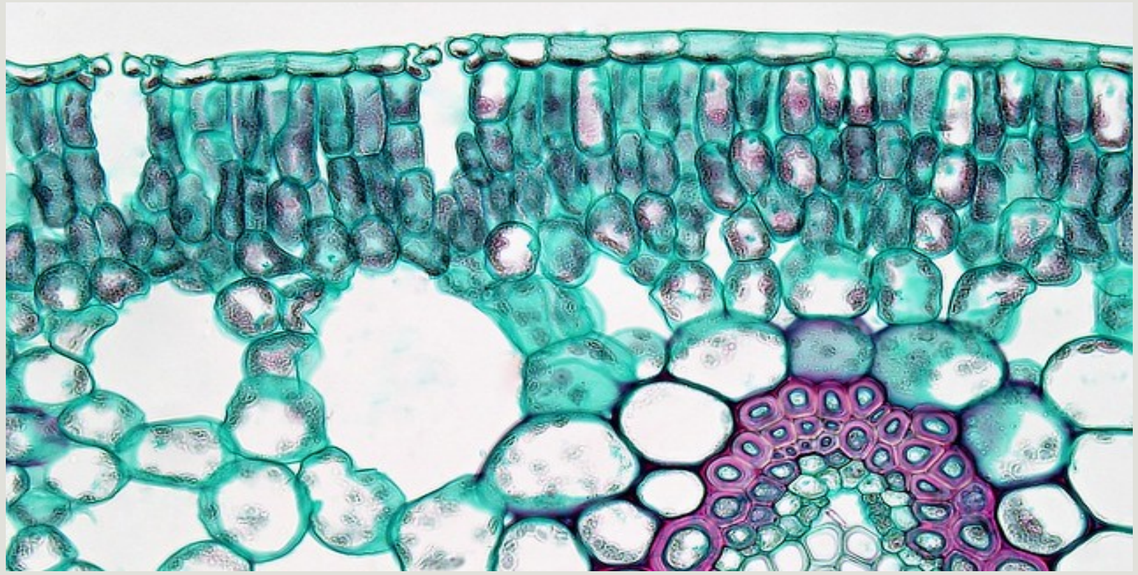


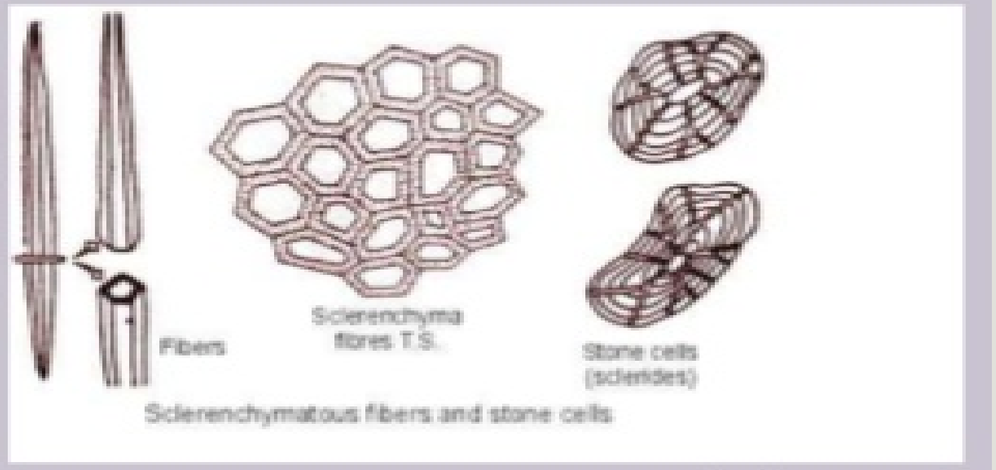
What are the functions of collenchyma tissue?

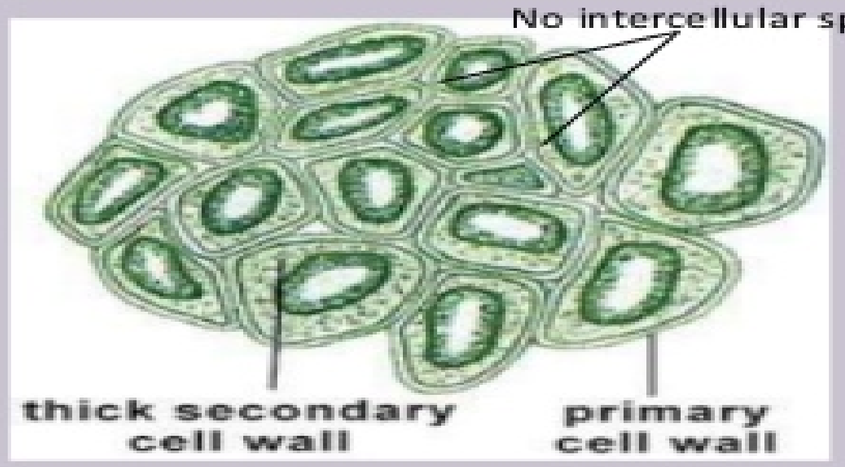
- Provide support for plants ,allowing bending but not breaking
- Provide mechanical support to new developed or growing organs especially roots and stem
- It allows the cells to expand and be stretched as the young stem grows
- The thickened edge of collenchyma walls : increases the strength of tissues
- Can carry out photosynthesis
- Can store starch as food

SCLERENCHYMA

- *Dead cells with no protoplasm.*
- *The walls of cells greatly thickened & lignified.*
- *Due to excessive thickening of the wall of sclerenchyma cells, its cell cavity or lumen becomes nearly absent.*
- *The cells of are closely packed.*
- *No intercellular spaces.*

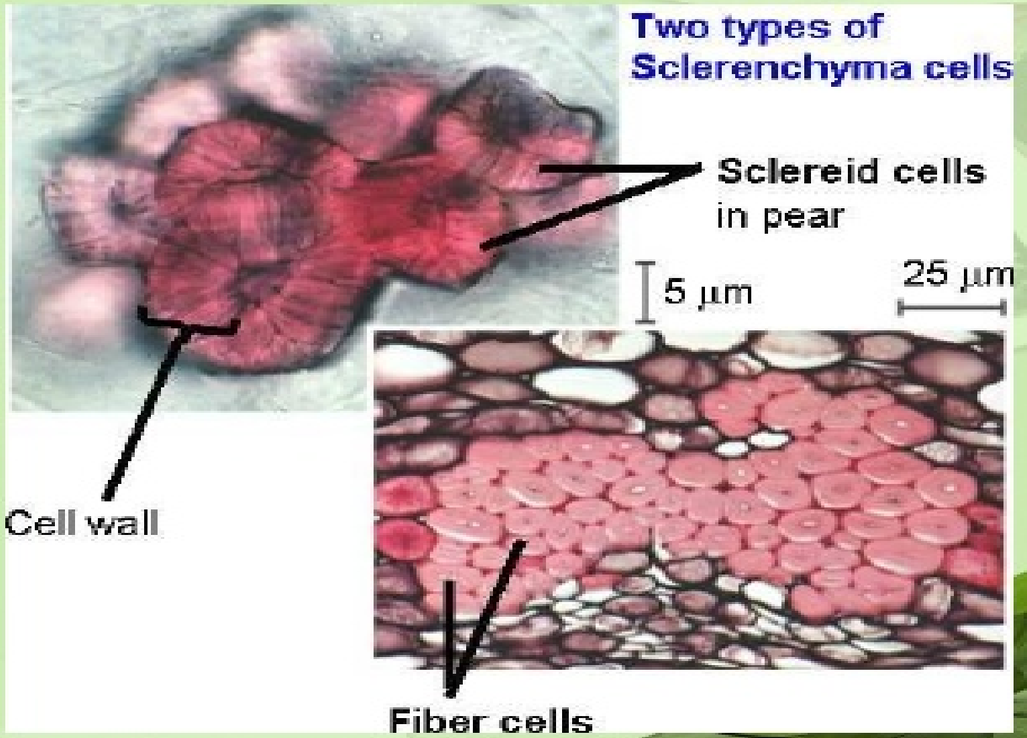
They are found in ***Stems, roots, veins of leaves, hard covering of seeds & nuts.***





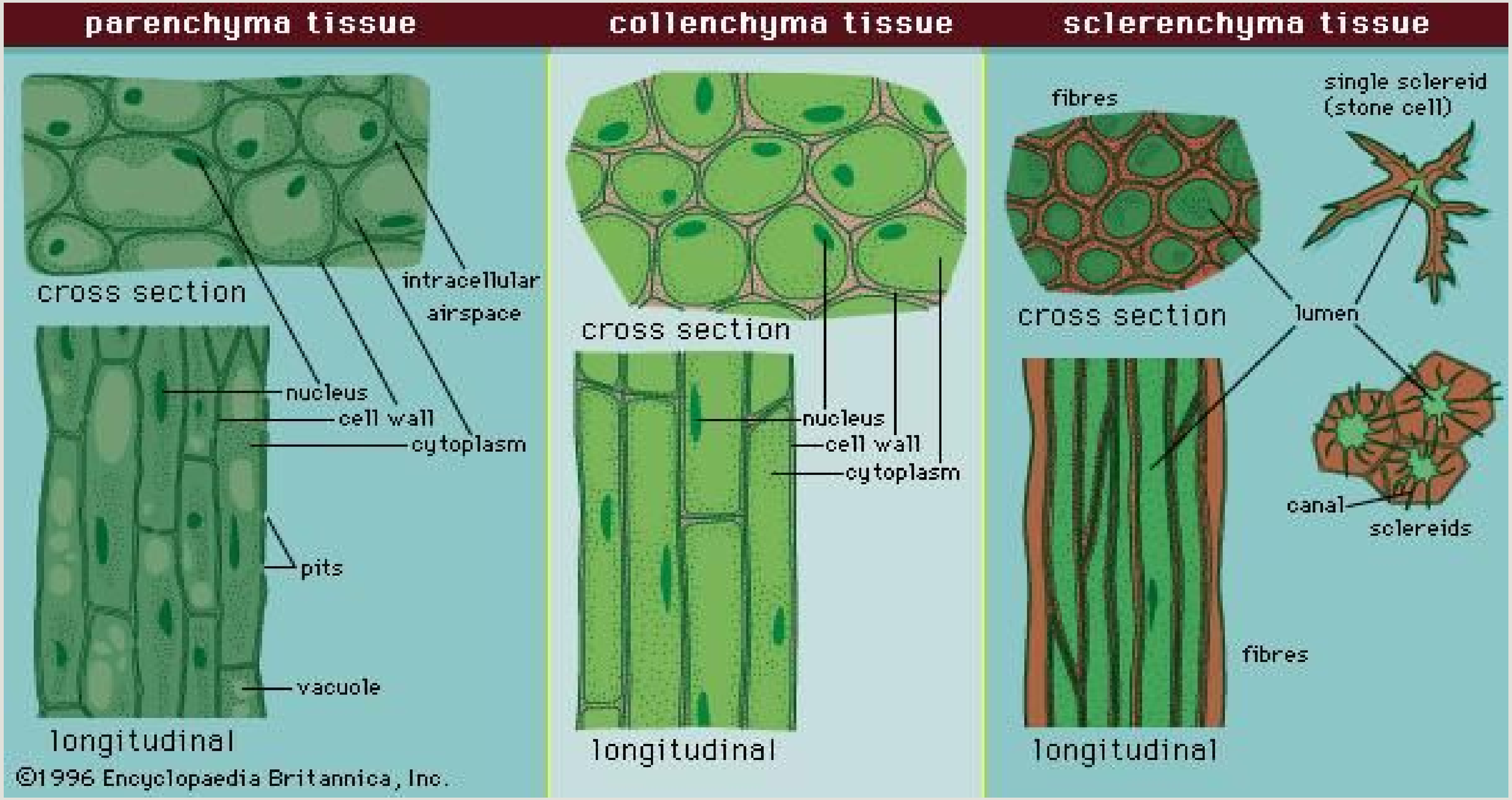
Sclerenchyma

- There are two types of sclerenchyma cells: elongated fibers and variously shaped sclereids.
- Fibers often organize into bundles. (They are common components of xylem.)
- Sclereids may pack together very densely. (Sclereids are found in fruits such as pears and this give them their gritty texture.) They are often referred to as "stone cells".



Differences between Fibres and Sclereids

Fibres	Sclereids
Fibres are elongated cells.	Sclereids are broad cells.
They are long, narrow-lumen, thick-walled, and dead cells that provide internal structure of plant.	They are polygonal cells that are found in fruit pulps.
They are generally unbranched.	They may or may not be branched.
It provides mechanical strength.	It provides stiffness.


parenchyma tissue
collenchyma tissue
sclerenchyma tissue
cross section
intracellular airspace
nucleus
cell wall
cytoplasm
pits
vacuole
longitudinal
cross section
nucleus
cell wall
cytoplasm
longitudinal
fibres
single sclereid (stone cell)
cross section
lumen
canal
sclereids
fibres
longitudinal
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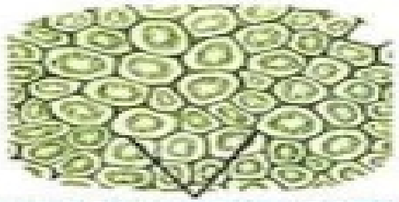
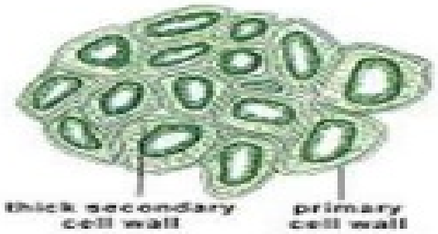
Features	Parenchyma	Collenchyma	Sclerenchyma
			
1. Cell shape	Isodiametric cells which are oval, spherical or polygonal in shape	Circular, oval or polyhedral	Variable in shape. Fibres and sclereids
2. Cell wall	Thin cellulosic cell wall	Uneven thickening on their cell wall.	Lignified secondary cell wall present
3. Cytoplasm	Abundant	Present	Absent
4. Nucleus	Present, (Living tissue)	Present, (Living tissue)	Absent (Dead tissue)
5. Vacuoles	Large vacuole	Vacuolated	Absent
6 .Intercellular spaces	Present	Absent	Absent
7. Occurrence	Basically packing tissue, All soft part of plant, Pith,cortex , medullary rays	Dicot stems, petiole and beneath the epidermis. Absent in monocot and roots	Dicot hypodermis, bundle sheath, pericycle, Seed, pulp of fruits.
8. Functions	Food storage, Photosynthesis	Provide tensile strength, Mechanical support, Photosynthesis	Protection from stress and strain, Mechanical strength

Protective tissues

Epidermis: They are simple permanent tissue, protective in function.

Characteristics of Epidermis

1. They are formed of living cells, arranged in a single layer.
2. In aerial parts, Epidermis is covered with a waterproof noncellular waxy covering called cuticle.
3. In leaves epidermis has small openings called stomata.

Functions of epidermis

1. It protects the underlying tissues from mechanical injury, chemicals and infection.
2. Cuticle protects against water loss and prevents wilting.
3. Stomata helps in gaseous exchange.

Cork: It is made up of thick walled dead cells.

Characteristics of cork

1. Cork cell are dead and closely packed without any intercellular spaces.
2. Their cell walls are deposited with waterproof , waxy substance called suberin. This makes cork impervious to water and air.

Functions of cork

1. It protects the plant from infection, mechanical injury and desiccation.
2. Cork is also used commercially in the manufacture of stoppers, sports goods etc.

Complex permanent tissues

Xylem: They are vascular as well as mechanical in nature. Responsible for conduction of water and minerals from roots to the top of the plant. They are made up of four elements.

1. Xylem Tracheid – They are dead, elongated cells with tapering ends. These form a long row, placed one above the other.
   They help in conduction of water and minerals and also provide mechanical support.
2. Xylem Vessels – They are tubular structures occur as long ducts. They have thick and lignified cell wall and wide lumen.
   They also help in conduction of water and minerals and provide mechanical support.
3. Xylem Fibres – They are long cells tapering at both ends. They are sclerenchymatous dead cells with lignified wall. They are also called wood fibres. They are found abundantly in woody plants. They provide mechanical support to the plant.
4. Xylem parenchyma – They are the living parenchymatous cells with thin cell wall. They store food and help in conduction of water.

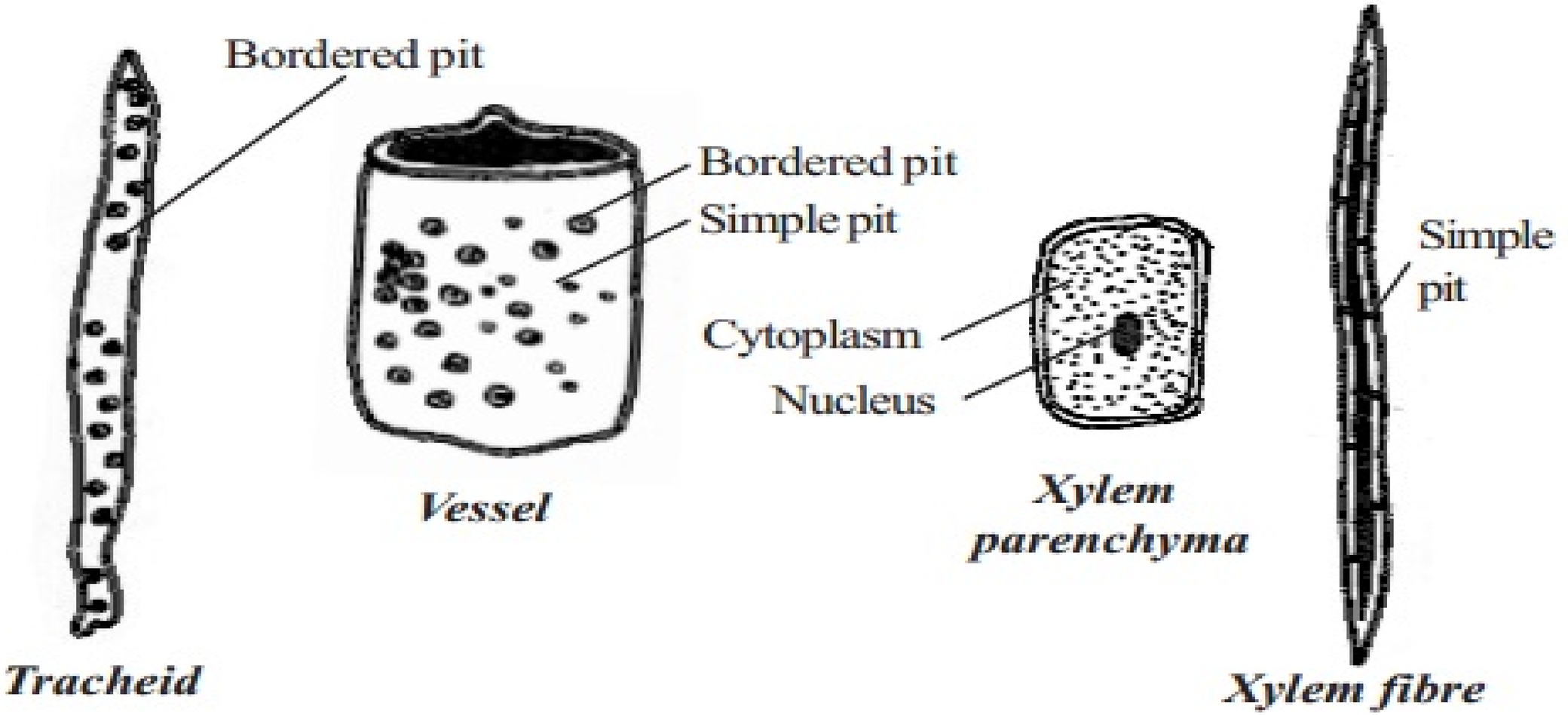
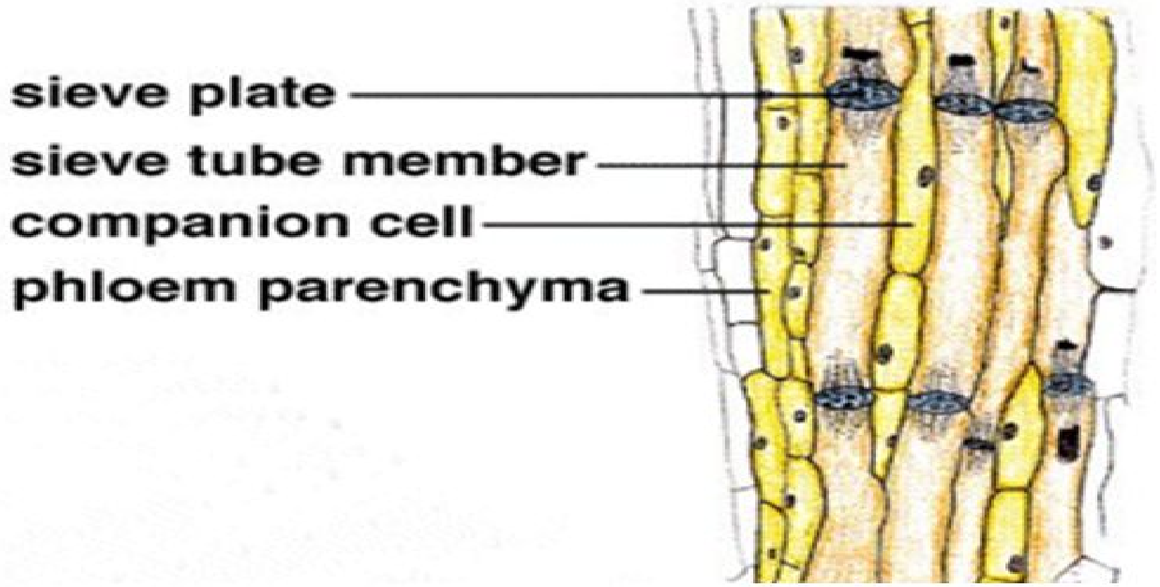


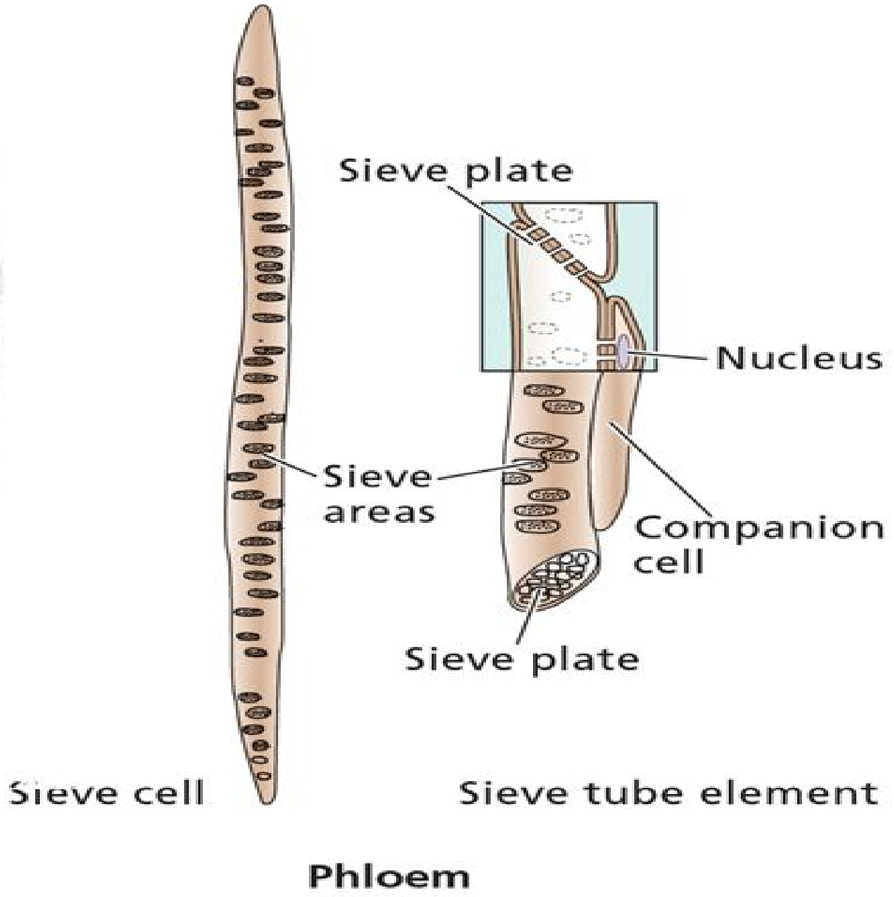
Fig. Kinds of xylem cells

Phloem – It is a living conducting tissue. It contains tubes for the transport of food products. It is also called bast. Along with xylem it extends all along the length of the plant body in the roots, stem, branches and leaves. Different elements of phloem are

1. **Sieve tubes** – These are cylindrical cells arranged in vertical rows. Their end walls are perforated by minute pores. These are called sieve plates. sieve tubes are the main conducting part of phloem.
2. **Companion cells** – They are elongated , thin walled living parenchyma cells with prominent nucleus. They help the sieve tubes in the conduction of food material.
3. **Phloem parenchyma** – It is formed of thin walled unspecialized parenchyma cells. These store food.
4. **Phloem fibre** – These provide mechanical strength. The textile fibres of jute, flax are phloem fibres.

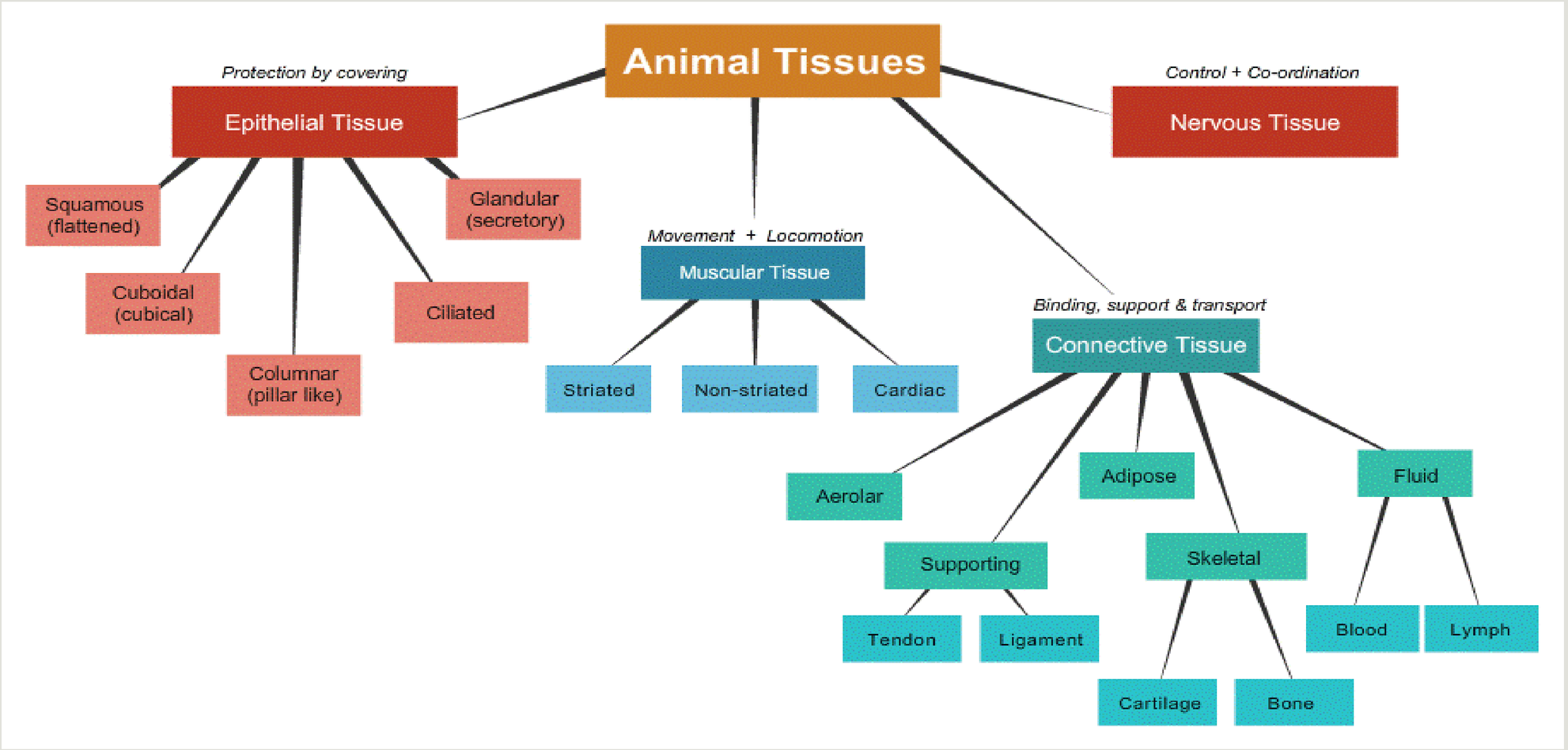
PHLOEM STRUCTURE





Xylem	Phloem
4) Tracheids, vessels, xylem fibres are dead tissues.	4) Phloem fibres are dead tissues.
5) Xylem gives mechanical strength to the plant.	5) Phloem does not give mechanical strength to the plant.
6) Conduction of water by xylem is unidirectional i.e., from roots to apical parts of the plant.	6) Food material conduction is bidirectional i.e., from leaves to storage organs or growing parts or from storage organs to growing parts of plants.
7) Xylem is star shaped.	7) Phloem is not in star shaped.
8) Xylem occupies the center of the vascular bundle.	8) Phloem occurs on outer side of the vascular bundle.
9) Tubular with hard walled cells.	9) Tubular with soft walled cells.

Meristematic tissue	Permanent tissue
Its component cells are living, small, spherical or polygonal and un-differentiated	Its components cells may be living or dead. They are large, differentiated with different shapes.
Cytoplasm is dense and vacuoles are nearly absent as they are metabolica'ly active.	Large central vacuole occurs in living permanent cells as, they are less metabolically active.
Intercellular spaces are absent.	Intercellular spaces are often present.
Cell wall of its cells is thin and elastic.	Cell wall of its cells may either thin or thick.
Nucleus of each cell of this tissue is large and prominent.	Nucleus of each cell of this tissue is less conspicuous.
Its cells grow and divide regularly.	Its cells do not normally divide.
It is a simple tissue.	It can be simple, complex or specialised.
Cell organelles of its cells are simple.	Cell organelles of its cells are well developed.
Cells of this tissue do not contain crystals and other inclusions.	Cells of this tissue possess crystals and other inclusions.
It provides growth to the plant.	It provides protection, support, conduction photosynthesis, storage, etc.


Animal Tissues
Protection by covering
Epithelial Tissue
Squamous (flattened)
Cuboidal (cubical)
Columnar (pillar like)
Ciliated
Glandular (secretory)
Movement + Locomotion
Muscular Tissue
Striated
Non-striated
Cardiac
Control + Co-ordination
Nervous Tissue
Binding, support & transport
Connective Tissue
Aerolar
Adipose
Fluid
Supporting
Tendon
Ligament
Skeletal
Cartilage
Bone
Blood
Lymph

Epithelial Tissue: They are protective animal tissue. It forms continuous sheet on both the surfaces of body and body organs. Hence also called covering tissue.

Characteristics of Epithelial Tissue :

1. They are closely packed without intercellular spaces.
2. The cells are closely held by cell junctions or cementing substances.
3. These tissues which forms the outer covering are called epithelium and the one that lines the body cavities are called endothelium.

Functions of Epithelial Tissue :

1. They protect the underlying cells from mechanical , chemical injuries and from bacterial, viral infections.
2. They help in absorption of water and nutrients.
3. They help in elimination of waste products.
4. Some epithelial tissues perform secretory function.

Types

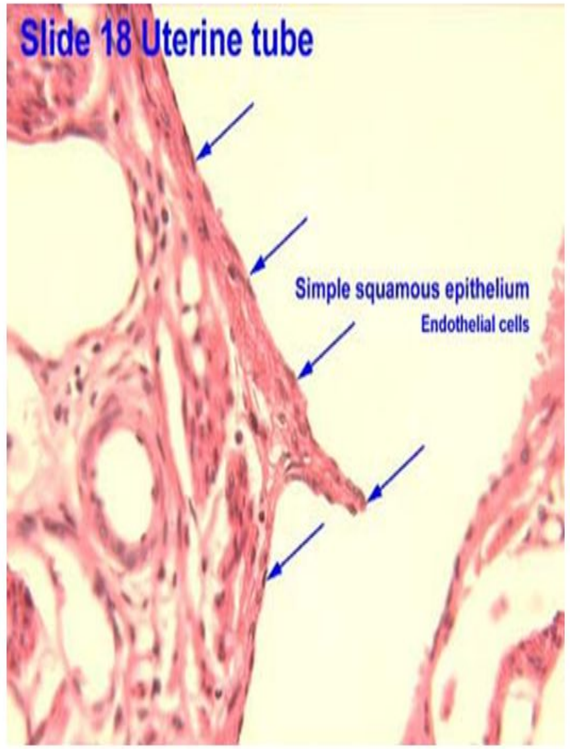
Depending on shape and function, the epithelial tissues are classified as:

a. Squamous epithelium b. Cuboidal Epithelium c. Columnar epithelium

. d. Glandular epithelium e. Ciliated epithelium

Squamous Epithelium

- **Simple squamous epithelium** is the most delicate type of tissue in the body
- They are located in absorption or secretion parts of the body
- Many have a fluid outer coating to protect from harm
- Examples are the alveoli of the lungs and the linings of vascular tissue

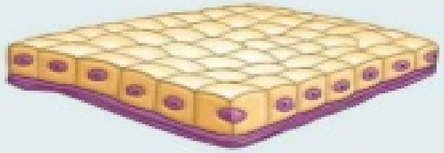


Functions

1. This protects the underlying parts of body from mechanical injury, entry of germs , chemicals and drying.
2. It also forms a selectively permeable surface for diffusion of gases.
3. It is also present in the lining of bowman’s capsule and helps in removal of nitrogenous wastes.

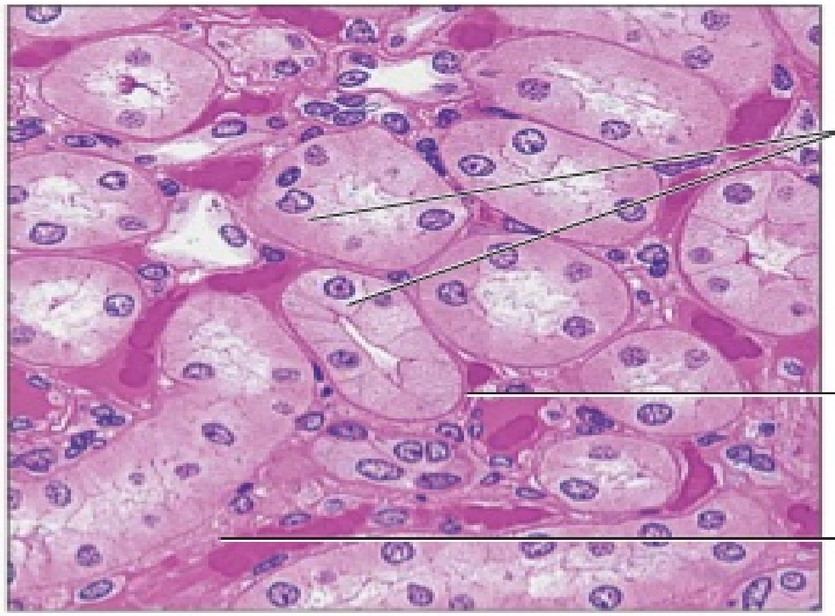
(b) Simple cuboidal epithelium

Description: Single layer of cubelike cells with large, spherical central nuclei.



Function: Secretion and absorption.

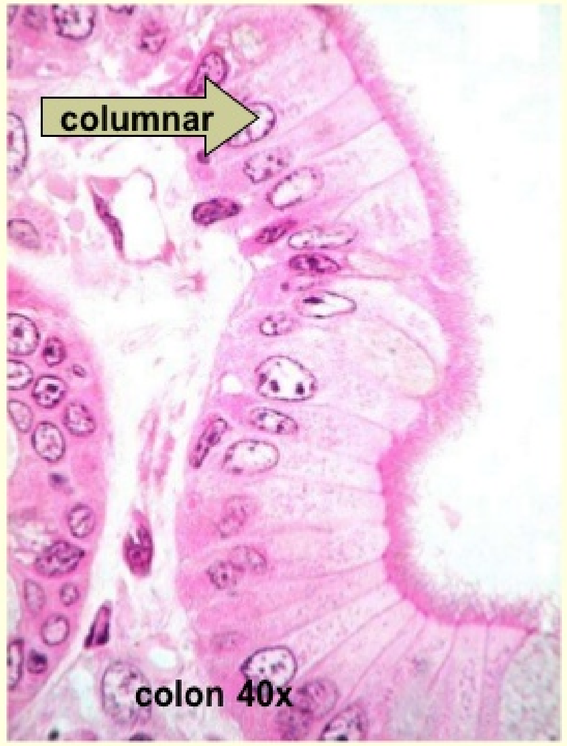
Location: Kidney tubules; ducts and secretory portions of small glands; ovary surface.



Photomicrograph: Simple cuboidal epithelium in kidney tubules (430x).

Simple columnar

- Single layer of tall cells.
- Usually involved in active secretion or absorption across the cell layer, often with striated borders and micro-villi.
- Found lining the digestive tract, the female reproductive tract.
- Modified simple columnar of the intestinal tract interspersed with mucous-secreting goblet cells for protective coating.



Functions

Its main function includes absorption and secretion . It also provides mechanical support to the organs.

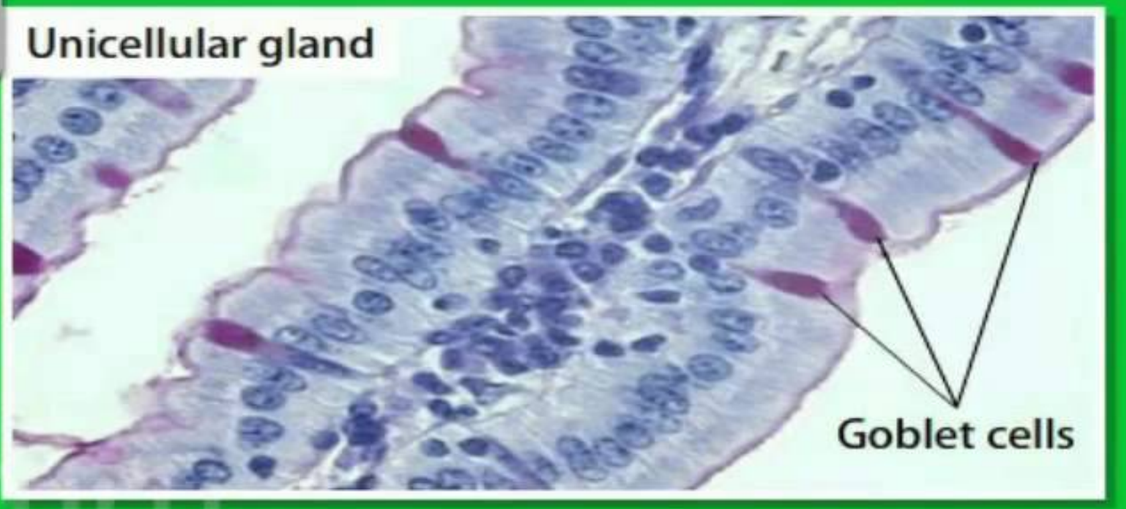
Glandular Epithelium

Columnar epithelium with goblet cells is called glandular epithelium.

Glandular epithelium are of two types:

Unicellular glands consist of single, isolated glandular cells such as the goblet cells.

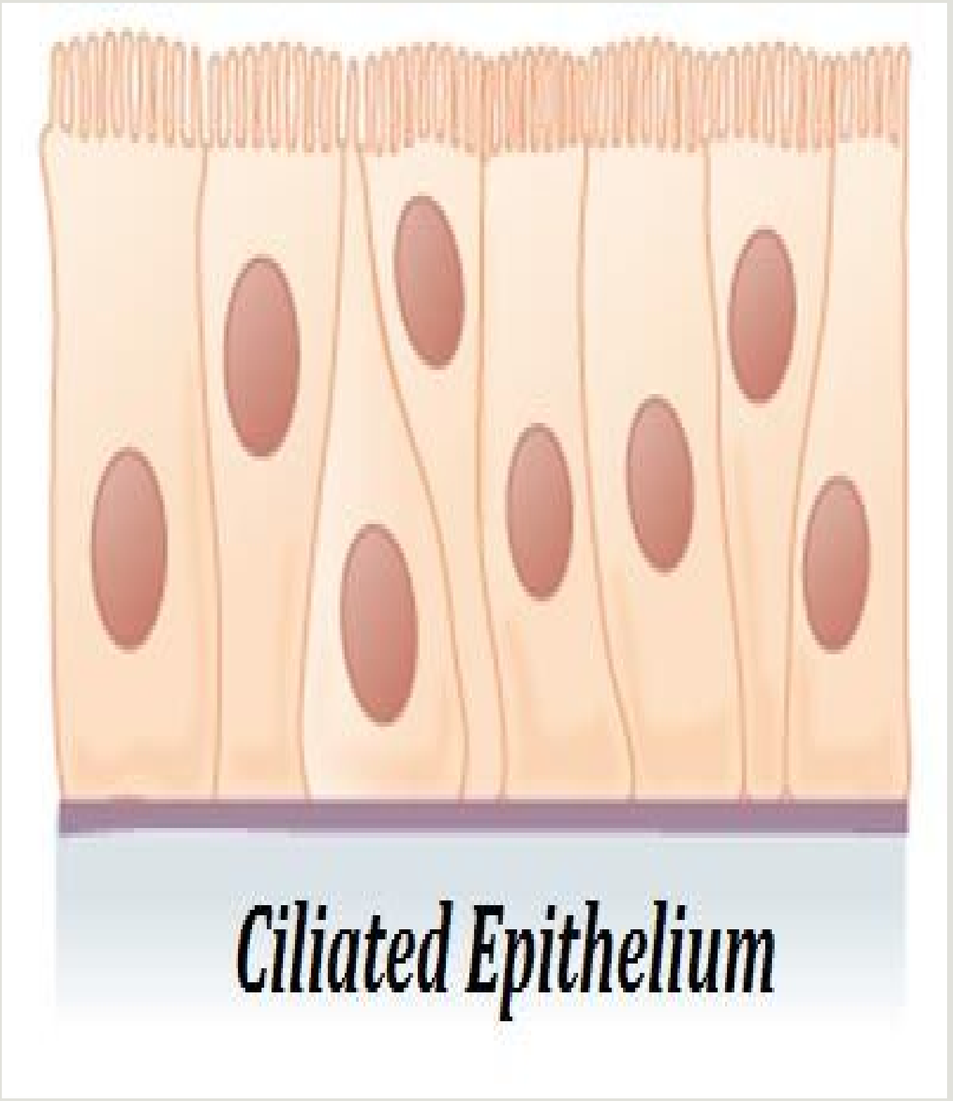
Multicellular glands are composed of clusters of cells. Most glands are multicellular including the salivary glands.



Ciliated Epithelium

- *If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium.*
- *It is of two types: Ciliated cuboidal epithelium and Ciliated columnar epithelium*

- *Function:*
- *It is responsible for passing of ovum through fallopian tube.*
- *In respiratory tract, it helps in expelling the mucus and particles trapped in it, towards the pharynx.*



Muscular tissue: **It is contractile tissue forms nearly 40% of total body weight. It occurs in the form of bundle and sheath.**

Characteristics of Muscular tissue

1. **The cells of muscular tissue are long and fibre like.**
2. **The cytoplasm of each muscle fibre is known as sarcoplasm and cell membrane is known as sarcolemma.**
3. **A number of muscle fibre are bonded together into a muscle bundle and are covered by muscle sheath.**
4. **The intercellular matrix between the cells are absent.**
5. **Myofibrils are formed of special contractile proteins Actin And Myosin**

Types of muscular tissue

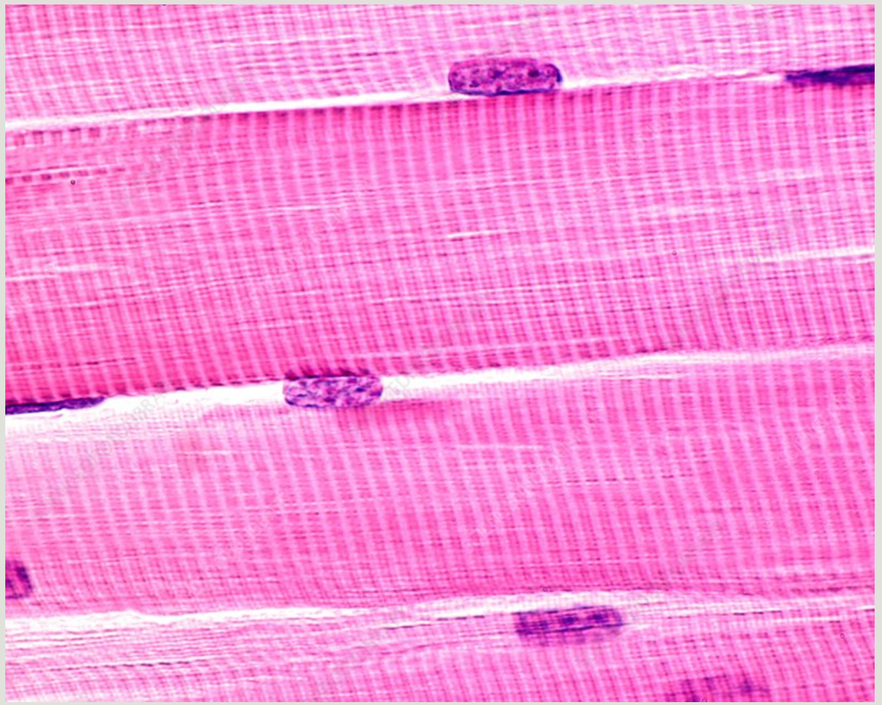
Striated or skeletal muscles

Non striated or smooth muscles

Cardiac muscles

Striated Muscles

They have alternate light and dark colour bands hence called striated muscles.
They are also called skeletal muscles because they are attached to bones and are responsible for their movement. They are also called voluntary muscles because their contraction is under the control of our will.
They are present in the limbs, face, neck diaphragm.



Structure

1. They are consist of unbranched cylindrical fibre.
2. Their sarcoplasm contain many nuclei.
3. They have alternate light and dark bands.
4. They contract and relax very rapidly and soon get fatigued due to accumulation of lactic acid.

Functions

1. They are responsible for all the voluntary movements.
2. They are responsible for locomotion.
3. Responsible for tongue movement.
4. Breathing movements and blinking of eyes are also because of them.

Nonstriated muscles

They are called non striated muscles as they do not have alternate light and dark bands.

They are also called involuntary muscles because their contraction is not under our control.

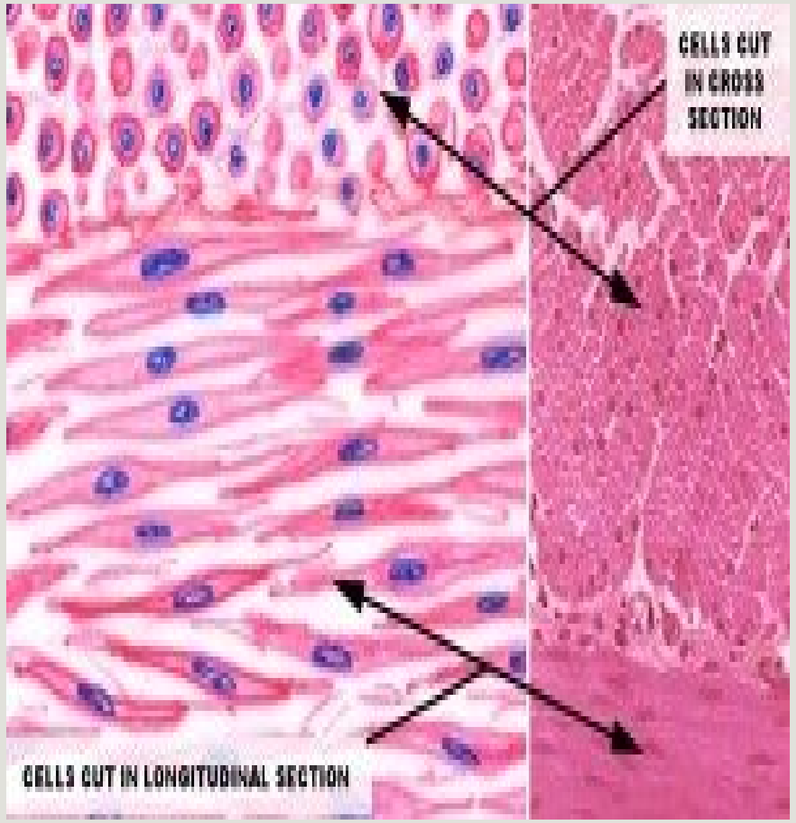
They are also called visceral muscles because are found in the wall of visceral organs like alimentary canal, urinary bladder, blood vessels etc.

Structure

1. These muscle fibres are spindle shaped with pointed ends.
2. The sarcolemma is absent.
3. They are uninucleate.
4. They contract slowly and rhythmically.

Functions

1. They are responsible for peristaltic movement of alimentary canal.
2. They control the movement of iris in eye



Cardiac Muscles

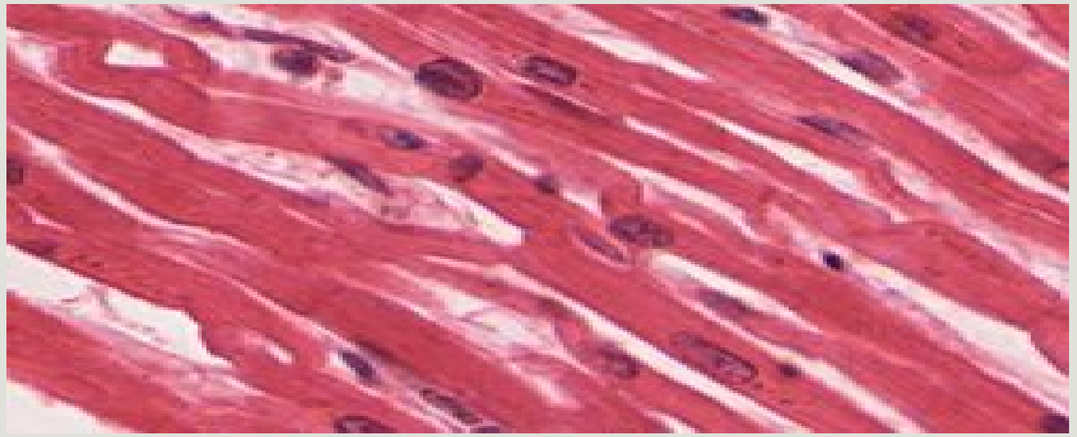
They are found in the wall of heart only. They are striated yet involuntary.

Structure

1. The cardiac muscle fibres are branched and form an interconnecting network.
2. The fibres are uninucleate.
3. Cardiac muscles contract tirelessly throughout life and never get fatigued.

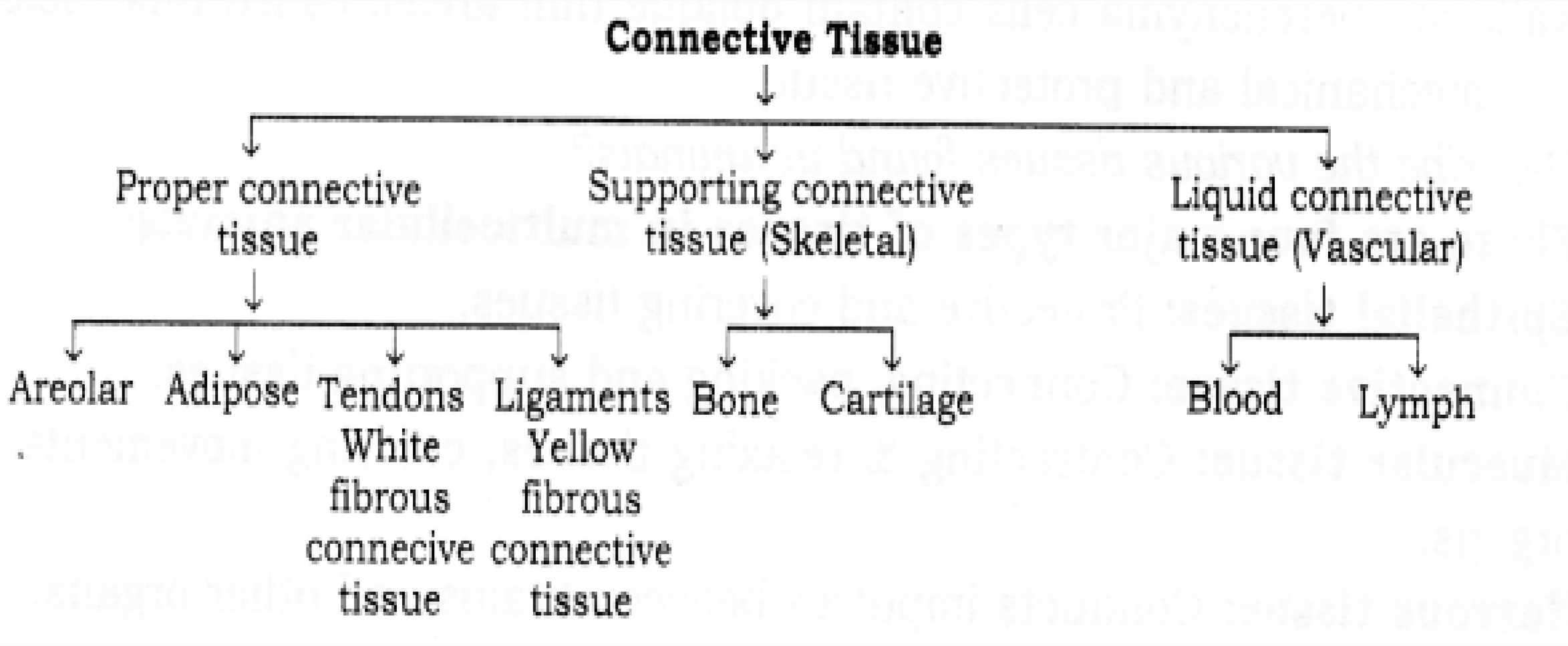
Functions

1. They are responsible for pulsating movements of heart chambers.
2. They pump blood from heart into the blood vessels.



Character	Striated Muscles	Unstriated Muscles	Cardiac Muscles
1. Shape of cells	Cells are long cylindrical, non-tapering and un-branched	Cells are long with tapering ends (spindle shape) and un-branched.	Cells are non-tapering, cylindrical and branched.
2. Nucleus	Many nuclei (multi-nucleated) which are situated towards the periphery of muscle fibre.	The cells have only one nucleus (uni-nucleated) situated in the center.	Each cell contains one or two nuclei situated in the center.
3. Striation	Transverse alternate light and dark bands present.	Striations or strips are absent.	Cells have faint striations.
4. Mode of Contraction	Voluntary contract rapidly but soon undergo fatigue.	Involuntarily not at our will. Contract comparatively slow but do not fatigue.	Involuntary, rhythmically contract and relax throughout life without fatigue under normal conditions.
5. Example of location	Hands, legs and other skeletal muscles.	Stomach wall, intestine, ureter, bronchi etc.	Present in heart.

Types of Connective tissue



Areolar Tissue: It is the basic and most widely distributive tissue, in which fibres are loosely arranged in a meshwork. It contains four types of cells and three types of fibres.

- Large star shaped that secrete fibres.(fibroblasts)
- Large amoeboid (histocytes) that engulf foreign substances.
- Irregular (mast cells) that secrete the matrix.
- Small lymphoid cells
- Three types of fibres are tough White collagen fibres and elastic yellow collagen fibres and reticular fibres.

They are found below the skin, surrounds the muscle bundles , blood vessels etc.

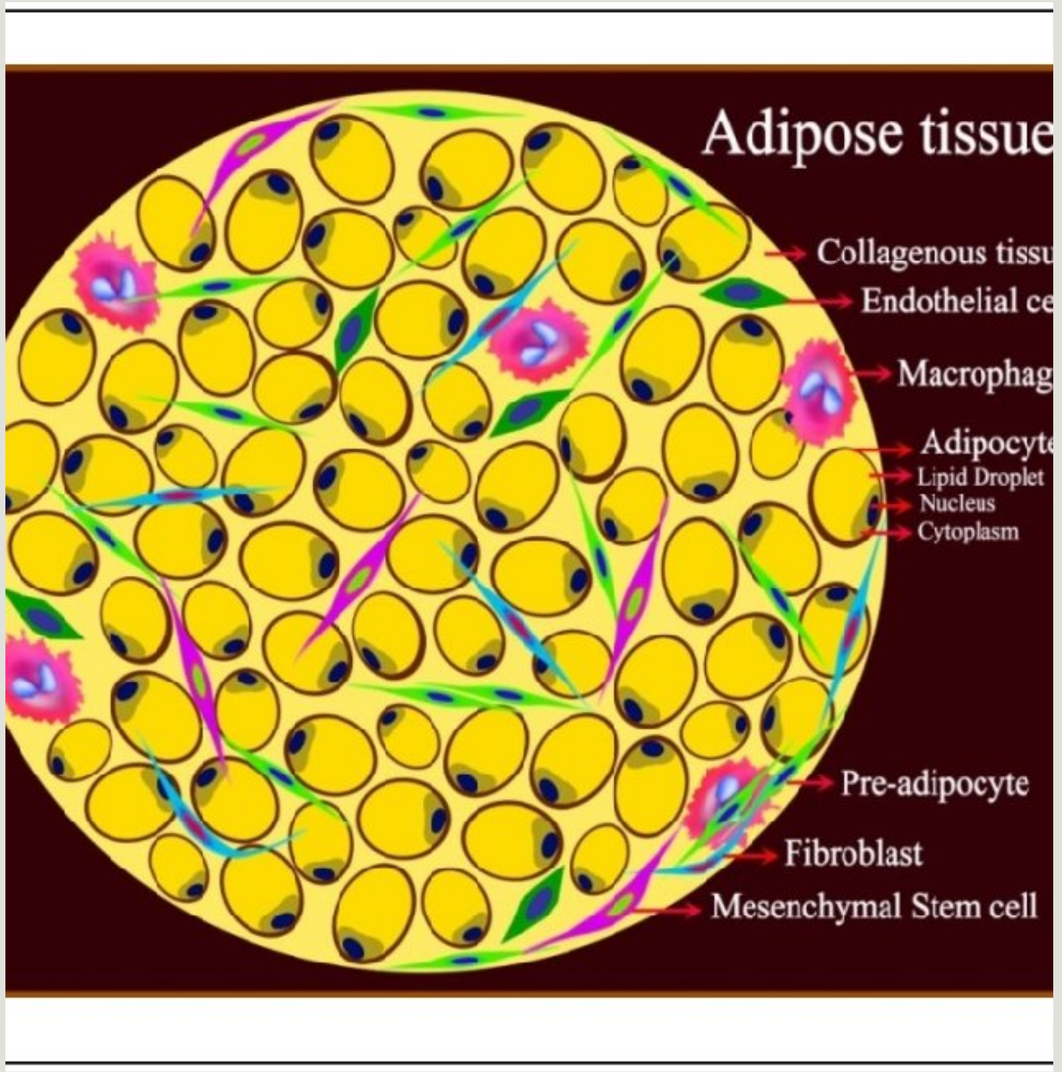
Functions:

1. It is the binding tissue.
2. It helps in the repair of tissues after injury.
3. Its histocytes protect against infection by engulfing foreign substances.

Adipose Tissue: It is fat storing connective tissue. Its cells become large and oval due to the storage of fat globules.
They are present below the skin, between the internal organs, below the eyeballs. Adipose tissue form Hump of camel and blubber of whale.

Functions:

1. It stores reserve fat.
2. It acts as heat insulator. Protect animals against severe winter.
3. Provides shape to the body.
4. It forms a shock absorbing cushion around vital organs.



White fibrous Connective tissue – Tendon:

It is dense connective tissue occurs as sheets or tendons. These fibres provide great strength but limited flexibility.

Functions:

1.Sheets of this tissue form covering of bones and cartilages.

2.As they form tendons that attaches muscles to the bones.

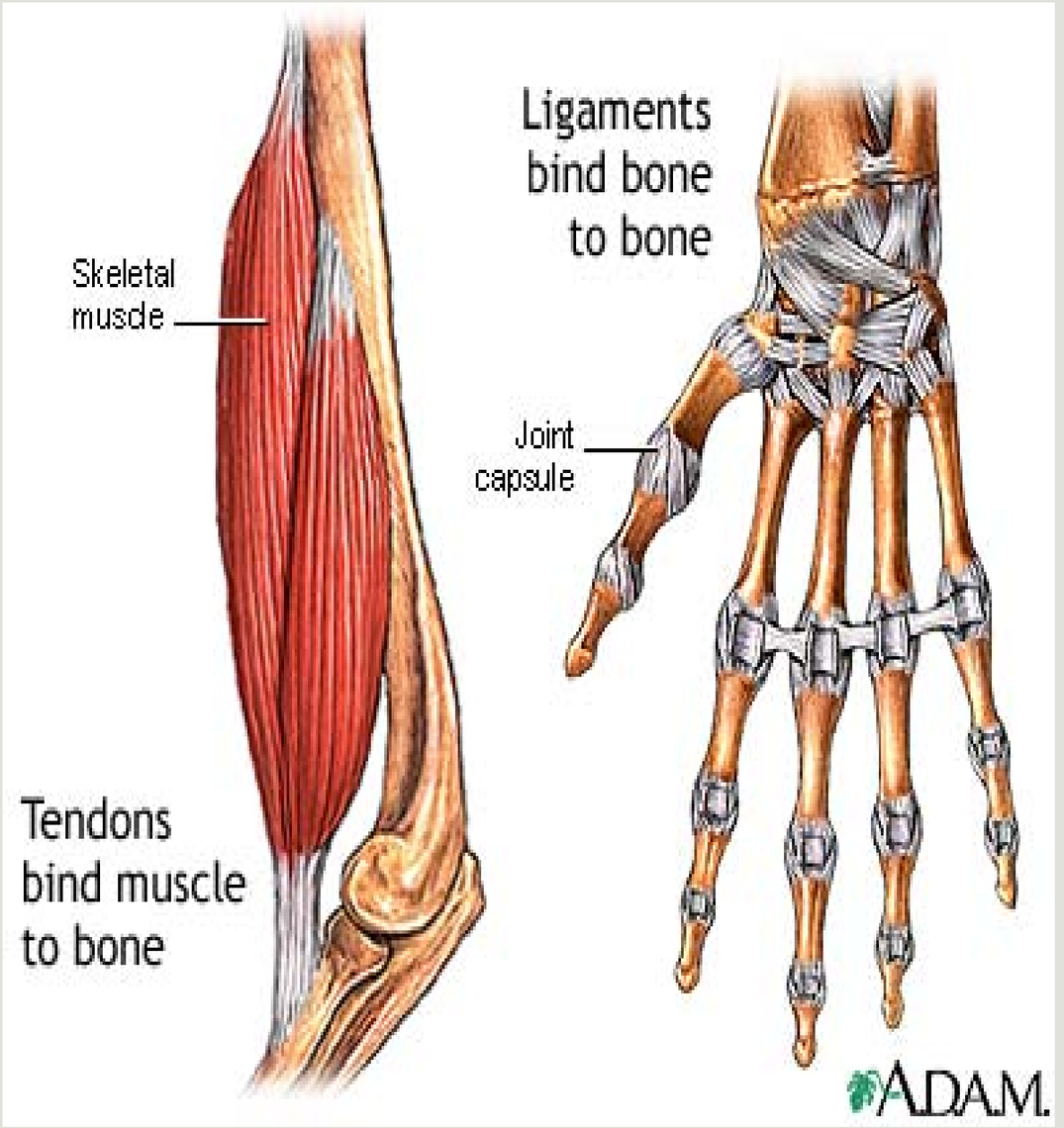
Yellow fibrous connective tissue – Ligaments

This tissue is highly elastic and form ligaments.

Functions:

1. They form covering of blood vessels, arteries and bronchioles.
2. Ligaments join bones to bones in joints.
3. Because of elasticity they allow bending and rotational movements of bones over joints.

Tendon	Ligament
Tendon joins skeletal muscle to a bone.	Ligaments join a bone to another bone.
It is tough and inelastic.	It is strong but elastic.
It is a modification of white fibrous tissue	It is a modification of yellow elastic tissue with some collagen fibres.
Fibroblasts lie in a almost continuous rows.	Fibroblasts lie scattered.
Fibres are seen as dense parallel bundles.	Fibres are densely crowded but not arranged in parallel bundles.



Skeleton Tissue: This tissue is formed of cartilages and bones and form the supporting framework of the body.

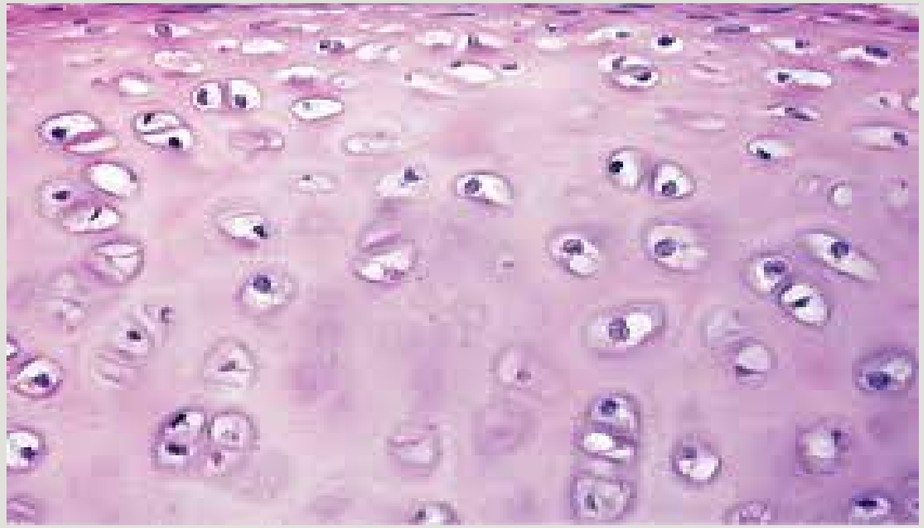
Cartilage

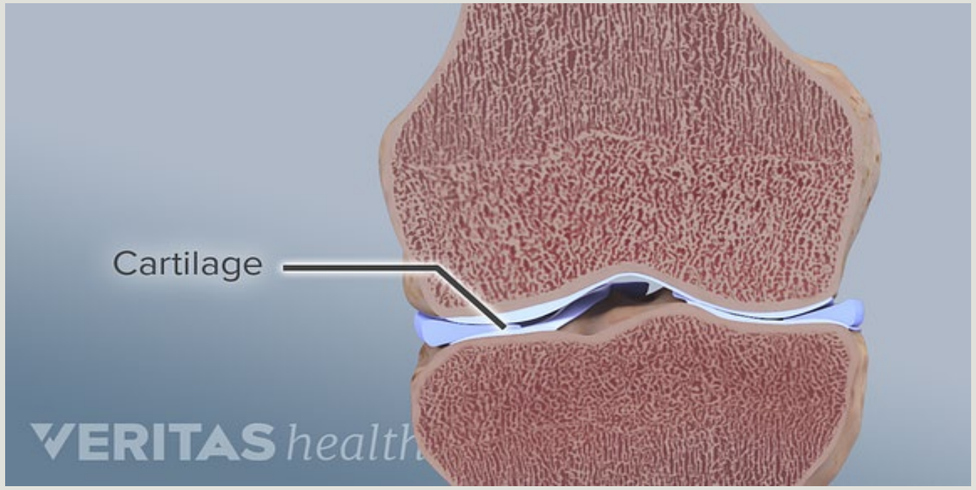
It is relatively soft and elastic skeletal tissue. Its matrix is dense and elastic due to the presence of special protein called chondrin.

They are present in the epiglottis, larynx, tracheal rings and in between the ribs and sternum.

Functions

1. Cartilage supports the various body parts . In cartilaginous fishes , they form the whole skeleton.
2. Intervertebral discs of cartilage absorb shock and function as cushion against stress.
3. At the end of long bones cartilage prevents wear and tear.

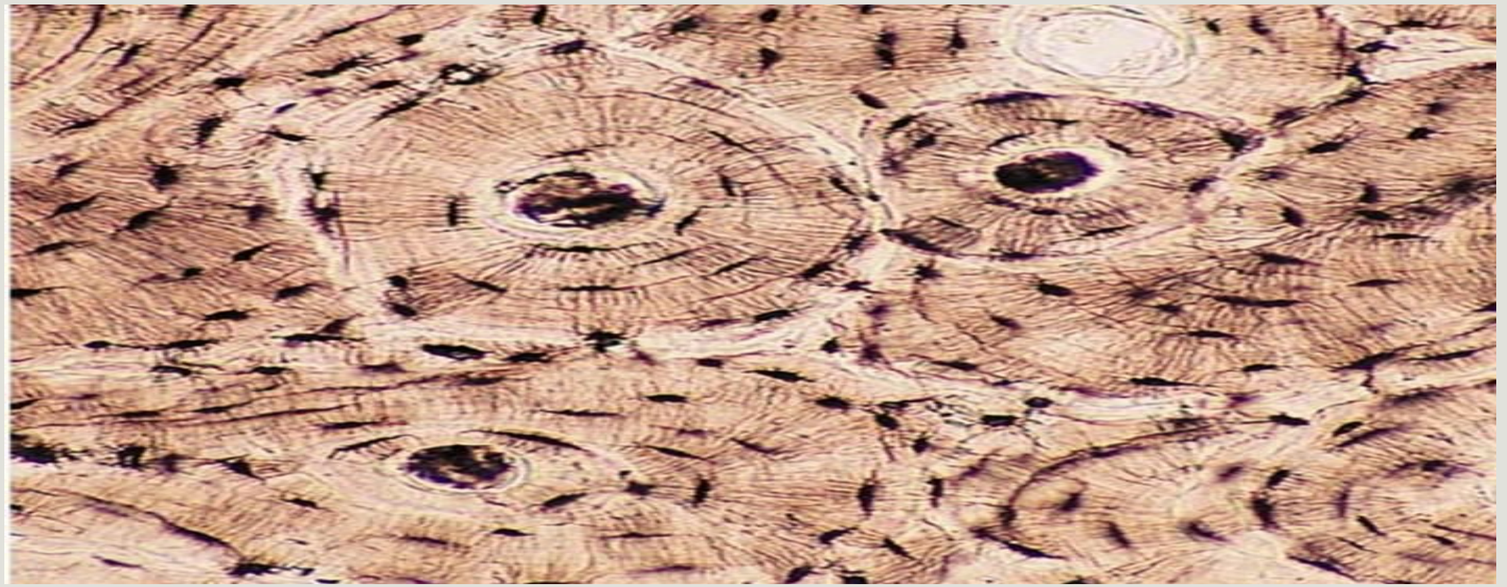




Bones : Bone is much harder, rigid and non flexible skeletal tissue. It forms the skeleton of vertebrates. The matrix of bone is very hard because of collagenous protein ossein. The long bones of vertebrates are hollow containing a marrow cavity which is filled with bone marrow. They form the endoskeleton of vertebrates.

Function

1. Cells of bone marrow give rise to blood corpuscles.
2. They form the supporting framework and protects internal organs.
3. Long bones help in locomotion.
4. These provide surface for the attachment of muscles.



Differences between Bone and Cartilage

Bone	Cartilage
1. Hard and inflexible.	1. Soft and flexible.
2. Large quantity of mineral salts, especially phosphates and carbonates of calcium and magnesium are present.	2. Deposition of minerals is rare.
3. Blood supply passes into the interior of bone through Haversian canals.	3. Blood supply is restricted to the outside. Haversian canals are absent.
4. Matrix shows concentric lamellae.	4. Matrix is homogeneous.
5. Lacunae have branched radiating channels called canaliculi.	5. Canaliculi are absent.
6. Osteocytes are present singly in a lacuna.	6. Chondrocytes are present singly or in groups of twos or fours in lacuna.

Vascular or fluid tissue

Blood and lymph are fluid connective tissue. These transport nutrients, oxygen, vitamins and hormones to the cells and remove carbon dioxide and nitrogenous wastes from the cell. The cells of vascular tissue is called corpuscles and they lack power of division.

Blood

This is a fluid connective tissue. In this tissue cells moves in a fluid or medium called blood plasma. Different types of blood cells are:

Red blood cells or erythrocytes, White blood cells or leucocytes, blood platelets or thrombocytes.

Red Blood Cells – These are the most abundant of the three of blood cells. Their shape varies in different vertebrates. They are biconcave and without nucleus in mammals. They contain red iron protein called Haemoglobin.

The presence of haemoglobin gives blood its red colour. The life span of RBCs in human is 120 days then they are destroyed in liver.

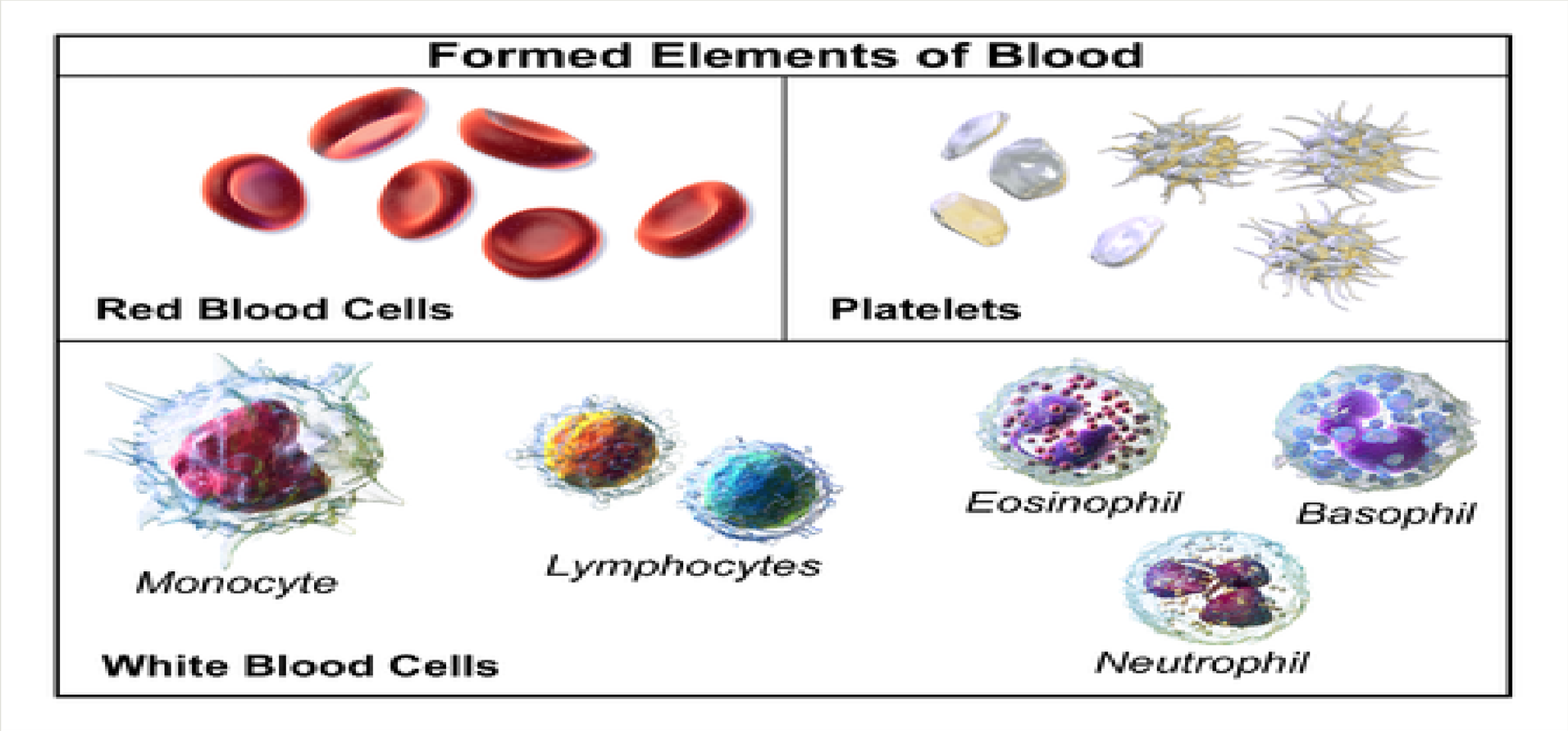
White Blood Cells – These are rounded , nucleated and colourless cells. They are formed in bone marrow, spleen . The lifespan of different types of WBCs ranges from eight hours to four days.

Functions

1. They protect our body from microbial infections by engulfing the microbes.
2. They secrete antibodies against pathogens.
3. They produce antiallergic reactions.

Blood platelets

They are minute , anucleated, fragile fragments of giant bone marrow cells ,called megakaryocytes.
They help in clotting of blood at the site of wound by releasing a chemical thromboplastin.



Differences between the red blood cell and white blood cells

Red blood cell	White blood cell
• contains haemoglobin	• haemoglobin absent
• No nucleus	• Nucleus present
• Circular and biconcave in shape	• Irregular in shpae
• Transport oxygen	• Phagocytosis or production of antibody
• Cannot squeeze out of capillaries (fine blood vessels)	• Able to squeeze out of fine blood vessels

Lymph

Like blood, it is also fluid connective tissue. Lymph is actually filtered blood without RBCs and blood platelets. WBCs are less numerous but lymphocytes are in abundance. They are produced in lymph nodes and lymph organs.

Functions of lymph

1. Lymph acts as a middle man between the blood and body tissue.
2. Lymphocytes provide immunity.

	Lymph		Blood
1.	It is a colourless fluid that does not contain RBCs.	1.	It is a red-coloured fluid that contains RBCs.
2.	It contains plasma and lesser number of WBCs and platelets.	2.	It contains plasma, RBCs, WBCs, and platelets.
3.	It helps in body defence and is a part of the immune system.	3.	It is associated with the circulation of oxygen and carbon dioxide.
4.	Its plasma lacks proteins.	4.	Its plasma has proteins, calcium, and phosphorus.
5.	It transports nutrients from the tissue cells to the blood, through lymphatic vessels.	5.	It transports nutrients and oxygen from one organ to another.
6.	The flow of lymph is slow.	6.	The flow of blood in the blood vessels is fast.

NERVOUS TISSUE

Cells of nervous tissue are called **NERVE CELLS or NEURONS**. Many nerve cells are bound by connective tissue to make a nerve.

FUNCTION:

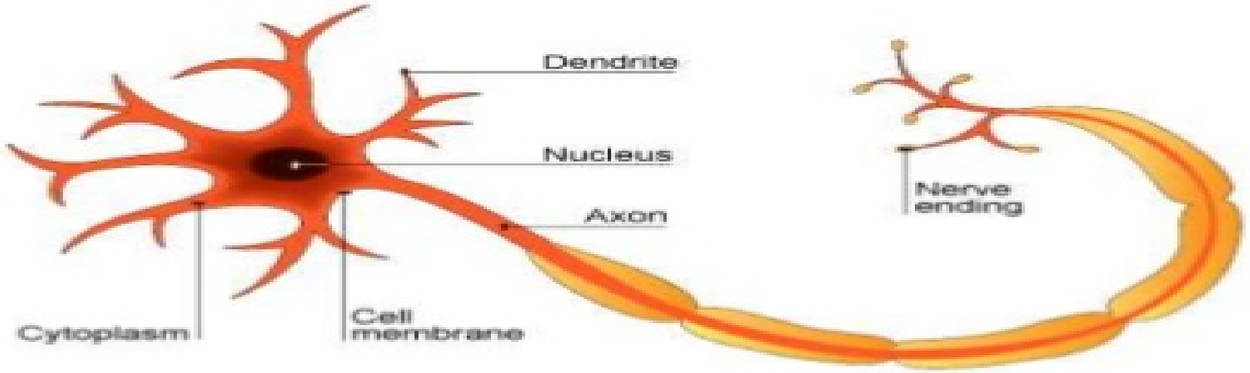
1. highly specialised tissue that helps in transmitting stimuli from one place to other in the body.
2. controls all activities of the body.

LOCATION: Brain,spinal cord and nerves are made of nervous tissue.

STRUCTURE: Its structure looks like a tree with branches coming out of it.

A neuron has 3 parts –

1. a star shaped body called **CYTON** which has nucleus and cytoplasm
2. a single long part called **AXON(carry messages away from cyton)**
3. short ,branched part called **DENDRITES(carry messages towards cyton).**



PERIOD 9

Difference between Axon and Dendrite

No.	Axon	Dendrite
1	Only one Axon per neuron	Many dendrites per neuron
2	Discharging end	Receiving end
3	Longer (sometimes several metres)	Shorter (under 1.5 mm)
4	Uniform length	Highly branched
5	Enlarged synaptic knot	No such structure
6	Only neurofibrils, no Nissl's granules	Both neurofibrils and Nissl's granules
7	Conducts neural impulse away from soma	Conducts neural impulse towards the soma

THANK YOU

Class 9th

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