

TISSUES

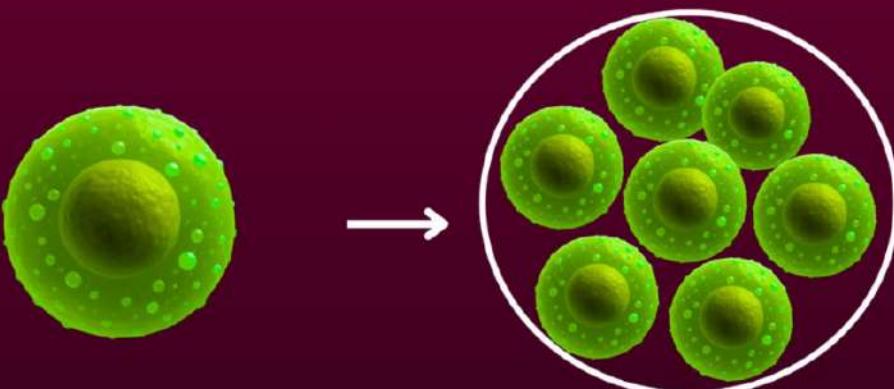
Class 9th

GUN
SHOT



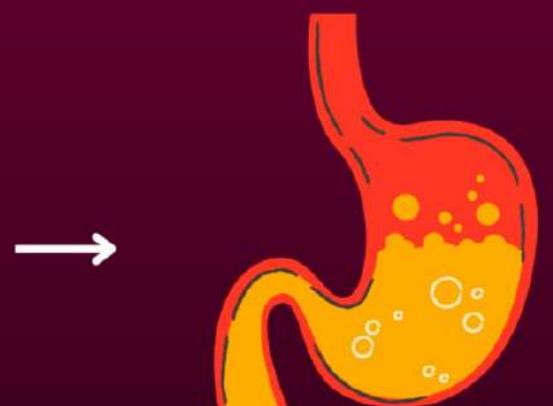
Tissues

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

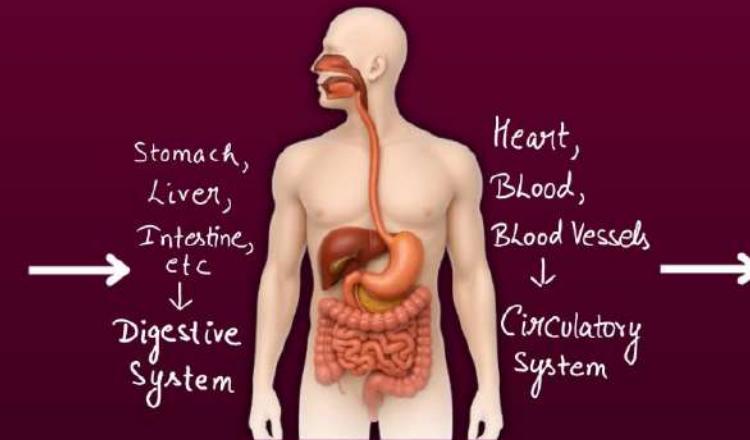


Cell

Tissue ✓



Organ ✓



Organ System ✓

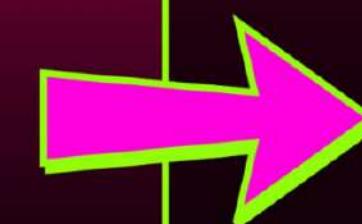


Organism ✓

Examples of tissues 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 ✓

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 ✓

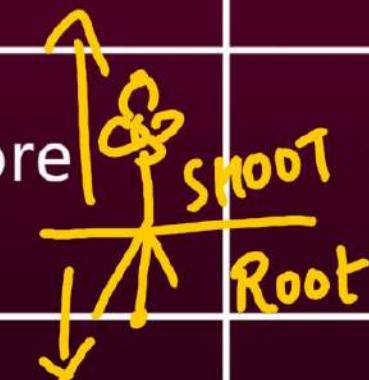
- Since tissues are organised groups of similar cells, they work faster and more efficiently compared to single cells doing all tasks. (Power of Unity)

Plants



Plants are fixed and they don't move ; Use less energy

Need to stay upright → have more supportive tissues.



Supportive tissues mostly have dead cells.

Animals



Animals move for food , shelter etc so they require more energy.

Growth happens only in specific regions (root & shoot tips).

Some tissues (meristematic) divide throughout life , Growth happens throughout Life

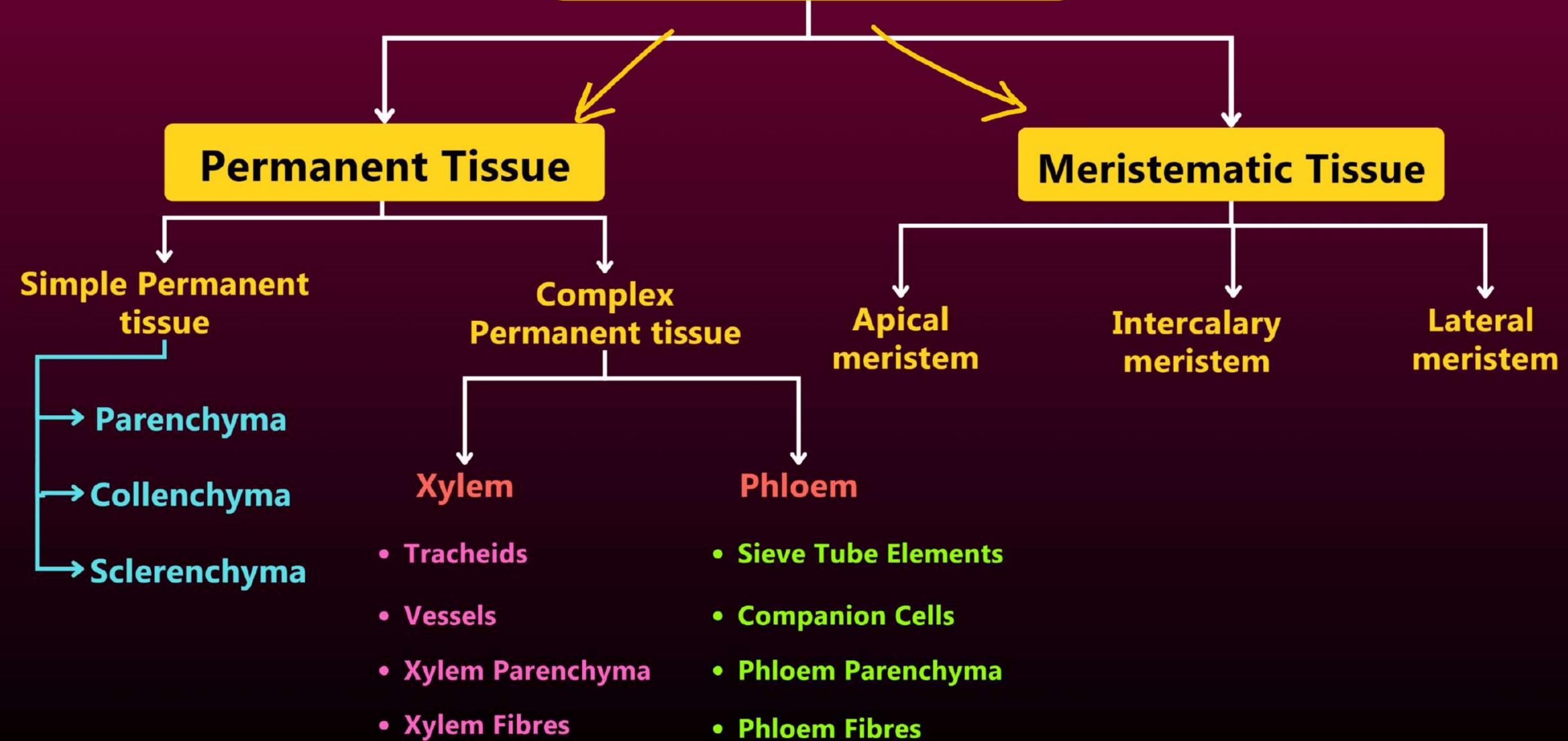
Supportive tissues are less because they can move.

Most tissues have living cells.

Growth is uniform all over the body.

After reaching a maturity stage, Growth stops

Plant Tissues





Meristematic Tissue

Cells continuously divide. \Rightarrow new cells

Cells are small in size and isodiametric in shape.
0 0 0 0 0

Vacuoles are usually absent 

Intercellular spaces are generally absent. 

Cell walls are thin. 

Permanent Tissue

Cells do not divide.

Cells are variable in shape and size 

Large Vacuoles are present in living cells 

Visible intercellular spaces are present. 

Cell walls can be thin or thick. 

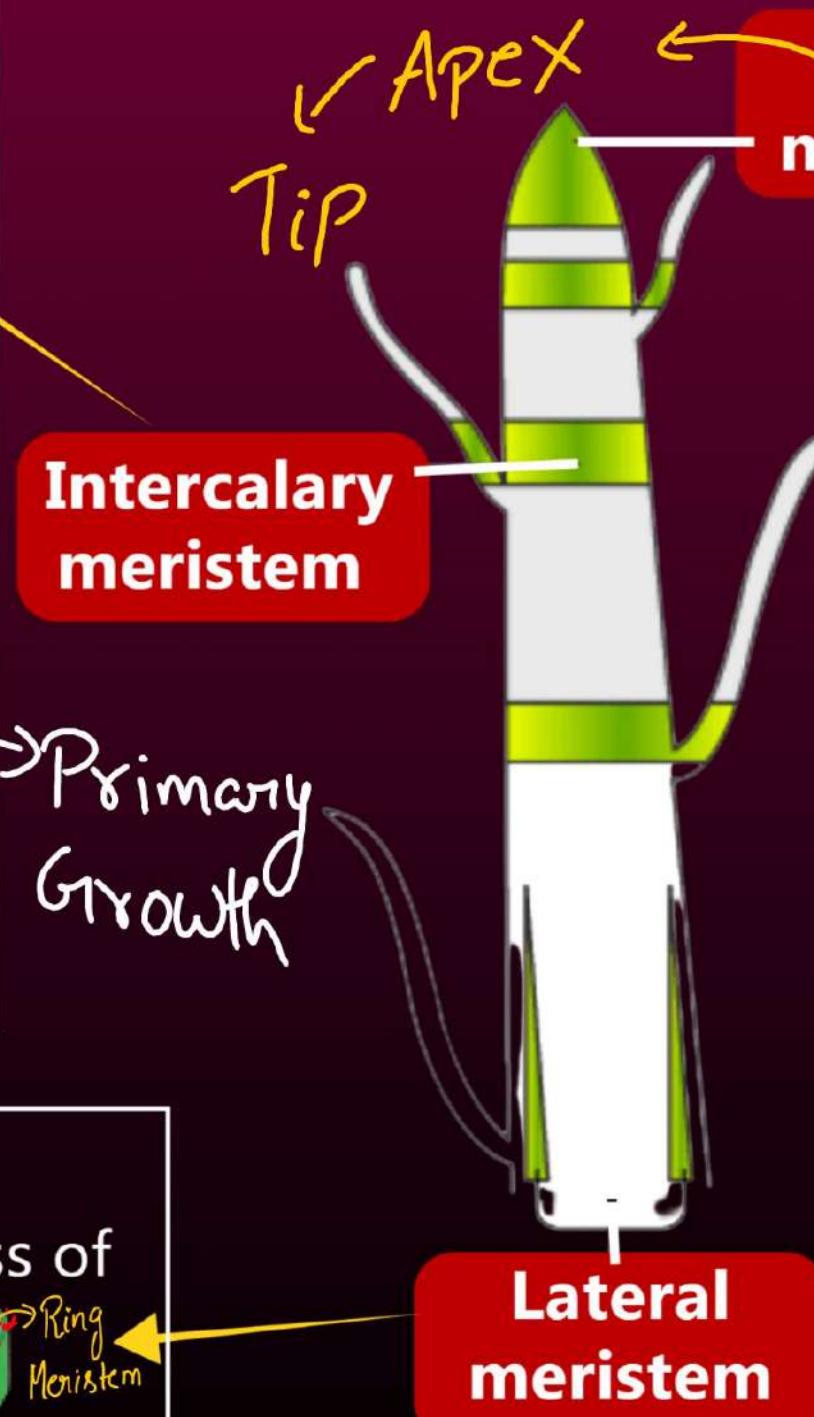
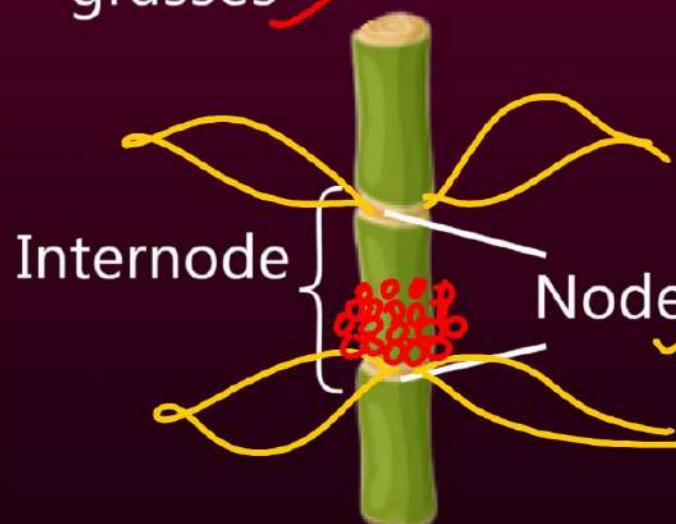
Meristematic Tissue - Provides growth of plant at specific location 

Meristematic Tissue



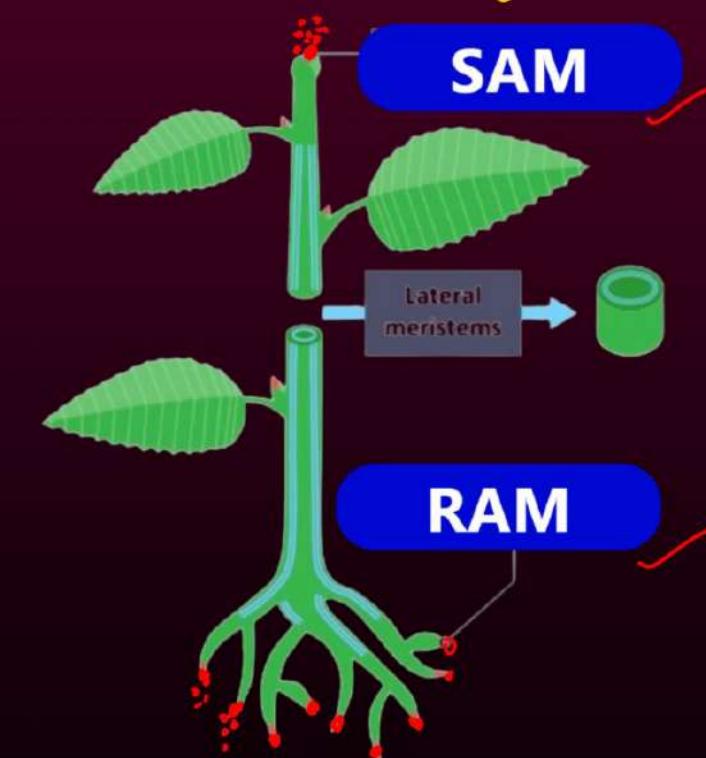
GROWTH
ALT

- Found in some plants like sugarcane, bamboo
- Present at base of internodes
- Makes stem longer , helps in regrowth of grasses



- Present laterally
- Increases girth / thickness of stem and root.
- Secondary Growth

- Present at tips of root and stem.
- Increases length of root and stem.
- Primary Growth



SAM- Shoot Apical Meristem
RAM - Root Apical Meristem

Permanent Tissue



1. The Permanent tissues are made of cells which have lost their capability to divide.
2. The Division & 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

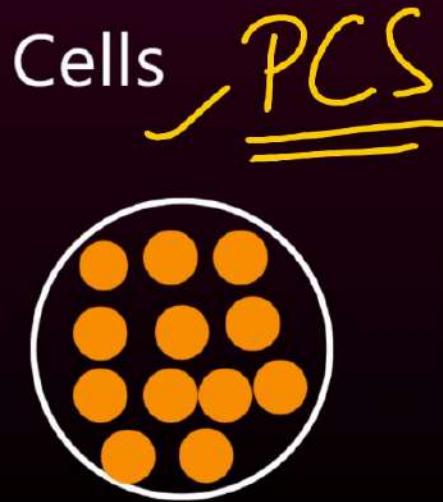
Made up of only one type of Cells

Parenchyma

Collenchyma

Sclerenchyma

Primary
structure
of Plant



Complex Permanent Tissues

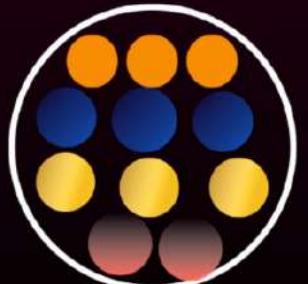
Made up of more than one type of Cells

Xylem

Phloem

Transport
System
of Plant

XP



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

NCERT

P C S

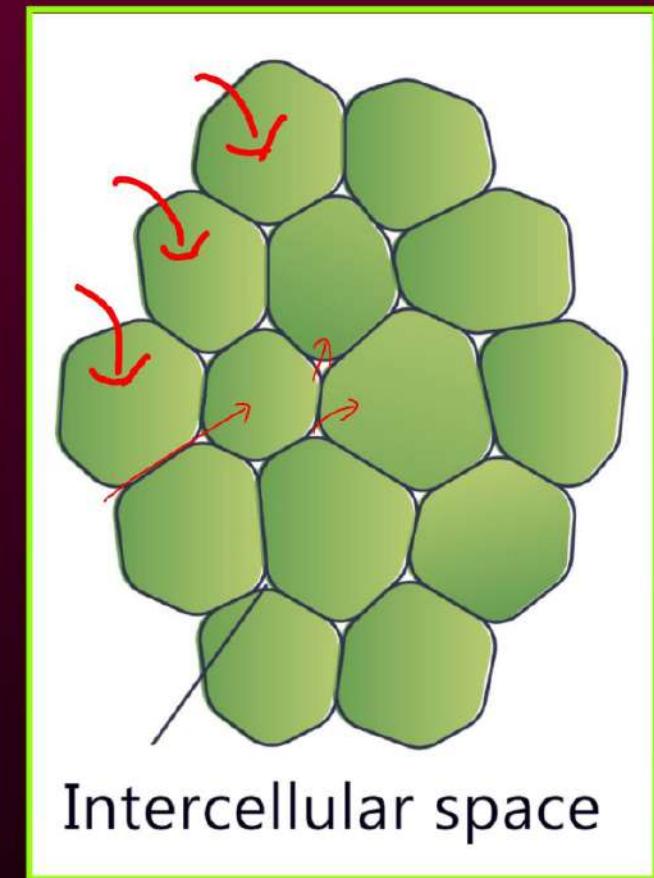
X P

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. <i>✓</i>
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.

Parenchyma → Storage of Food (Living)

- These tissues are most abundant (present in almost all parts of Plants) ✓
- Present in Stem, Leaves, roots, Fruits & 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* & performs photosynthesis.
Found in Leaves

Air Aerenchyma



Parenchyma with large *air cavities* that help aquatic plants to float. (eg- Lotus)

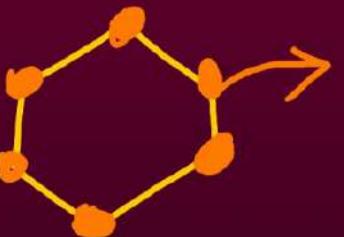


Cells

Collenchyma

→ Flexibility with support

1. Collenchyma Tissues are present in Leaf Stem
(leaf stalk)



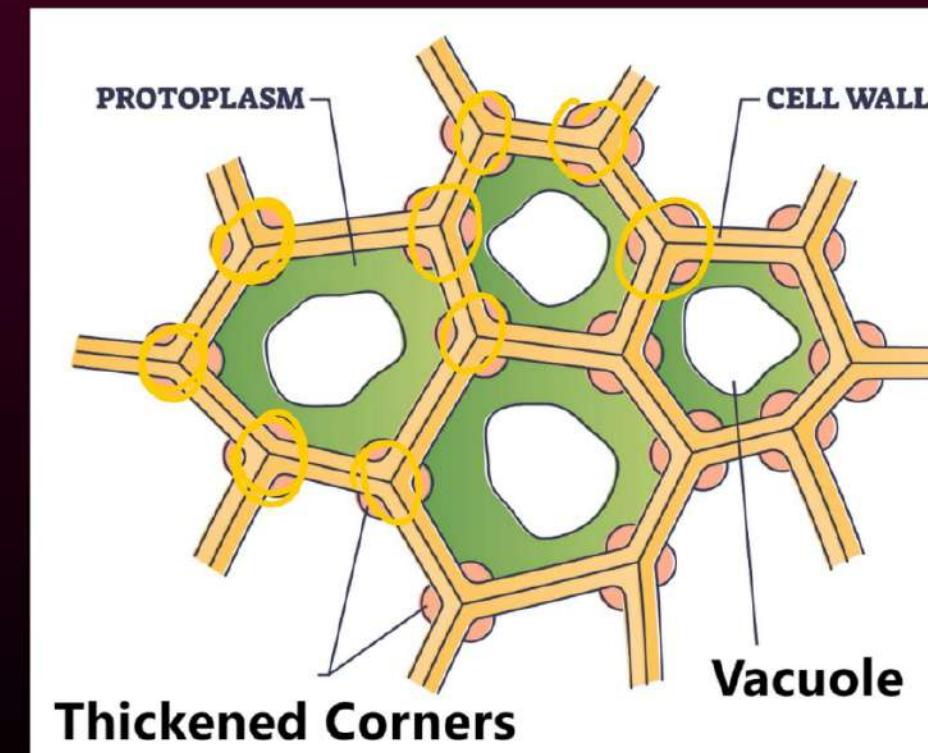
2. Main Functions -

- Provides Flexibility to various parts of a plant like bending of tendrils and stems of climbers without breaking
- Provides mechanical support

3. Cells are living and Unevenly thickened at the corners, due to presence of chemicals - Pectin & hemicellulose

4. There is very little intercellular space

Living



Sclerenchyma

→ Hardness & Stiffness Dead

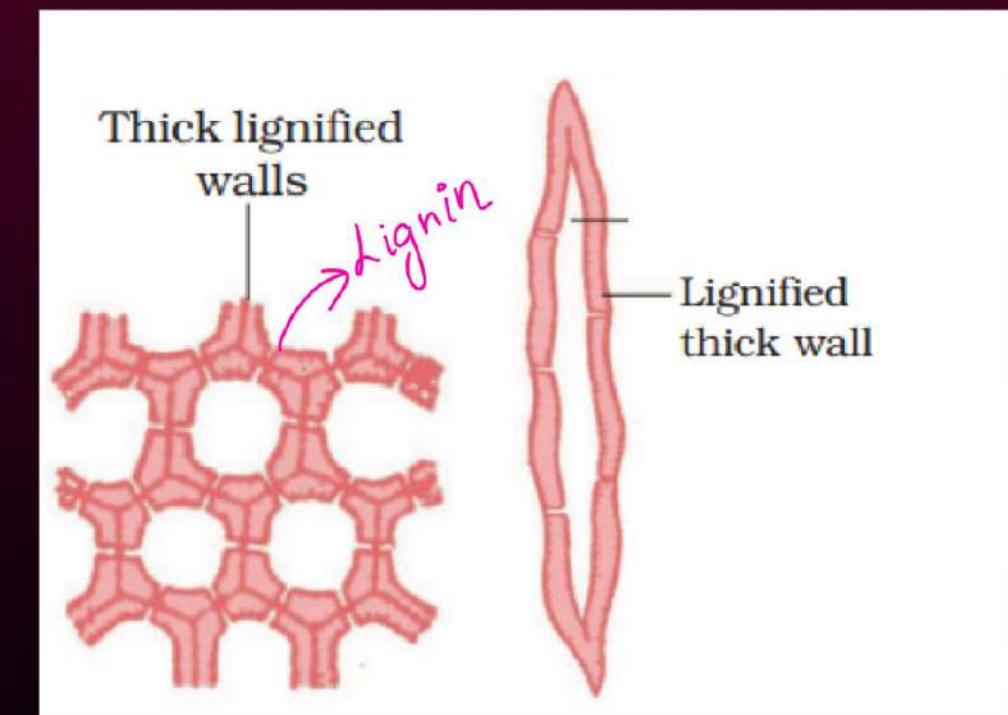
1. Present in Husk of Coconut , Hard covering of Nuts, stems of plant and in the veins of leaves.

2. Main Functions -

- Provides Hardness & Stiffness to Plants
- Provides strength to the plant parts

3. Cells have very thick Cell Walls due to presence of chemical - Lignin

4. DEAD Cells with No Intercellular Space (negligible)



Simple Permanent Tissues PCS

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

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

XP

Complex Permanent Tissue

→ Transport system

Made up of more than one type of cells

Conductive tissues Or Vascular bundles

Xylem ✓

Water & Minerals transport
- roots to stems and leaves.

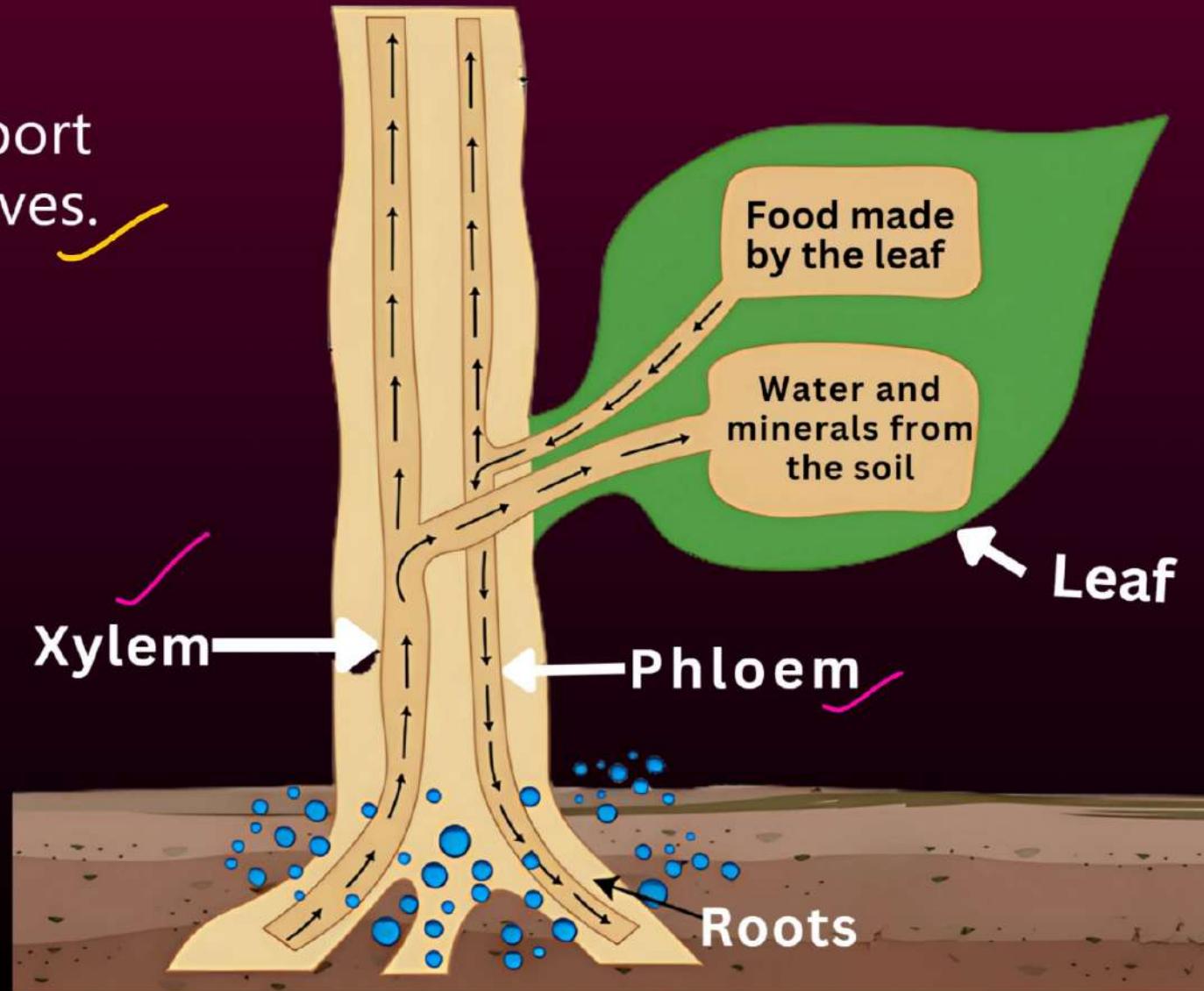
XYLEM TUBES

Phloem ✓

Food Transport
- leaves to all other parts
of plant

{ Translocation ✓ }

PHLOEM TUBES



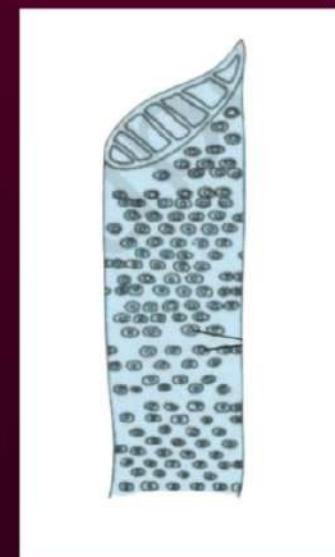
Xylem

Learn Dead Tissue

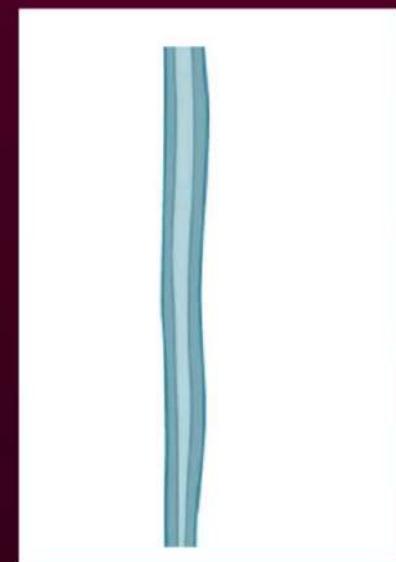
Tracheids



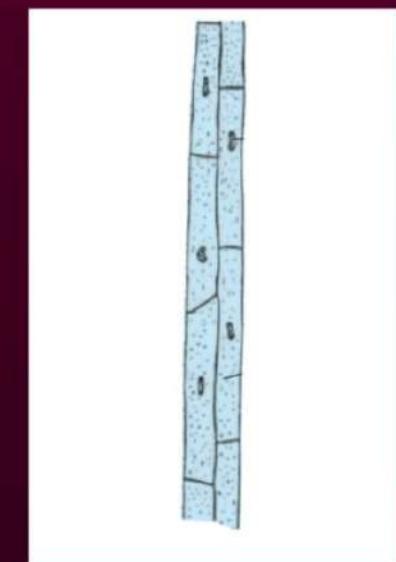
Vessels



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

Living Tissue

1. Sieve tubes

Angiosperms
(Flowering Plants)

-Tube like conducting structures, transports food
Walls of sieve tube cells perforated by
numerous pores, they are called **sieve plates**-
helps in transport of food.

Nucleus X L

2. Companion cells

- found next to sieve tube elements
have a nucleus L

3. Phloem parenchyma

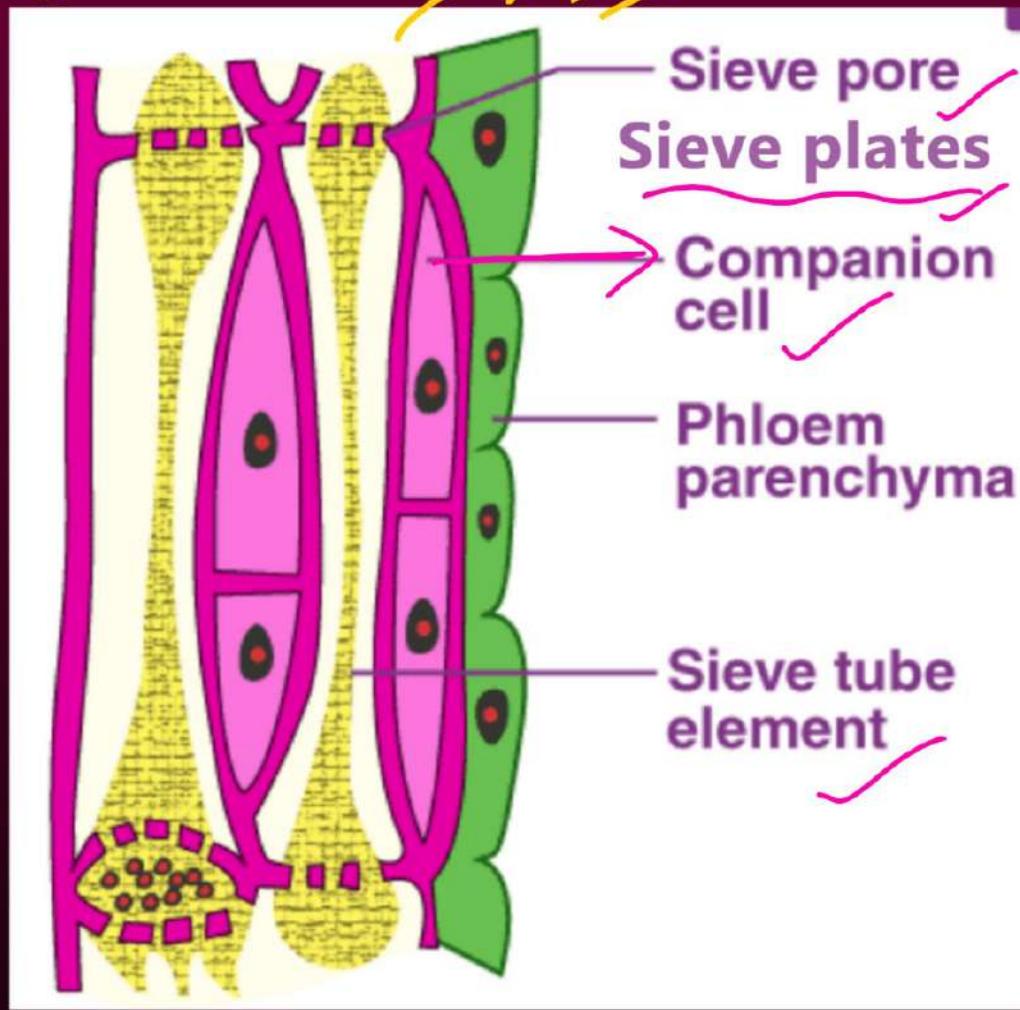
-Stores Food (starch) L

4. Phloem fibres

-give mechanical support to sieve tubes D

5. Sieve Cells

-Sieve cells are single, elongated phloem cells found in Gymnosperms
(Non Flowering Plants), lacking sieve plates and companion cells L



Except **phloem fibres**, other **Phloem cells are living cells**.

Xylem

1. It transports water and minerals from roots to stem and leaves



2. Xylem consists of tracheids, vessels, xylem fibres and xylem parenchyma.

3. Only xylem parenchyma is living.



4. Tracheids, vessels, xylem fibres are dead tissues.



5. Conduction of water by xylem is unidirectional (upward from root)



Phloem

1. It transports food material from the leaves to all other parts of the plant.



2. Phloem consists of sieve tubes, sieve cells, companion cells, phloem fibres and phloem parenchyma.



3. Sieve tubes, sieve cells, companion cells and phloem parenchyma are living.

4. Phloem fibres are dead tissues.

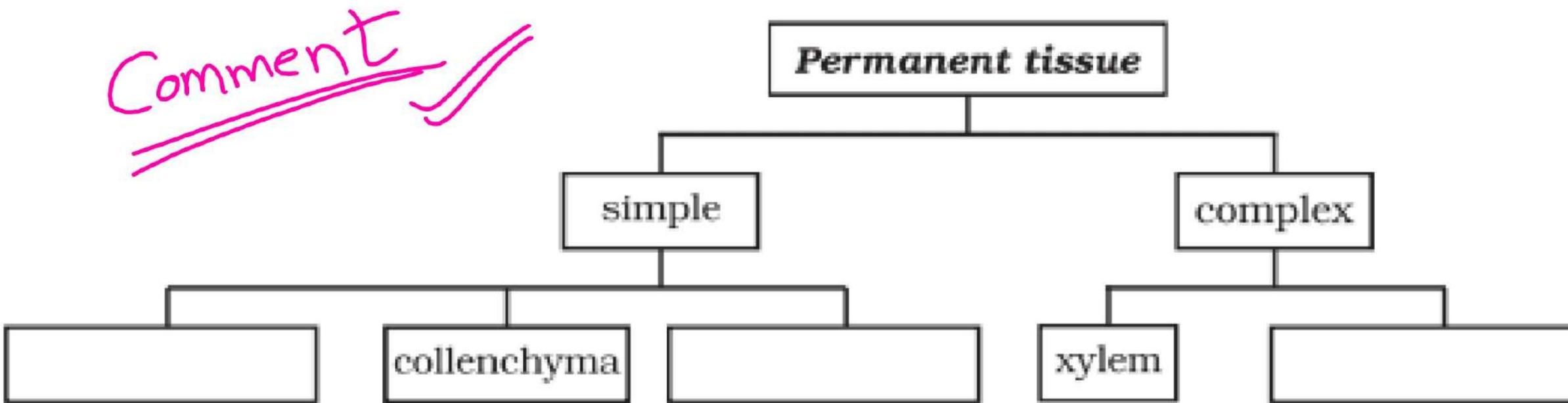


5. Food material conduction is bidirectional (upward and downward from leaves)



Q) Complete the following chart:

NCERT



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

Protective Tissues

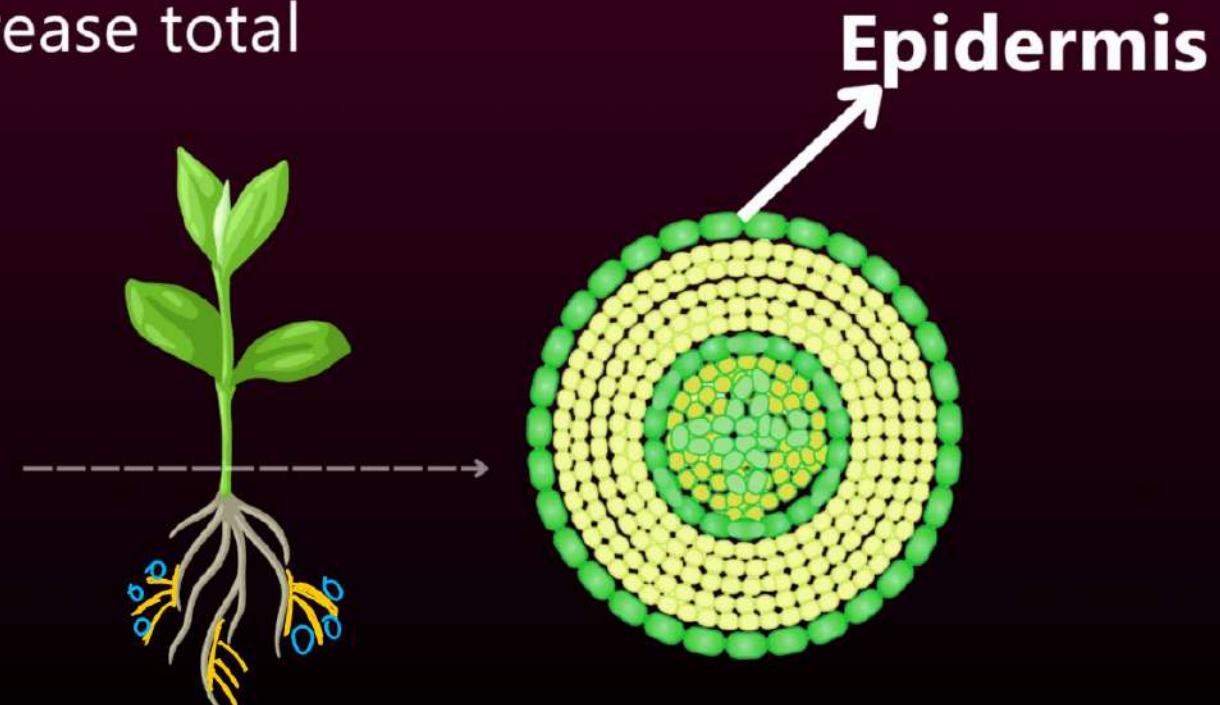
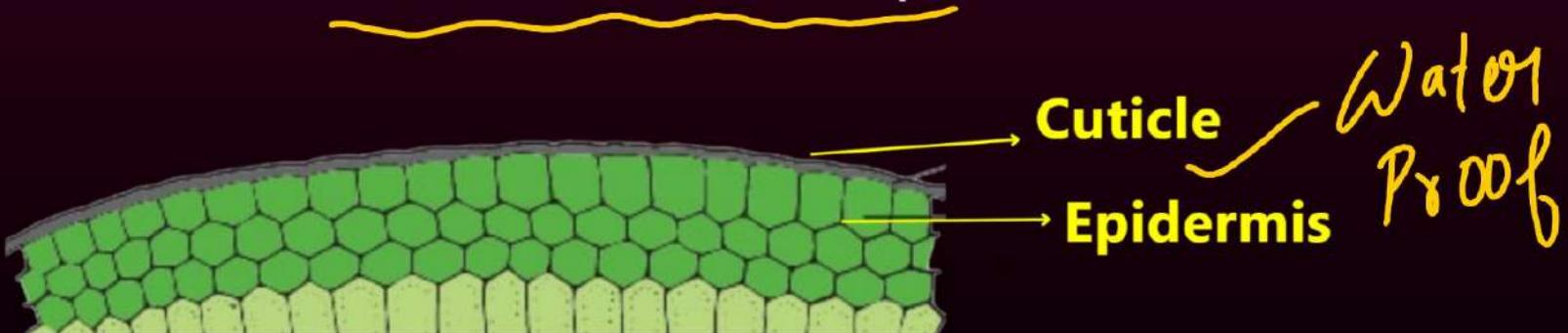
Epidermis

Cork

Epidermis

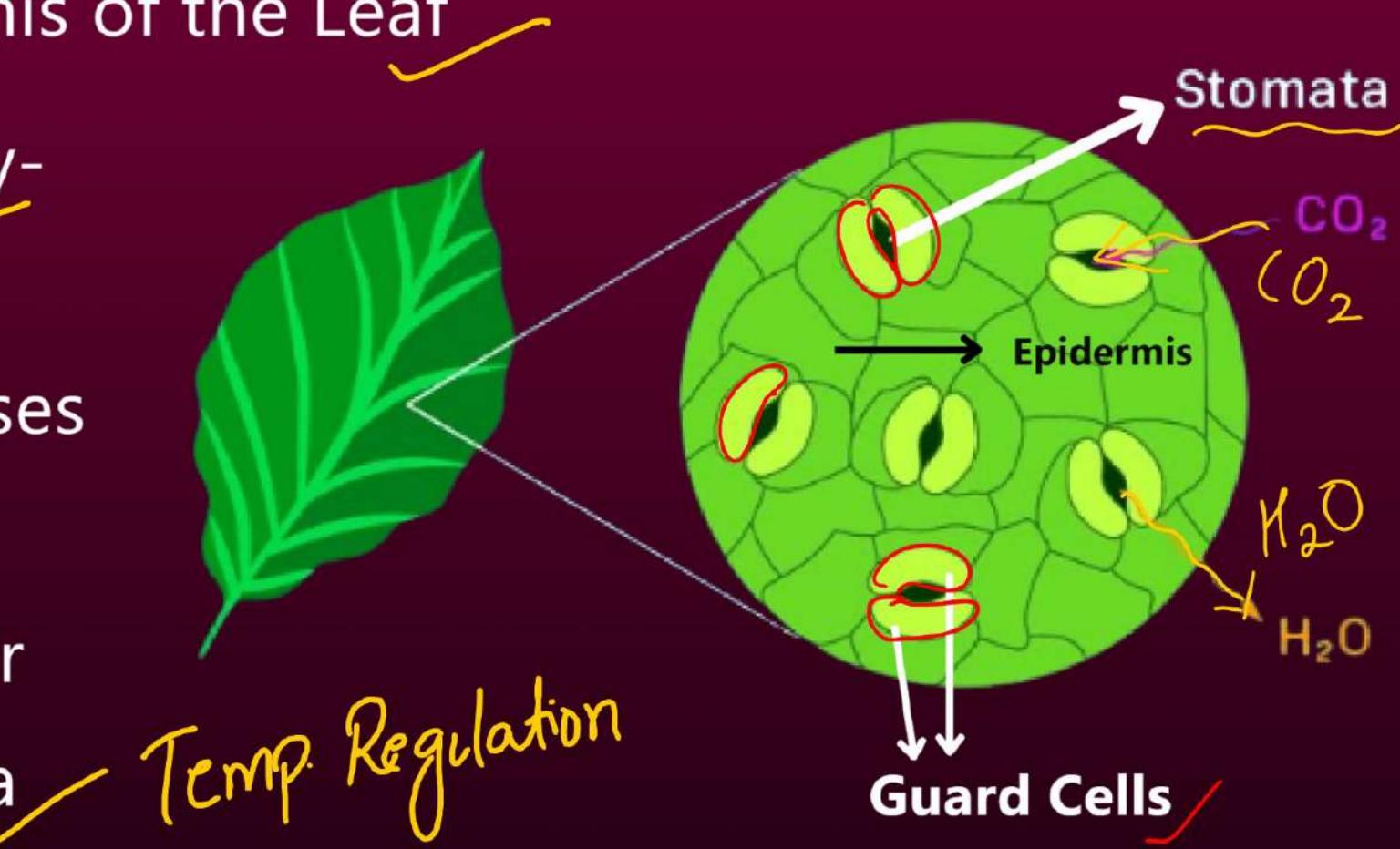
**Outermost thin layer of cells.
Entire Plant Surface is covered with Epidermis**

1. Continuous layer without Intercellular spaces ✓
2. Provide Protection to plants - From Injury , Against Parasitic attack & Against Water Loss
3. In desert plants → Epidermis has a thick waxy covering of cutin to reduce water loss by transpiration (cutin is a chemical substance with waterproof quality).
4. 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

1. Stomata are enclosed by two kidney-shaped cells called Guard Cells
2. Each stoma helps in exchange of gases with atmosphere ✓
3. Transpiration (Loss of water as water vapour) takes place through stomata ✓



Q) What are the functions of the stomata? NCERT

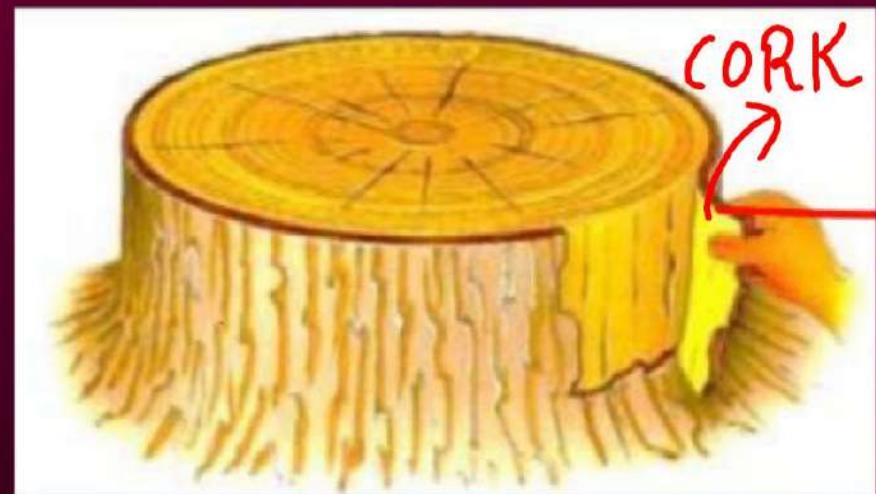
Ans -

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

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 & 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 & Water loss



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

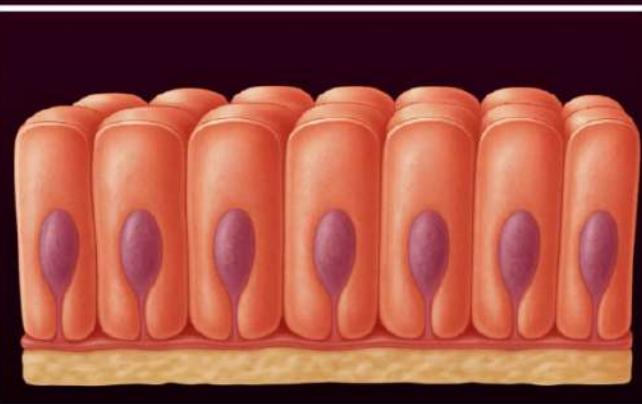
NCERT

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

Animal Tissues

Epithelial tissue

Outer covering of body and lining of organs



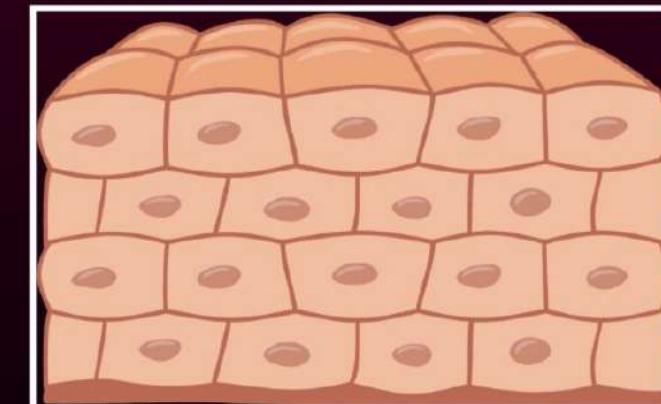
Connective tissue

Blood, Bones, tendons, cartilage, ligaments



Muscular tissue

Help in movement of body



Nervous tissue

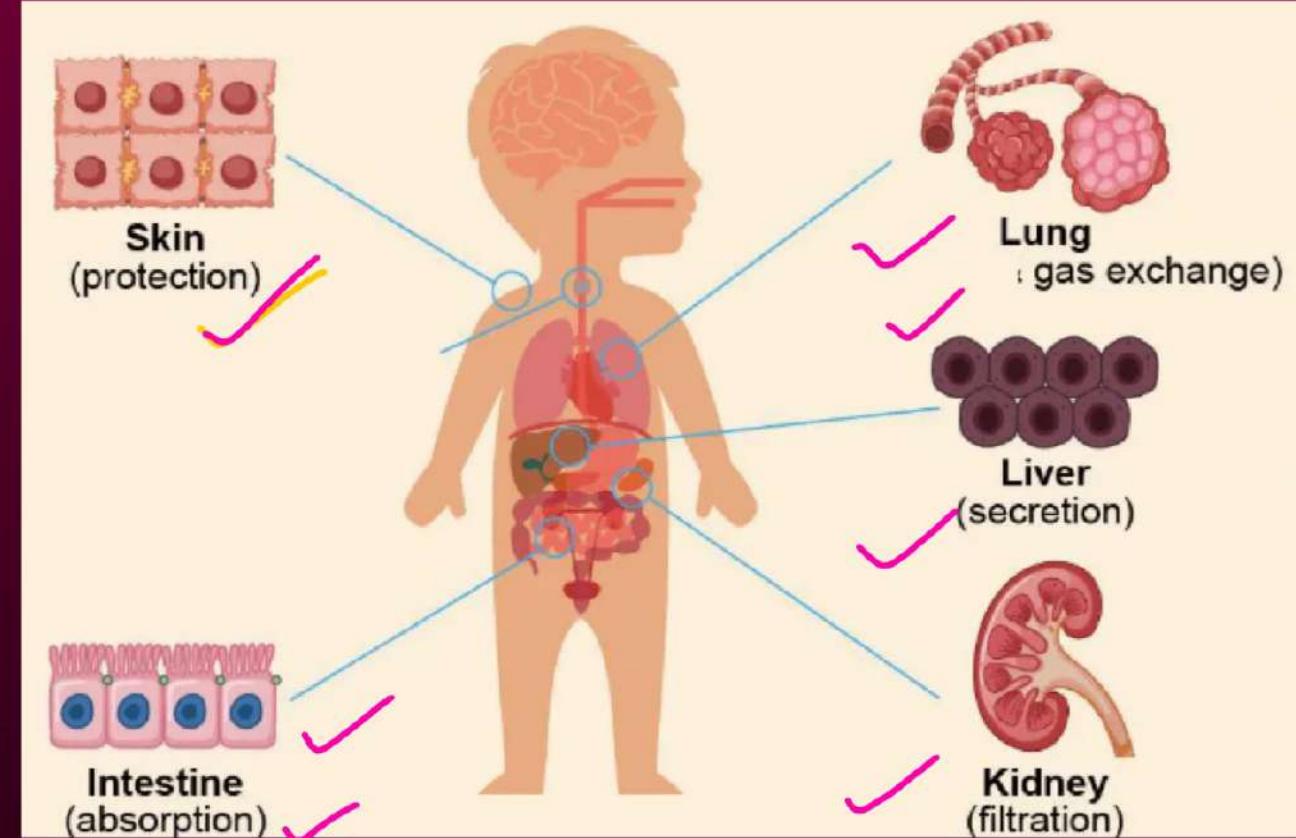
Transmission of messages between brain spinal cord & body



Epithelial Tissue

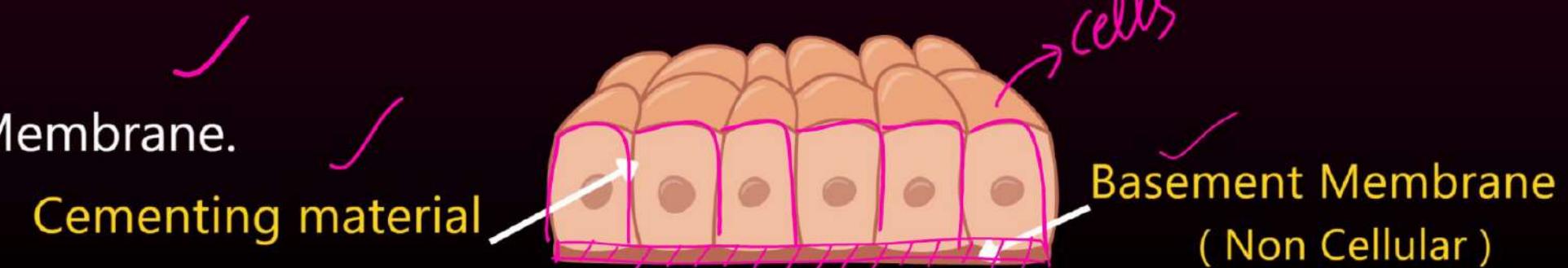
Protective Covering tissues in animals

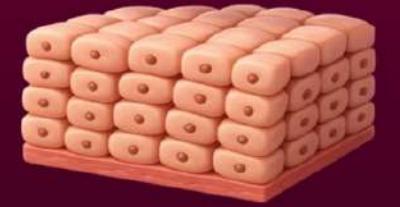
1. Epithelium covers most organs.
2. Location : skin, lining of the mouth, lining of blood vessels, lung alveoli and kidney tubules .
3. The cells of epithelial tissue are tightly packed , with almost NO intercellular space forming a continuous sheet.



4. Functions - Protection ; Absorption ; Exchange of Gases ; Secretion ;Filtration

5. Epithelium Tissue is separated from the tissues below by a non cellular membrane - Basement Membrane.



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

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



Muscular Tissue

1. Tissue made of elongated cells.



2. Help in movements in our body.



3. Movement is due to Contraction and Relaxation of

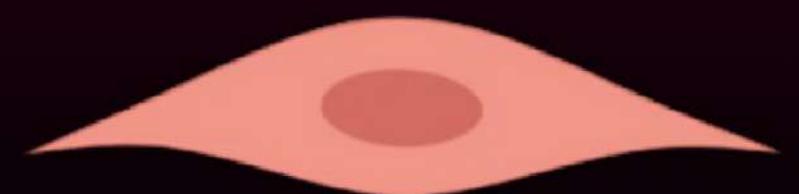
special protein present in muscles - Contractile Proteins

Types

Skeletal Muscle
Striated Muscle

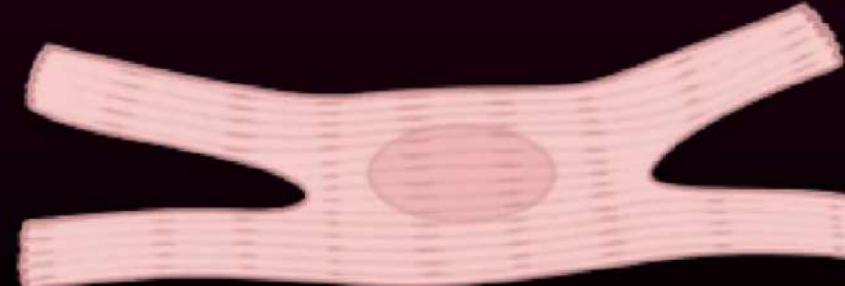


Smooth Muscle
Unstriated Muscle



Diag.
imp

Cardiac Muscle



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 ✓	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.)	Pumps blood by rhythmic contraction & relaxation ✓
Tiredness	Get tired easily ✓	Do Not Get Tired ✓	Do Not Get Tired ✓

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

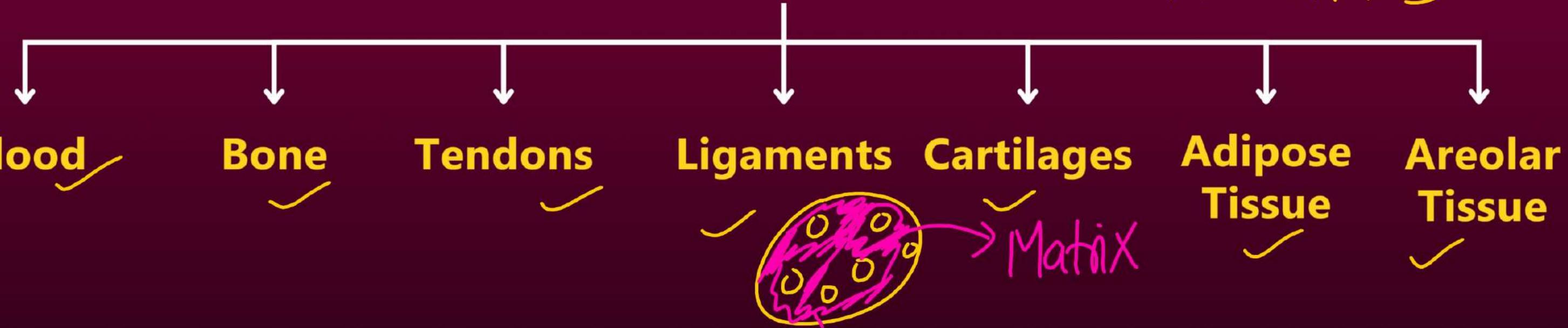
Q) What is the specific function of the cardiac muscle?

imp 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.

Connective Tissue

CAT LAB²



1. Connective Tissues Protects, Supports, Transport substances, Stores 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.

chikki



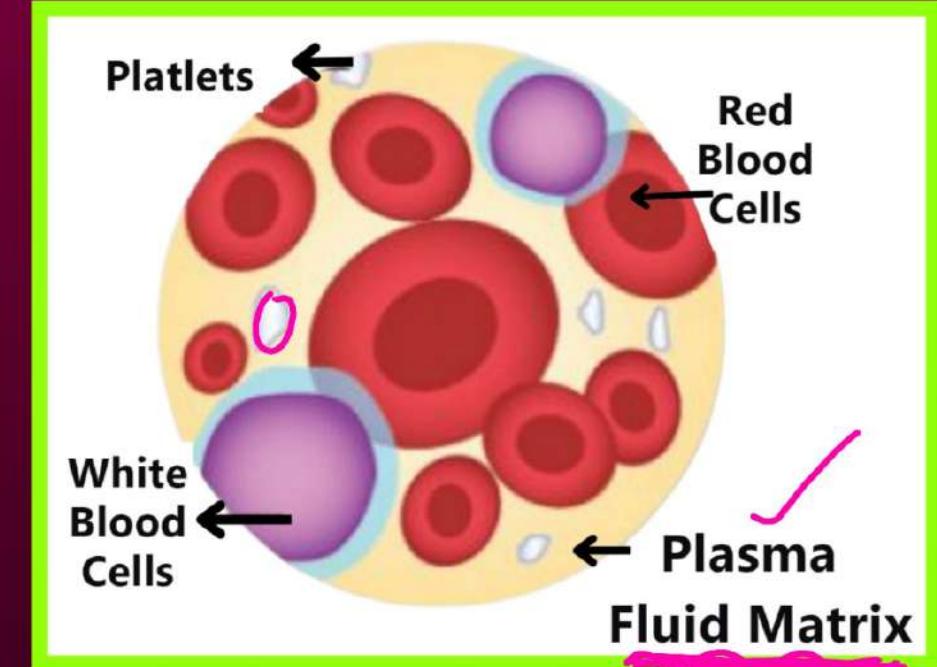
Blood

1. Blood is a fluid connective tissue.



2. Function → Transportation of gases, digested food, hormones & waste materials to different parts of the body ; Provides protection.

(2)



Plasma ✓

Fluid Matrix of Blood ✓

90 % water , 7% Protein

Transport of digested food, CO₂ waste ✓ ✓

Red Blood Corpuscles (RBCs)

Red Red Pigment
Hemoglobin is present

Hemoglobin in RBC helps transport oxygen to different parts of body ✓

White Blood Corpuscles (WBCs)

1. Fight infections ✓
2. Types: ✓

- Neutrophils
- Eosinophils
- Basophils
- Lymphocytes
- Monocytes

Platelets

Blood clotting ✓

imP

Tendons

1. Connective tissue that attaches muscles to bone.

2. Help in the movement of bones ✓

3. Strong and Non-elastic

Ligaments

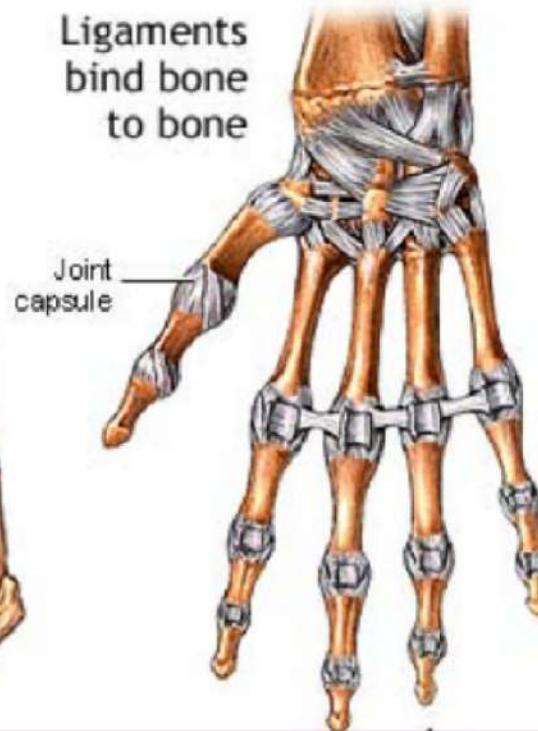
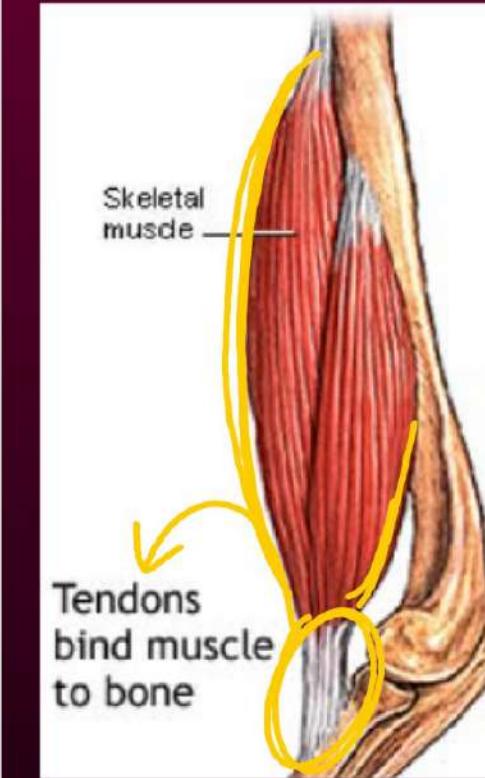
1. Connective tissue that attaches bone to bone.

2. Help in holding of bones together
(support to joints) ✓

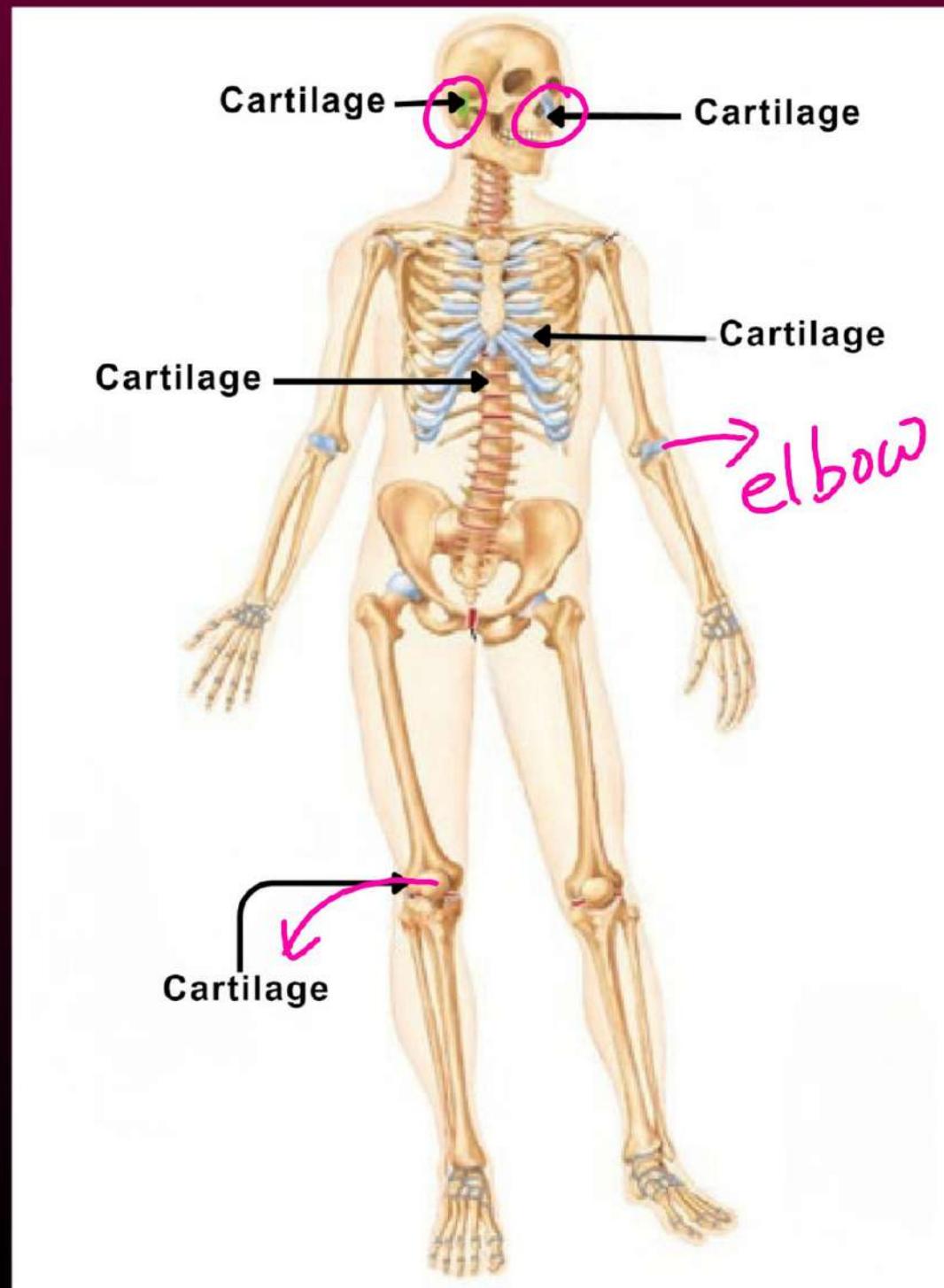
3. Strong and elastic ✓



Bone Loves Bone



Cartilage



1. Cartilage is found in joints (such as the knees and elbows), the ears and nose, and various location.
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



2. We cannot bend the bones in our arms



3. Matrix made up of Calcium & Phosphorus (Hard)



4. It provides shape to the body
Protects vital body organs such as brain, Lungs ,etc.,



1. Flexible not very hard



2. We can fold the cartilage of the ears,



3. Matrix made up of proteins & Sugars (Not that Hard)

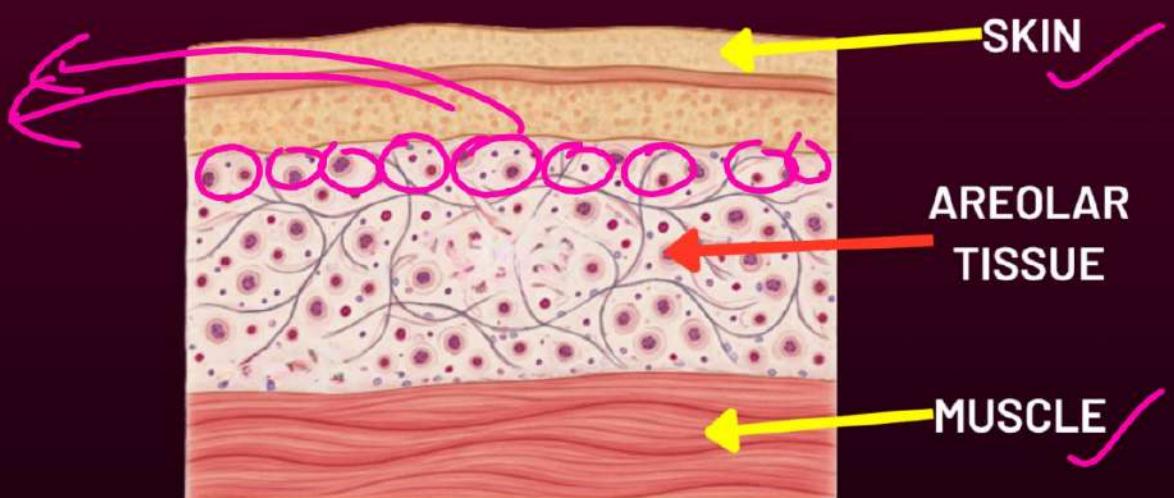


4. It provides cushioning, reduces friction, offers support.
Smoothens bone surfaces at joints



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

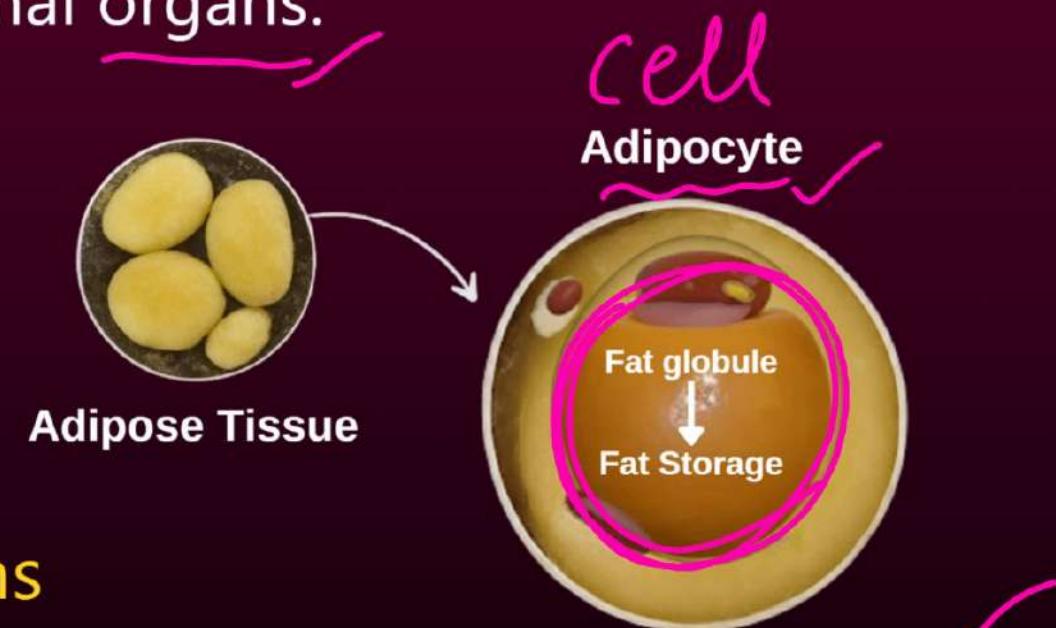


Functions

- Helps in tissue repair after injury
- Fills the space inside the organs

Adipose Tissue

1. Stores Fat. → **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 Bear

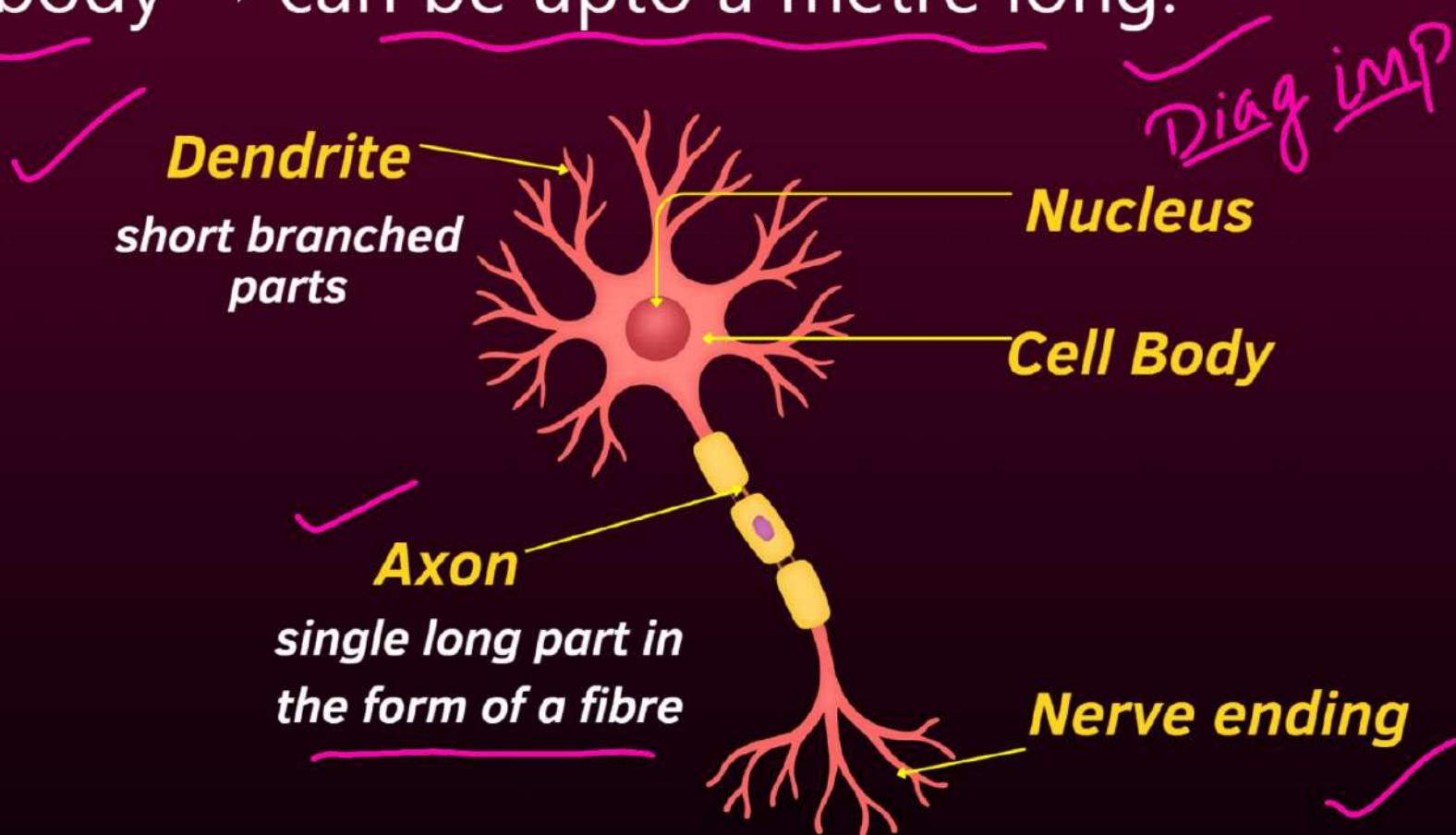


Nervous Tissue



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 body → can be upto a metre long.

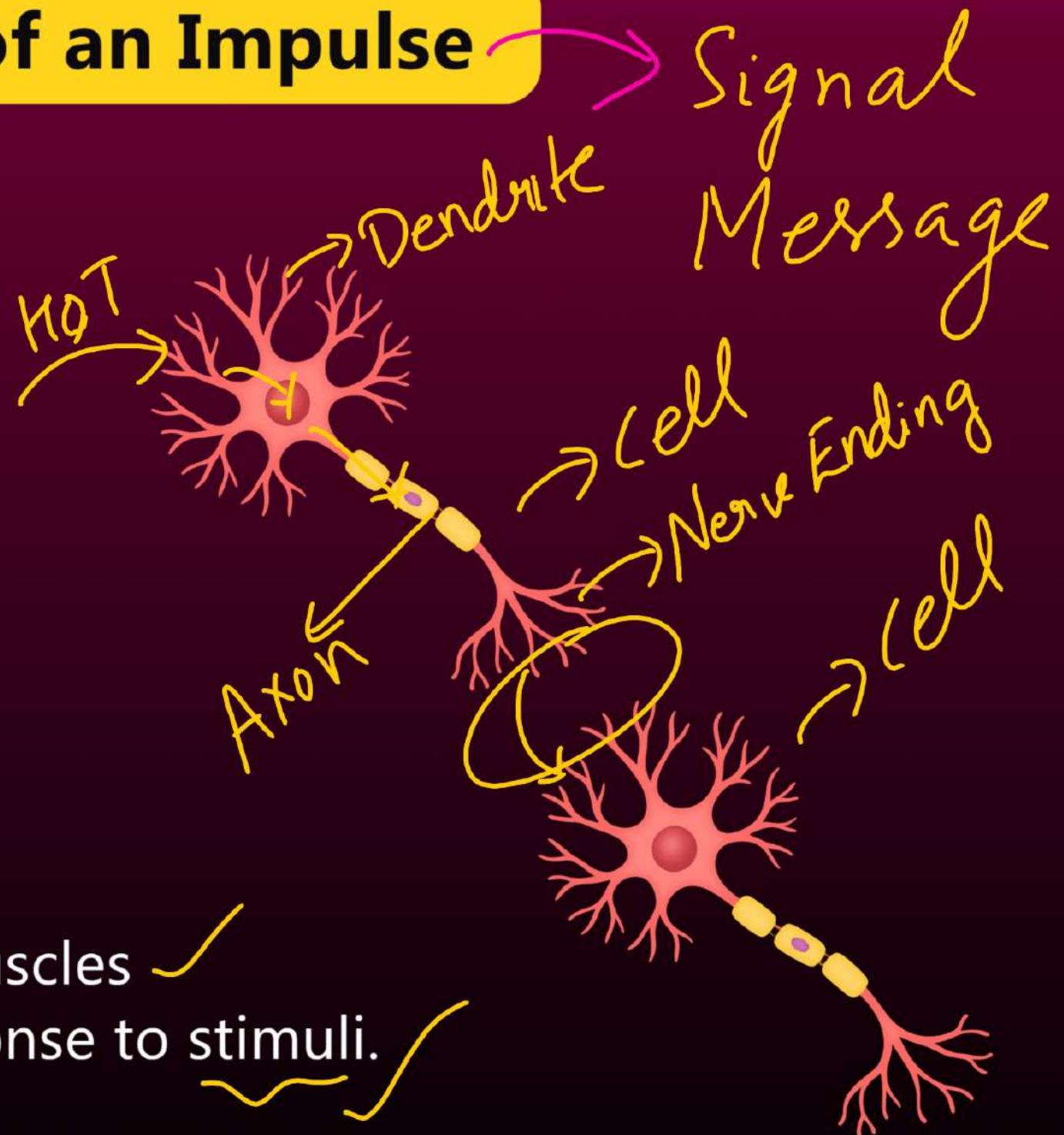
Nervous tissue receive stimuli (any change in surrounding) and transmit it rapidly from one part of body to another.



Neuron Or Nerve Cell

Transmission of an Impulse

- 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.