

TISSUES

Tissues: A group of cells that are similar in structure and work together to perform a particular function.

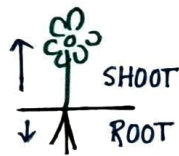


Examples of tissue are Muscle, Nerves, Blood, Xylem, phloem, etc

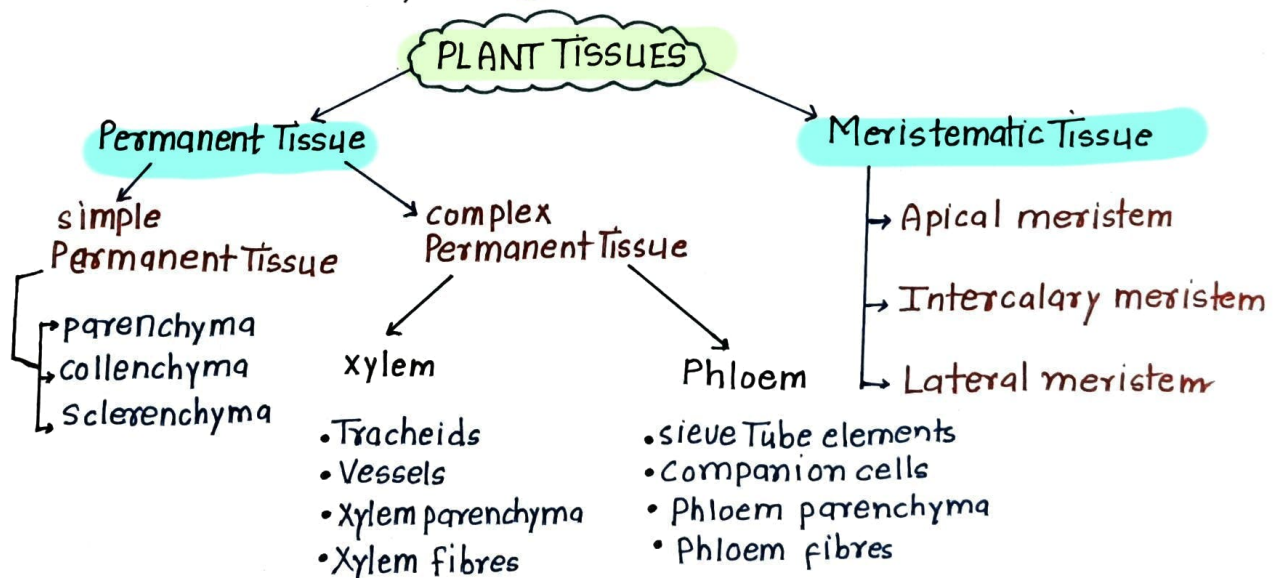
Division of work

Muscular Tissues help in movement.
Nervous Tissues carry messages.
Blood Tissues carry oxygen, food, waste, etc

→ Division of Labour



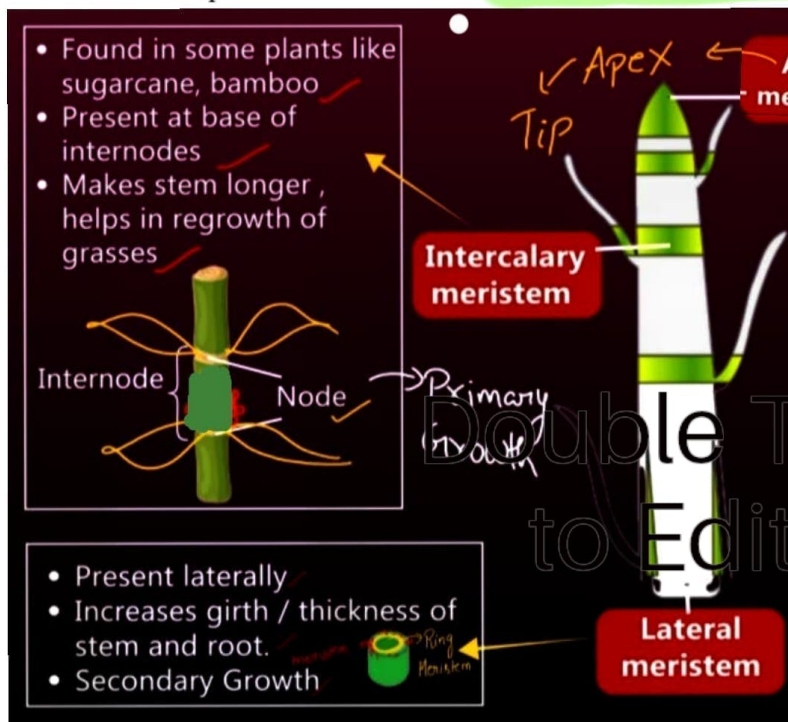
Plants 	Animals 
they don't move from place to another as plant could show movement	Animals move for food, shelter etc so they require more energy.
Need to stay upright → have more supportive tissues.	Supportive tissues are less because they can move.
Supportive tissues mostly have dead cells.	Most tissues have living cells.
Growth happens only in specific regions (root & shoot tips).	Growth is uniform all over the body.
Some tissues (meristematic) divide throughout life, Growth happens throughout Life	After reaching a maturity stage, Growth stops



Meristematic Tissue	Permanent Tissue
Cells continuously divide. → new cells	Cells do not divide.
Cells are small in size and isodiametric in shape.	Cells are variable in shape and size
Vacuoles are usually absent	Large Vacuoles are present in living cells
Intercellular spaces are generally absent. ✓	Visible intercellular spaces are present.
Cell walls are thin.	Cell walls can be thin or thick.

provides growth of plant at specific location.

MERISTEMATIC TISSUE



Permanent Tissue

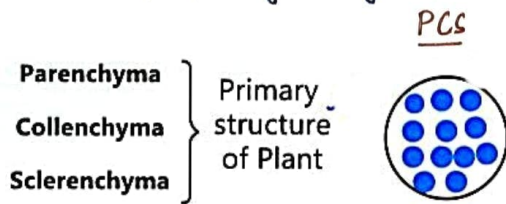
1. The permanent tissues are made of cells which have lost their capability to divide.
2. The Division and Differentiation of the cells of meristematic tissues give rise to permanent tissues.

Division - The single cell first divides many times to form a large number of cells

Differentiation - Now these cells take up a permanent shape, size and a function. This process of taking up a permanent shape, size and a function is called differentiation.

Simple Permanent Tissues

- Made up of only one type of cells



Complex Permanent Tissues

- Made up of more than one type of cells

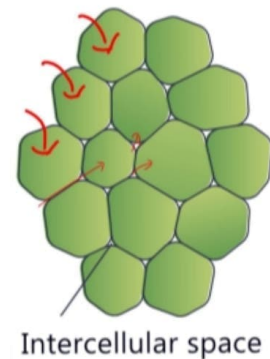


Parenchyma :- storage of food (Living)

- These tissues are most abundant (present in almost all parts of plants).
- Present in stem, leaves, roots, fruits and flowers.
- Main Function - storage of food, also helps in photosynthesis.
- They have thin cell walls - made of chemical - cellulose
- Living cells with large intercellular space.

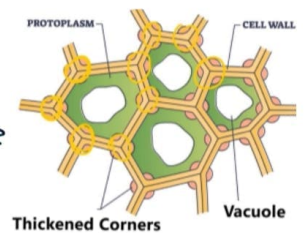
Chlorenchyma :- parenchyma that contains chlorophyll and performs photosynthesis. Found in leaves.

Aerenchyma :- parenchyma with large air cavities that help aquatic plants to float (eg - lotus)



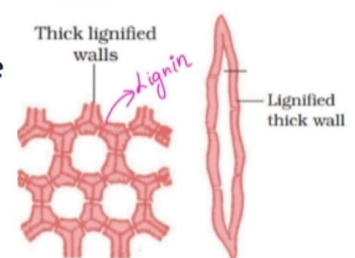
Collenchyma :- Flexibility with support

- collenchyma Tissues are present in leaf stem (leaf stalk).
- Main function - provides flexibility to various parts of a plant like bending of tendrils and stems of climbers without breaking.
provides mechanical support.
- Cells are living and Unevenly at the corners, due to presence of chemicals - pectin & hemicellulose
- There is very little intercellular space.



Sclerenchyma :- Hardness and stiffness

- Present in Husk of Coconut, Hard covering of nuts, stems of plant and in the veins of leaves.
- Main Functions :
 - provides, Hardness and stiffness to plants.
 - provides strength to the plants parts.
- Cells have very thick cell walls due to presence of chemical - Lignin.
- Dead Cells with No intercellular space (negligible)

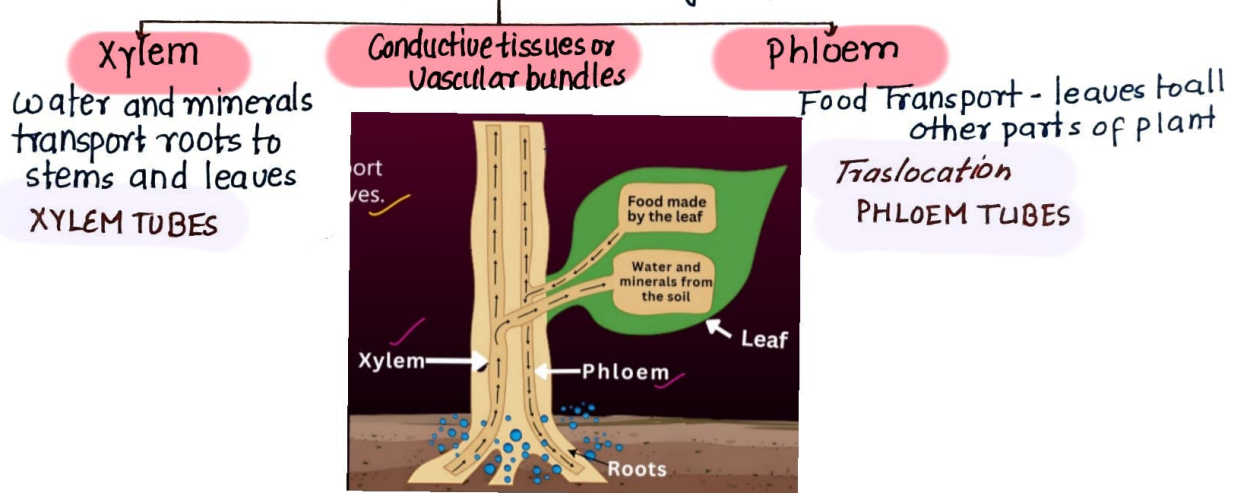


simple Permanent Tissue

Features	Parenchyma	Collenchyma	Sclerenchyma
Location	Stem, Leaves, roots, fruits and Flowers	Leaf Stalk (Leaf Stem)	Husk of coconut, hard covering of Nuts and Seeds, Veins of Leaves
Main function	Storage of food, helps in photosynthesis	Provides Flexibility with mechanical support	Provides hardness and stiffness
Nature of cells	Living	Living	Dead
Cell wall	Thin, made of cellulose	Unevenly thickened at corners, made of Pectin & hemicellulose	Thick, made of lignin
Intercellular spaces	Large	Very little	Absent

Complex Permanent Tissue → Transport system

made up of more than one type of cells



Xylem

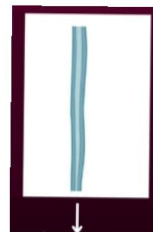
Tracheids



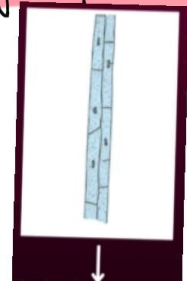
Vessels



Xylem fibres



Xylem parenchyma



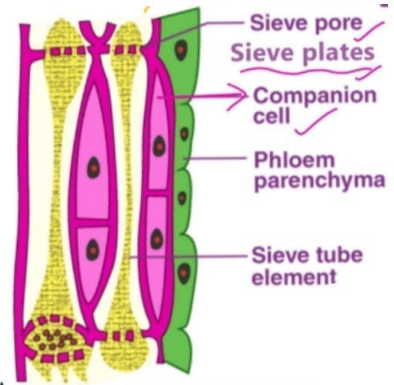
1. Tubular structures (acts like pipes).
2. Transport water and minerals vertically.
3. Made of Dead cells.

1. provide support
2. Dead cells

1. stores food (starch)
2. living cells

Phloem

- Sieve tubes** - Tube like conducting structures, transports food.
 walls of sieve tube cells perforated by numerous pores, they are called **sieve plates** - help in transport of food.
Angiosperms (flowering plants)
- Companion cells** - found next to sieve tube elements. have a nucleus.
- Phloem parenchyma** - stores food (starch).
- Phloem fibres** - give mechanical support to sieve tubes.
- Sieve cells** - sieve cells are single, elongated phloem cells found in *Gymnosperms* (Non flowering plants), lacking sieve plates and companion cells.



Except phloem fibres, other phloem cells are living cells.

Xylem	Phloem
1. It transports water and minerals from roots to stem and leaves	1. It transports food material from the leaves to all other parts of the plant.
2. Xylem consists of tracheids, vessels, xylem fibres and xylem parenchyma.	2. Phloem consists of sieve tubes, sieve cells, companion cells, phloem fibres and phloem parenchyma.
3. Only xylem parenchyma is living.	3. Sieve tubes, sieve cells, companion cells and phloem parenchyma are living.
4. Tracheids, vessels, xylem fibres are dead tissues.	4. Phloem fibres are dead tissues.
5. Conduction of water by xylem is unidirectional (upward from root)	5. Food material conduction is bidirectional (upward and downward from leaves)

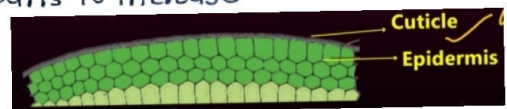
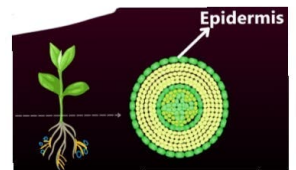
PROTECTIVE TISSUES

Epidermis

Cork

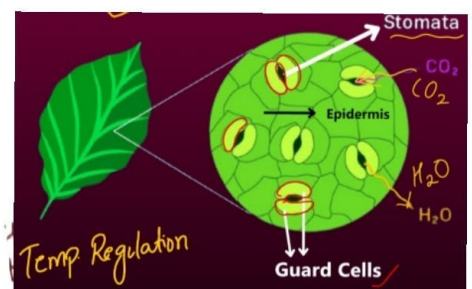
Epidermis :- outermost thin layer of cells.
 Entire Plant surface is covered with **Epidermis**.

- Continuous layer without intercellular spaces.
- provide protection to plants - from injury, Against parasitic attack and Against water loss.
- In desert plants → Epidermis has thick waxy covering of cutin to reduce water loss by transpiration (cutin is a chemical substance with waterproof quality)
- Epidermal cells of roots have long hair-like parts to increase total surface area for water absorption.



stomata :- small pores in the Epidermis of the leaf.

- stomata are enclosed by two kidney-shaped cells called Guard cells.
- Each stomata helps in exchange of gases with atmosphere.
- Transpiration (loss of water as water vapour) takes place through stomata.

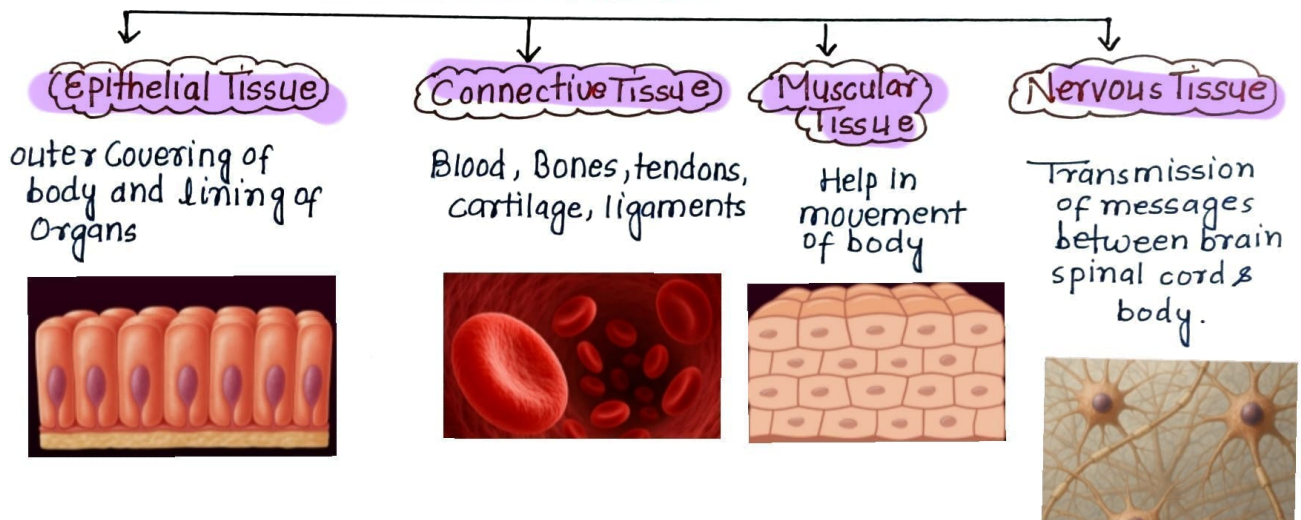


Cork:- The outer protective tissue of Bark of tree is called cork.

1. Cork is produced from secondary meristem / lateral meristem. (increase in thickness or girth) in later stage of plant's life.
2. Cells of cork are dead and Intercellular spaces are absent.
3. Cell walls are very thick, due to presence of a chemical - **suberin**.
4. No movement of water or even gas can occur through cork due to presence of suberin.
5. **Functions:** protects from injury and water loss

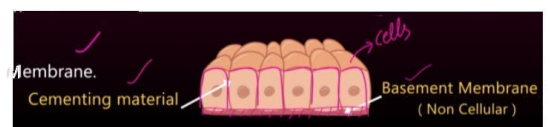
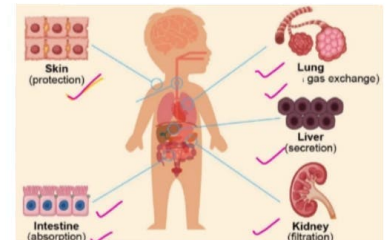


ANIMAL TISSUES



Epithelial Tissue:- protective covering tissue in animals.

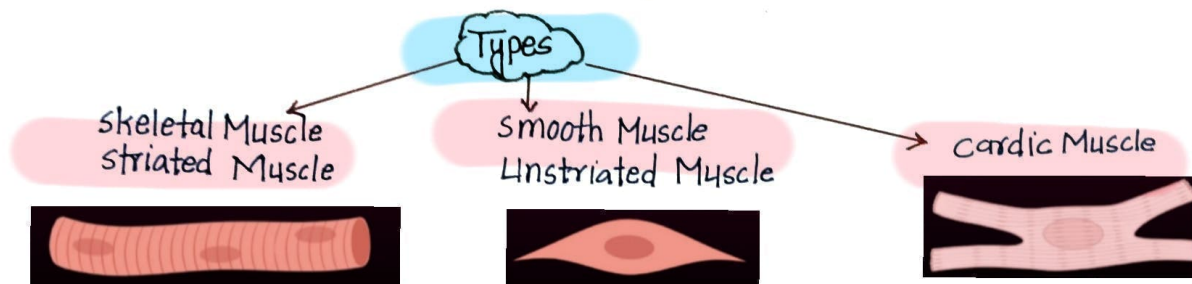
1. Epithelial covers most organs.
2. **location** : skin, lining of the mouth, lining of blood vessels, lung alveoli and kidney tubules.
3. The cells of epithelial tissue are tightly packed, with almost no intercellular space forming a continuous sheet.
4. **Function** : Protection, Absorption, Exchange of gases, secretion, Filtration.
5. Epithelium Tissue is separated from the tissue below by a non cellular membrane - Basement membrane.

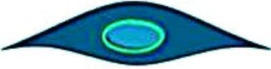


Tissue	Appearance	Shape	Location	Function
<u>Simple Squamous Epithelium</u>		Single layer flat thin cells ✓	Blood vessels, lung alveoli ✓	Transportation of substances ✓
<u>Stratified Squamous Epithelium</u>		Multi layer flat thin cells	inner imp? Skin, lining of mouth ✓	Protection ✓
<u>Cuboidal Epithelium</u>		Cube shaped cells	Lining of kidney tubules, ducts of salivary glands ✓	Secretion, filtration, Mechanical support ✓
<u>Columnar Epithelium</u>		Tall pillar-like cells	Inner lining of intestine ✓	Absorption & secretion ✓
<u>Ciliated Columnar Epithelium</u>		Columnar cells with Cilia (hair-like structures) ✓	Respiratory system ✓	Cilia move and push the mucus forward to clear it ✓
<u>Glandular Epithelium</u> ✓		Portion of epithelium that folds inward ✓	Glands of body (sweat gland, salivary gland etc) ✓	Secretion of substances ✓

MUSCULAR TISSUE

1. Tissue made of elongated cells.
2. Help in movements in our body.
3. Movement is due to contraction and Relaxation of special protein present in muscles – **Contractile proteins**.



Tissue	Skeletal / Striated Muscle	Smooth / UnStriated Muscle	Cardiac Muscle
Location	Attached to bones	blood vessels, iris in eyes, Walls of alimentary canal, bronchi in lungs, ureters	Heart
Control	Voluntary (under our will) ✓	Involuntary (not under our will)	Involuntary (not under our will)
Appearance (Microscope) cell	Striated (shows light & dark bands) ✓ 	Unstriated (no bands) ✓ 	Light Striated (faint bands) ✓ 
Cell Shape	Long, cylindrical, unbranched ✓ imp?	Spindle-shaped (long with pointed ends) ✓	Cylindrical, branched ✓
Nuclei per Cell	Multinucleate (many nuclei) ✓	Uninucleate (one nucleus)	Uninucleate (one nucleus)
Function	Helps in body movement, locomotion ✓	Helps in involuntary movements (food movement, blood flow, etc.) ✓	imp? Pumps blood by rhythmic contraction & relaxation ✓
Tiredness	Get tired easily ✓	Do Not Get Tired	Do Not Get Tired ✓

CONNECTIVE TISSUE

CAT LAB²

Blood

Bone

Tendons

Ligaments

Cartilage

Adipose Tissue

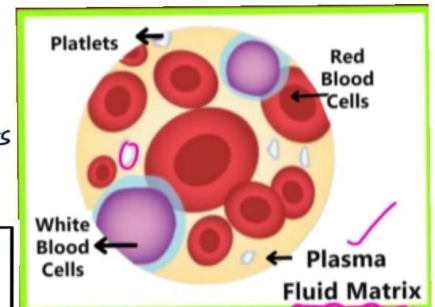
Areolar Tissue

1. Connective Tissue protects, supports, transport substances, store fat, fill spaces, connect two tissues, give flexibility, etc.
2. Cells of connective tissues are loosely packed.
3. Space between cells filled with matrix.
4. matrix may be jelly-like, fluid or rigid.



BLOOD :-

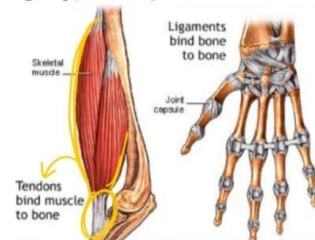
1. Blood is a fluid connective tissue.
2. *Function:* Transportation of gases, digested food, hormones and waste materials to different parts of the body; provides protection.



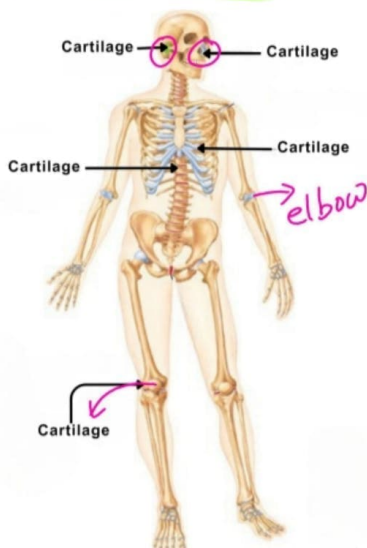
Plasma	Red Blood Corpuscles (RBCs)	White Blood Corpuscles (WBCs)	Platelets
Fluid Matrix of Blood 90 % water, 7% Protein Transport of digested food, CO ₂ , waste	Red Pigment Hemoglobin is present Hemoglobin in RBC helps transport oxygen to different parts of body	1. Fight infections 2. Types: - Neutrophils - Eosinophils - Basophils - Lymphocytes - Monocytes	Blood clotting

Tendons	Ligaments
1. Connective tissue that attaches muscles to bone.	1. Connective tissue that attaches bone to bone.
2. Help in the movement of bones	2. Help in holding of bones together (support to joints)
3. Strong and Non-elastic	3. Strong and elastic

Bone loves Bone



CARTILAGE :-

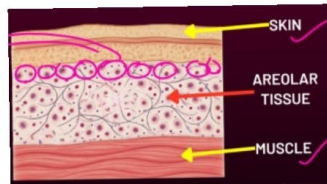


1. Cartilage is found in joints (such as the knees and elbows), the ears and nose, and various locations.
2. it's a flexible connective tissue. cells are widely spaced.
3. it provides cushioning, reduces friction, offers support.

BONE	CARTILAGE
1. Hard and non-flexible ✓	1. Flexible not very hard ✓
2. We cannot bend the bones in our arms ✓	2. We can fold the cartilage of the ears, ✓
3. Matrix made up of Calcium & Phosphorus (Hard) ✓	3. Matrix made up of proteins & Sugars (Not that Hard) ✓
4. It provides shape to the body ✓ Protects vital body organs such as brain, Lungs, etc., ✓	4. It provides cushioning, reduces friction, offers support. ✓ Smoothens bone surfaces at joints ✓

Areolar Tissue

1. Most abundant tissue in animal.
2. fills spaces- filling Tissues
3. found between skin and muscles, around blood vessels and nerves and in the bone marrow.



functions:

- Helps in tissue repair after injury.
- Fills the space

Adipose Tissue

1. store fat.
2. Made of fat cells (Adipocytes) filled with large fat globules.
3. found below the skin and between internal organs.



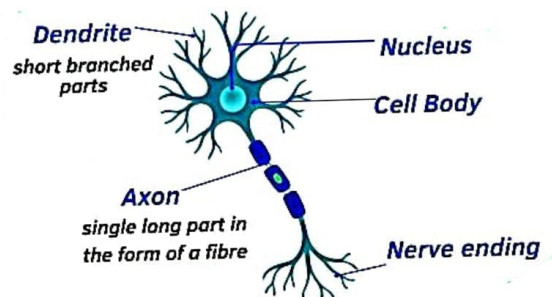
Functions:

- stores energy in the form of fat.
- Provides insulation (Temperature regulation) eg- polar Bears

NERVOUS TISSUE

1. Brain, spinal cord and nerves are composed of the nervous tissue.
2. cells of Nervous tissue is called Nerve cells or Neurons.
3. Neurons are the longest cells in the body → can be upto a metre long.

Nervous tissue receive stimuli (any change in surrounding) and transmit it rapidly from one part of body to another.



Neuron Or Nerve Cell

Transmission of an Impulse

→ signal message.

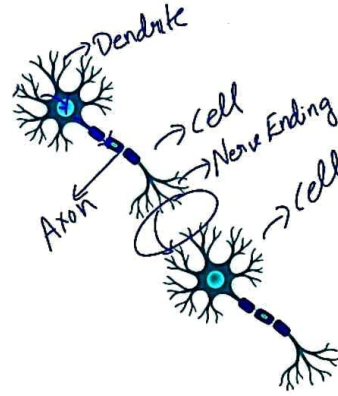
Nerve impulse (signal)

Reaches dendrites

Move along the axon

Reach the nerve ending

Impulse is passed to dendrites of next neuron



1. Nerve impulses help us to move our muscles.
2. Enable animals to move rapidly in response to stimuli.

Questions & Answer

Q) What is the utility of tissues in multi-cellular organisms? **NCERT**

Ans -

1. Division of Labour

- Different tissues perform different functions (e.g., muscle tissue helps in movement, nervous tissue carry messages, Blood tissue carry oxygen, food, waste etc)
- This division of work makes the organism more efficient.

2. Structural Support

- Some tissues like Bone in Animals & Simple Tissues in Plants provide strength, giving the body shape and support.

3. Efficient Functioning

- Since tissues are organised groups of similar cells, they work faster and more efficiently compared to single cells doing all tasks. (Power of Unity)

Q) How are simple tissues different from complex tissues in plants? **NCERT**

Ans -

Simple Tissues	Complex Tissues
1. A simple tissue is formed of only one type of cells.	1. A complex tissue is made of more than one type of cells.
2. They form primary structure of the plant.	2. They form transport system of the plant.
3. There are three types of simple plant tissues - parenchyma, collenchyma and sclerenchyma.	3. There are two types of complex plant tissues - xylem and phloem.

Q) Differentiate between parenchyma, collenchyma and sclerenchyma on the basis of their cell wall. ? **NCERT**

Ans -

PARENCHYMA	COLLENCHYMA	SCLERENCHYMA
1. Cell wall is thin 2. It is made up of cellulose	1. Cell wall is unevenly thickened at corners 2. It is made up of pectin and hemicellulose	1. Cell wall is thick. 2. It is made up of lignin

Q) Name the regions in which parenchyma tissue is present. ? **NCERT**

Ans -

- These tissues are most abundant (present in almost all parts of Plants)
- Present in Stem, Leaves, roots, Fruits & Flowers

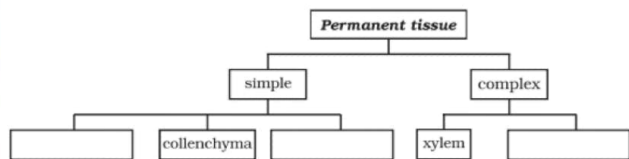
Q) How many types of elements together make up the xylem tissue? Name them. ? **NCERT**

Ans -

Xylem tissue is composed of four main types of elements: Tracheids, Vessels, Xylem Parenchyma, and Xylem Fibers

Q) Complete the following chart:

NCERT



Q) What are the functions of the stomata? **NCERT**

Ans -

- 1) Exchange Of Gases
- 2) Transpiration - Loss of water as water vapour

Q) How does the cork act as a protective tissue? **NCERT**

Cork cells are compactly arranged due to absence of intercellular space. Cell Walls are Very thick, due to presence of a chemical - Suberin. No movement of water or even gas can occur through Cork due to presence of Suberin. Cork protects plant from injury and water loss

Q) Identify the type of tissue in the following:

NCERT

skin
bark of tree
lining of kidney tubule
vascular bundle

Ans -

- (a) Stratified Squamous Epithelial Tissue
- (b) Cork
- (c) Cuboidal Epithelial Tissue
- (d) Complex Permanent Tissue - Xylem & Phloem

Q) Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body **NCERT**

Ans -

Feature	Striated Muscle	Unstriated Muscle	Cardiac Muscle
Structure	Long, cylindrical & unbranched	Spindle-shaped (long with pointed ends)	Cylindrical, branched
Location	Attached to bones	Blood vessels, iris in eyes, walls of alimentary canal, bronchi of lungs	Heart

Q) What is the specific function of the cardiac muscle? **NCERT**

Ans - The specific function of cardiac muscle is to pump blood throughout the body by contracting and relaxing rhythmically. They do this continuously without getting tired.