MATH LOVE INSTITUTE

Raipur, Chhattisgarh

Education as a Service (EaaS)

Contact: +91 7869553517 | www.mathlove.in

Class 9 Biology - Chapter 2: TISSUE

🧬 TISSUE

📌 Chapter Overview

Tissues are groups of similar cells working together to perform specific functions. Let's explore the amazing world of tissues!

- 🔬 What is a Tissue?
- 🌱 Plant Tissues - Meristematic and Permanent
- 🧱 Simple Permanent Tissues (Parenchyma, Collenchyma, Sclerenchyma)
- 🚿 Complex Permanent Tissues (Xylem and Phloem)
- 🦁 Animal Tissues - Four Types
- 📋 Epithelial Tissue
- 🦴 Connective Tissue
- 💪 Muscular Tissue
- ⚡ Nervous Tissue

🔬 1. WHAT IS A TISSUE?

⭐ DEFINITION ⭐

A tissue is a group of similar cells having a common origin and performing a specific function.

🔑 Key Points

- 💡 **Similar cells:** Same type of cells grouped together
- 🎯 **Common origin:** Arise from same source
- ⚡ **Specific function:** Specialized for particular work
- 📚 **Study of tissues:** Called HISTOLOGY

Why tissues?

- Division of labor - cells specialize for efficiency
- Better organization in multicellular organisms
- Each tissue performs specific function

🌿 vs 🦁 Plant vs Animal Tissues

Feature	Plant Tissues	Animal Tissues
Growth	Localized (specific regions)	All over the body
Dead cells	Many tissues have dead cells	Most tissues have living cells
Cell wall	Present	Absent
Movement	Stationary	Can move
Energy requirement	Less (stationary)	More (movement)

🌱 2. PLANT TISSUES

📊 Classification of Plant Tissues

Based on dividing capacity:

1. **MERISTEMATIC TISSUES** - Dividing tissues (growth)
2. **PERMANENT TISSUES** - Non-dividing tissues (function)

🌿 3. MERISTEMATIC TISSUES

🔑 Characteristics

Definition: Group of cells that have the ability to divide continuously

Features:

- 🔄 **Actively dividing:** Cells divide continuously
- 📦 **Compact:** Closely packed cells, no intercellular spaces
- 🧱 **Thin cell walls:** Made of cellulose
- 🧬 **Dense cytoplasm:** Large prominent nucleus
- 🚫 **No vacuoles:** Vacuoles absent or very small
- ⚡ **Function:** Responsible for growth in plants

📍 Types Based on Position

1️⃣ APICAL MERISTEM

Location: Present at growing tips of stems and roots (apex)

Function:

- Increases **length** of stem and root
- Responsible for **primary growth**
- Helps plant grow taller and roots deeper

Example: Root tip, shoot tip

2️⃣ LATERAL MERISTEM (CAMBIUM)

Location: Present in the sides/lateral parts of stems and roots

Function:

- Increases **thickness/girth** of stem and root
- Responsible for **secondary growth**
- Makes plant stouter/thicker

Types:

- **Vascular cambium:** Produces secondary xylem and phloem
- **Cork cambium:** Produces cork (protective layer)

Example: Cambium in tree trunks (makes them thick)

3️⃣ INTERCALARY MERISTEM

Location: Present at the base of leaves or internodes (between nodes)

Function:

- Increases length of internodes
- Helps in regeneration of damaged parts
- Growth in the middle of plant body

Example: Base of grass leaves (grass grows even after cutting due to this)

🌾 **This is why grass grows back after mowing!**

🧱 4. PERMANENT TISSUES

🔑 Characteristics

Definition: Tissues formed from meristematic tissues that have lost the ability to divide

Features:

- 🚫 **Lost dividing ability:** Cells do not divide
- 📏 **Definite shape and size:** Mature cells
- 🎯 **Specific functions:** Specialized for particular work
- 💧 **May have vacuoles:** Large vacuoles present
- 🪶 **May be living or dead**

Two Types:

1. **SIMPLE PERMANENT TISSUES** - Made of one type of cells
2. **COMPLEX PERMANENT TISSUES** - Made of more than one type of cells

🧱 5. SIMPLE PERMANENT TISSUES

1️⃣ PARENCHYMA - The Packing Tissue

🔬 Structure and Function

Structure:

- Made of **living cells**
- **Thin cell walls** made of cellulose
- **Large intercellular spaces** (loose packing)
- Cells may be **spherical, oval, or polygonal**
- Large vacuoles present

Functions:

- 🍎 **Storage:** Stores food, water, and waste products
- 🍃 **Photosynthesis:** When contains chlorophyll (chlorenchyma)
- 🎈 **Buoyancy:** When has air spaces (aerenchyma - in aquatic plants)
- 🔧 **Packing:** Fills spaces between other tissues
- 💪 **Support:** Provides turgidity to plant parts

Special Types:

- **Chlorenchyma:** Parenchyma with chlorophyll (green, photosynthesis)
- **Aerenchyma:** Parenchyma with large air cavities (buoyancy in water plants)

Location: Leaves, stem cortex, root cortex, fruits, seeds

2️⃣ COLLENCHYMA - The Flexible Support

🔬 Structure and Function

Structure:

- Made of **living cells**
- **Thickened cell walls** at corners (due to cellulose and pectin)
- **Little or no intercellular spaces**
- Cells are **elongated**
- May contain chloroplasts

Functions:

- 💪 **Mechanical support:** Provides strength with flexibility
- 🌱 **Allows bending:** Young stems and leaves can bend without breaking
- 🍃 **Photosynthesis:** When contains chloroplasts

Location: Below epidermis in dicot stems, leaf stalks (petiole)

> 🌿 **Collenchyma = Flexible Support Tissue**
>
> **Helps young plants bend in wind without breaking!**

3️⃣ SCLERENCHYMA - The Hard Support

🔬 Structure and Function

Structure:

- Made of **DEAD cells** at maturity
- **Very thick walls** due to **lignin deposition**
- **NO intercellular spaces**
- Cells are **long and narrow**
- No protoplasm (dead cells)

Functions:

- 💪 **Mechanical strength:** Provides hardness and rigidity
- 🛡️ **Protection:** Protects soft tissues
- 📏 **Makes plant parts hard:** Woody parts

Types:

- **Fibers:** Long, thick-walled cells (jute, hemp fibers)
- **Sclereids:** Short, variously shaped cells (hard shell of nuts)

Location: Stem, veins of leaves, hard covering of seeds and nuts

> 🟤 **Sclerenchyma = Hard Support Tissue**
>
> **Makes coconut shell hard! Used to make ropes and mats.**

📊 Comparison: Parenchyma vs Collenchyma vs Sclerenchyma

Feature	Parenchyma	Collenchyma	Sclerenchyma
Cell nature	Living	Living	Dead (at maturity)
Cell wall	Thin (cellulose)	Thick at corners	Very thick (lignified)
Intercellular spaces	Present (large)	Absent or little	Absent
Main function	Storage, photosynthesis	Flexible support	Hard support, strength
Location	All soft parts	Below epidermis, petiole	Stem, veins, hard parts
Example	Fruit pulp, pith	Leaf stalk	Coconut shell, jute fiber

🚀 6. COMPLEX PERMANENT TISSUES

🔑 Key Characteristics

Definition: Tissues made up of more than one type of cells working together as a unit

Two Types:

1. **XYLEM** - Conducts water and minerals
2. **PHLOEM** - Conducts food

Also called: VASCULAR TISSUES or CONDUCTING TISSUES

💧 XYLEM - The Water Highway

🔬 Structure and Function

Definition: Complex tissue that conducts water and minerals from roots to all parts of plant

Four Components:

1. TRACHEIDS

- **Dead cells** with thick, lignified walls
- **Long, tube-like** with tapering ends
- Primitive type of conducting cells
- Present in gymnosperms and pteridophytes

2. VESSELS (TRACHEAE)

- **Dead cells** with thick, lignified walls
- **Long tubular structures**
- Cells arranged end-to-end forming **continuous pipe**
- More efficient than tracheids
- Present in angiosperms (flowering plants)

3. XYLEM PARENCHYMA

- **Living cells**
- Only living component of xylem
- **Function:** Stores food and helps in lateral conduction

4. XYLEM FIBERS

- **Dead cells** with thick walls
- **Function:** Provides mechanical strength and support

Overall Functions of Xylem:

- 💧 **Conduction:** Transports water and minerals from roots upward

- 💪 **Support:** Provides mechanical strength to plant
- 📦 **Storage:** Xylem parenchyma stores food

💧 XYLEM = Water + Minerals ↑ (Upward)

From Roots → Stem → Leaves

PHLOEM - The Food Highway

Structure and Function

Definition: Complex tissue that transports food (prepared in leaves) to all parts of plant

Four Components:

1. SIEVE TUBES

- **Living cells** but without nucleus at maturity
- **Long tube-like structures**
- Cells arranged end-to-end
- End walls have pores called **sieve plates**
- Main conducting element

2. COMPANION CELLS

- **Living cells** with nucleus and dense cytoplasm
- Associated with sieve tubes
- **Function:** Help sieve tubes in conduction (as sieve tubes lack nucleus)
- Present only in angiosperms

3. PHLOEM PARENCHYMA

- **Living cells**
- **Function:** Stores food and helps in lateral conduction
- Absent in monocots

4. PHLOEM FIBERS (BAST FIBERS)

- **Dead cells** with thick walls
- **Function:** Provides mechanical strength
- Example: Jute fibers

Overall Functions of Phloem:

- 🌿 **Conduction:** Transports food from leaves to all parts
- 🔁 **Bidirectional:** Can move up or down as needed
- 📦 **Storage:** Phloem parenchyma stores food
- 💪 **Support:** Phloem fibers provide strength

🌿 PHLOEM = Food (Sugar) ↕ (Both directions)

From Leaves → All Parts (Up and Down)

📊 Comparison: Xylem vs Phloem

Feature	Xylem	Phloem
Transports	Water and minerals	Food (sugars, amino acids)
Direction	Unidirectional (upward only)	Bidirectional (up and down)
From	Roots	Leaves
To	All parts (mainly leaves)	All parts (storage organs)
Main cells	Tracheids and Vessels (dead)	Sieve tubes (living)
Cell walls	Thick, lignified	Thin, cellulose
Nucleus	Absent (dead cells)	Absent in sieve tubes, present in companion cells
Process	Transpiration pull	Translocation

🦁 7. ANIMAL TISSUES

📊 Classification of Animal Tissues

Four Main Types:

1. **EPITHELIAL TISSUE** - Covering and lining tissue
2. **CONNECTIVE TISSUE** - Connecting and supporting tissue
3. **MUSCULAR TISSUE** - Movement tissue
4. **NERVOUS TISSUE** - Communication tissue

📋 8. EPITHELIAL TISSUE - The Protective Cover

🔑 Key Characteristics

Definition: Tissue that covers body surfaces and lines body cavities

Features:

- 📦 **Closely packed cells** with no intercellular spaces
- 🧱 **Forms continuous sheet**
- 🛡️ **Covers body surfaces** (outer and inner)
- 📍 **Rests on basement membrane**
- 🔄 **High regeneration capacity** (repairs quickly)

Functions:

- 🛡️ **Protection:** Protects underlying tissues
- 📥 **Absorption:** Absorbs nutrients (intestine)
- 🚪 **Selective permeability:** Controls exchange
- 💧 **Secretion:** Forms glands
- 👅 **Sensation:** Contains sensory receptors

📊 Types Based on Layers

1️⃣ SIMPLE EPITHELIUM (Single Layer)

A. SQUAMOUS EPITHELIUM

- **Structure:** Thin, flat cells like floor tiles
- **Function:** Diffusion and filtration
- **Location:** Lining of blood vessels, alveoli (lungs), nephrons (kidneys)

B. CUBOIDAL EPITHELIUM

- **Structure:** Cube-shaped cells
- **Function:** Secretion and absorption
- **Location:** Kidney tubules, salivary glands, thyroid gland

C. COLUMNAR EPITHELIUM

- **Structure:** Tall, pillar-like cells
- **Function:** Secretion and absorption
- **Location:** Lining of stomach, intestine
- **Special:** May have cilia (ciliated epithelium) or microvilli

D. CILIATED EPITHELIUM

- **Structure:** Columnar cells with hair-like cilia
- **Function:** Movement of particles/mucus
- **Location:** Respiratory tract (windpipe), fallopian tubes

2️⃣ COMPOUND EPITHELIUM (Multiple Layers)

Also called: STRATIFIED EPITHELIUM

- **Structure:** Made of more than one layer of cells
- **Function:** Protection against wear and tear
- **Limited role:** in secretion and absorption
- **Location:** Skin, lining of mouth, esophagus

More layers = More protection

3️⃣ GLANDULAR EPITHELIUM

Definition: Specialized epithelium that forms glands for secretion

Types:

- **Unicellular glands:** Single-celled (Example: Goblet cells in intestine secrete mucus)
- **Multicellular glands:** Many cells (Example: Salivary glands, pancreas)

Function: Secretion of enzymes, hormones, mucus, sweat, etc.

🦴 9. CONNECTIVE TISSUE - The Body's Framework

🔑 Key Characteristics

Definition: Tissue that connects, supports, and protects other tissues and organs

Features:

- 📦 **Cells loosely packed**
- 🌊 **Abundant matrix:** Cells embedded in intercellular matrix
- 🧬 **Matrix composition:** Varies (liquid, jelly-like, solid)
- 🔄 **Vascular:** Well supplied with blood vessels

Functions:

- 🔗 **Connects:** Links different tissues and organs
- 💪 **Supports:** Provides structural framework
- 🛡️ **Protects:** Guards vital organs
- 📦 **Stores:** Fat storage
- 🚚 **Transports:** Blood transports materials

📊 Types of Connective Tissue

1️⃣ LOOSE CONNECTIVE TISSUE (AREOLAR TISSUE)

Structure:

- Loosely arranged fibers and cells
- Contains fibroblasts (cells that produce fibers)
- Semi-fluid matrix

Functions:

- Fills space between organs
- Supports and repairs tissues
- Helps in fighting infections

Location: Between skin and muscles, around blood vessels and nerves, in bone marrow

2️⃣ ADIPOSE TISSUE (FAT TISSUE)

Structure:

- Cells filled with fat globules (adipocytes)
- Nucleus pushed to periphery
- Less matrix and fewer blood vessels

Functions:

- 🔋 **Energy storage:** Stores fat as energy reserve
- 🌡️ **Insulation:** Prevents heat loss
- 🛡️ **Cushioning:** Protects organs from shocks

Location: Below skin, between internal organs, around kidneys, in bone marrow

3️⃣ DENSE CONNECTIVE TISSUE (FIBROUS TISSUE)

Structure:

- Densely packed fibers
- Less matrix and fewer cells
- Great tensile strength

Types:

A. TENDONS

- Connect **muscles to bones**
- Parallel arrangement of collagen fibers
- Very strong but not elastic

B. LIGAMENTS

- Connect **bones to bones** at joints
- Contains elastic fibers
- Very elastic and flexible

4️⃣ SKELETAL TISSUE (SKELETON)

Two Types:

A. CARTILAGE

- **Structure:** Solid, semi-rigid matrix containing chondrocytes (cartilage cells)
- **Matrix:** Made of protein and sugar (chondrin)
- **Function:** Flexible support, reduces friction between bones
- **Location:** Nose tip, ear pinna, joints between bones, trachea (windpipe)

B. BONE

- **Structure:** Hard, rigid matrix containing bone cells (osteocytes)
- **Matrix:** Made of protein (collagen) + minerals (calcium, phosphorus)
- **Haversian canals:** Contain blood vessels and nerves
- **Functions:**
  - 💪 Support and shape to body
  - 🛡️ Protects vital organs
  - ⚓ Anchors muscles
  - 🏭 Produces blood cells (in bone marrow)
  - 📦 Stores minerals (calcium, phosphorus)
- **Location:** Entire skeleton

5️⃣ BLOOD - The Fluid Connective Tissue

Structure:

- **Matrix:** Liquid plasma (55%)
- **Cells:** Blood cells suspended in plasma (45%)

Components:

A. PLASMA (Liquid matrix)

- 90% water
- Contains proteins, glucose, amino acids, salts, hormones, waste products

B. BLOOD CELLS

i) Red Blood Cells (RBC / Erythrocytes)

- Disc-shaped, biconcave
- No nucleus (in mammals)
- Contains **hemoglobin** (red pigment)
- **Function:** Transport oxygen and some CO_2

ii) White Blood Cells (WBC / Leucocytes)

- Colorless, irregular shape
- Have nucleus
- **Function:** Fight infections and diseases (immunity)

iii) Platelets (Thrombocytes)

- Small, cell fragments without nucleus
- **Function:** Blood clotting (stop bleeding)

Functions of Blood:

- 🚚 **Transportation:** Oxygen, CO_2, nutrients, hormones, waste
- 🛡️ **Protection:** WBCs fight infections

- 🩹 **Clotting:** Platelets prevent blood loss
- 🌡️ **Temperature regulation:** Distributes heat
- ⚖️ **Maintains pH:** Buffers

💪 10. MUSCULAR TISSUE - The Movement Makers

🔑 Key Characteristics

Definition: Tissue specialized for contraction and movement

Features:

- 🧬 **Elongated cells:** Called muscle fibers
- 🪢 **Contractile proteins:** Actin and myosin
- ⚡ **Highly vascular:** Rich blood supply for energy
- 🔋 **Many mitochondria:** For ATP production

Function: Movement and locomotion

📊 Types of Muscular Tissue

1️⃣ STRIATED MUSCLES (SKELETAL MUSCLES)

Structure:

- Long, cylindrical, unbranched fibers
- **Multinucleated** (many nuclei)
- Nuclei located at periphery
- **Dark and light bands (striations)** visible under microscope

Control: Voluntary - under conscious control

Functions:

- 🏃 **Body movements:** Walking, running, jumping
- 💪 **Limb movement:** Moving arms and legs
- 😊 **Facial expressions**

Location: Attached to bones via tendons

Fatigue: Tires quickly (needs rest)

2️⃣ SMOOTH MUSCLES (UNSTRIATED / INVOLUNTARY MUSCLES)

Structure:

- Spindle-shaped (fusiform) cells
- **Uninucleated** (single nucleus)
- Nucleus in center
- **No striations** (smooth appearance)

Control: Involuntary - not under conscious control

Functions:

- 🍽️ **Peristalsis:** Movement of food in alimentary canal
- 📦 **Contractions:** In blood vessels, urinary bladder
- 👁️ **Iris movement:** Controls pupil size

Location: Internal organs (stomach, intestine, blood vessels, iris, bronchi)

Fatigue: Does not tire easily

3️⃣ CARDIAC MUSCLES (HEART MUSCLES)

Structure:

- Cylindrical, branched fibers
- **Uninucleated** (single nucleus)
- Nucleus in center
- **Faint striations** visible
- **Intercalated discs:** Special junctions between cells

Control: Involuntary - rhythmic contractions not under conscious control

Function:

- ❤️ **Heart pumping:** Rhythmic contraction and relaxation
- Pumps blood throughout life without rest

Location: Wall of heart (myocardium)

Fatigue: Never tires (works 24/7 for entire life!)

❤️ Cardiac muscles = Life-long workers!

Beat about 100,000 times per day!

📊 Comparison: Three Types of Muscles

Feature	Striated	Smooth	Cardiac
Striations	Present (dark & light bands)	Absent	Faint
Shape	Long, cylindrical	Spindle-shaped	Cylindrical, branched
Nuclei	Many (multinucleated)	One (uninucleated)	One (uninucleated)
Control	Voluntary	Involuntary	Involuntary
Location	Attached to bones	Internal organs	Heart wall
Fatigue	Tires quickly	Doesn't tire easily	Never tires
Example	Biceps, triceps	Stomach, intestine	Heart

⚡ 11. NERVOUS TISSUE - The Communication Network

🔑 Key Characteristics

Definition: Specialized tissue for receiving stimuli and transmitting messages

Features:

- ⚡ **Excitability:** Can respond to stimuli
- 📡 **Conductivity:** Can transmit impulses
- 🧠 **Highly specialized** cells

Function: Control and coordinate body activities

🔬 Components of Nervous Tissue

1️⃣ NEURONS (NERVE CELLS)

Definition: Functional and structural unit of nervous system

Structure of a Neuron:

A. CELL BODY (CYTON/SOMA)

- Contains nucleus and cytoplasm
- Granular cytoplasm with **Nissl's granules**

B. DENDRITES

- Short, branched projections from cell body
- **Function:** Receive impulses from other neurons or receptors
- Conduct impulses **towards cell body**

C. AXON

- Single, long projection from cell body
- Covered by **myelin sheath** (fatty insulating layer)
- **Nodes of Ranvier:** Gaps in myelin sheath
- **Function:** Transmit impulses **away from cell body**
- Ends in **axon terminals** (synaptic knobs)

D. SYNAPSE

- Junction between two neurons
- Gap between axon terminal of one neuron and dendrite of next
- Impulse transmitted via **neurotransmitters** (chemical messengers)

Signal Flow: Dendrite → Cell Body → Axon → Next Neuron

2️⃣ NEUROGLIA (GLIAL CELLS)

Definition: Supporting cells of nervous system

Functions:

- Provide support and nutrition to neurons
- Protect neurons
- Remove dead neurons
- Fill spaces between neurons

Note: More numerous than neurons but cannot transmit impulses

⚡ Functions of Nervous Tissue

- 🎯 **Receives stimuli:** Senses changes in environment
- 📡 **Transmits impulses:** Sends signals rapidly
- 🧠 **Controls:** Coordinates all body activities
- 💭 **Thinking and memory:** Higher mental functions
- 🔄 **Reflexes:** Quick automatic responses

Location: Brain, spinal cord, nerves throughout body

⚠️ 12. COMMON MISTAKES

❌ MISTAKE 1: Xylem vs Phloem Confusion

Wrong: "Xylem transports food"

Correct: Xylem = Water & Minerals, **Phloem** = Food

Tip: Xylem = X-ray (upward), Phloem = Food (both ways)

❌ MISTAKE 2: Living vs Dead Cells

Wrong: "Sclerenchyma cells are living"

Correct: Sclerenchyma cells are **DEAD at maturity** (lignified walls)

Remember: Parenchyma & Collenchyma = Living, Sclerenchyma = Dead

❌ MISTAKE 3: Tendon vs Ligament

Wrong: "Tendons connect bone to bone"

Correct: Tendons = Muscle to Bone, **Ligaments** = Bone to Bone

Tip: T for Tendon = Muscle To bone

❌ MISTAKE 4: Muscle Types

Wrong: "Cardiac muscles are voluntary"

Correct: Only **striated muscles are voluntary**; smooth and cardiac are involuntary

❌ MISTAKE 5: Meristematic Location

Wrong: "All meristematic tissues are at tips"

Correct: Apical at tips, **Lateral** at sides, **Intercalary** at base/nodes

13. PRACTICE QUESTIONS

Multiple Choice Questions (1 mark each)

Q1. Which tissue makes the plant hard and stiff?

(a) Parenchyma
(b) Collenchyma
(c) Sclerenchyma ✓
(d) Chlorenchyma

Answer: (c) Sclerenchyma has thick, lignified walls providing hardness

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Q2. Phloem transports:

(a) Water
(b) Minerals
(c) Food ✓
(d) Gases

Answer: (c) Phloem conducts food from leaves to all parts

Q3. Cardiac muscles are found in:

(a) Limbs
(b) Heart ✓
(c) Stomach
(d) Blood vessels

Answer: (b) Cardiac muscles are present only in heart wall

Q4. Which connective tissue has a liquid matrix?

(a) Bone
(b) Cartilage

(c) Blood ✓
(d) Adipose

Answer: (c) Blood has liquid plasma as matrix

Q5. Functional unit of nervous system is:

(a) Nephron
(b) Neuron ✓
(c) Axon
(d) Dendrite

Answer: (b) Neuron is the structural and functional unit

📝 Short Answer Questions (2-3 marks)

Q6. Differentiate between meristematic and permanent tissues.

Answer:

Meristematic Tissue	Permanent Tissue
Cells actively dividing	Cells lost ability to divide
No intercellular spaces	Intercellular spaces present
Thin cell walls	Thick cell walls (may be)
Small or no vacuoles	Large vacuoles
Function: Growth	Function: Various specific functions

Q7. What are the components of xylem? Write one function of xylem.

Answer:

Four components of Xylem:

1. Tracheids (dead cells, tubular)
2. Vessels (dead cells, pipe-like)
3. Xylem parenchyma (living cells)
4. Xylem fibers (dead cells)

Function: Xylem conducts water and minerals from roots to all parts of the plant.

Q8. Differentiate between striated and smooth muscles.

Answer:

Striated Muscles	Smooth Muscles
Cylindrical, unbranched fibers	Spindle-shaped cells
Multinucleated	Uninucleated
Striations present	No striations
Voluntary control	Involuntary control
Attached to bones	Internal organs

📝 Long Answer Questions (5 marks)

Q9. Draw a well-labeled diagram of neuron and explain its structure.

Answer:

[Diagram should include: Cell body, Nucleus, Dendrites, Axon, Myelin sheath, Nodes of Ranvier, Axon terminals]

Structure:

1. Cell Body (Cyton):

- Contains nucleus and cytoplasm
- Has Nissl's granules
- Center of metabolic activity

2. Dendrites:

- Short, branched projections
- Receive signals from other neurons
- Conduct impulse towards cell body

3. Axon:

- Single, long fiber
- Covered by myelin sheath (insulation)
- Transmits impulse away from cell body
- Ends in axon terminals

4. Synapse:

- Gap between two neurons
- Impulse transmitted by neurotransmitters

Q10. Describe different types of simple permanent tissues in plants.

Answer:

Three types of simple permanent tissues:

1. PARENCHYMA:

- **Structure:** Living cells, thin walls, large spaces
- **Function:** Storage of food and water, photosynthesis
- **Location:** Soft parts - pith, cortex, fruits

2. COLLENCHYMA:

- **Structure:** Living cells, thick corners, little space
- **Function:** Flexible mechanical support
- **Location:** Below epidermis, leaf stalks

3. SCLERENCHYMA:

- **Structure:** Dead cells, very thick lignified walls, no spaces
- **Function:** Mechanical strength and hardness
- **Location:** Stem, veins, hard coverings

🏆 14. EXAM PREPARATION GUIDE

🎯 High Priority Topics

- ✨ Definition and classification of tissues
- ✨ Types of meristematic tissues (location and function)
- ✨ Comparison: Parenchyma, Collenchyma, Sclerenchyma
- ✨ Xylem and Phloem structure and functions
- ✨ Four types of animal tissues
- ✨ Types of epithelial tissue
- ✨ Blood components and functions
- ✨ Three types of muscles (comparison)
- ✨ Structure of neuron
- ✨ Tendons vs Ligaments

💡 EXAM STRATEGY

For Diagrams:

- Practice: Plant tissues, Neuron, Types of muscles
- Draw large, neat diagrams in center of page
- Label all parts clearly with arrows
- Use pencil for diagrams, pen for labels

Common Question Patterns:

1. Comparison tables (3-5 marks) - Very common!
2. Functions of tissues (2-3 marks)
3. Diagrams with labels (3-5 marks)
4. Differences between tissues (3 marks)
5. Components and their functions (3 marks)

📋 QUICK REVISION - Tissue Summary

PLANT TISSUES:

- Meristematic: Growth (Apical, Lateral, Intercalary)
- Simple Permanent: Parenchyma (storage), Collenchyma (flexible), Sclerenchyma (hard)
- Complex: Xylem (water ↑), Phloem (food ↕)

ANIMAL TISSUES:

- Epithelial: Covering (Simple: Squamous, Cuboidal, Columnar; Compound)
- Connective: Support (Areolar, Adipose, Tendon, Ligament, Cartilage, Bone, Blood)
- Muscular: Movement (Striated-voluntary, Smooth-involuntary, Cardiac-heart)
- Nervous: Communication (Neuron, Neuroglia)

🔬 Key Mnemonics

Plant Simple Tissues: "PCS"

- **P**arenchyma - Packing & Storage
- **C**ollenchyma - Corner thickening
- **S**clerenchyma - Strong & Dead

Animal Tissues: "ECMN"

- **E**pithelial - External covering
- **C**onnective - Connect & support
- **M**uscular - Movement
- **N**ervous - Nerves & brain

Blood Cells: "RPW"

- **R**BC - Red (oxygen carrier)
- **P**latelets - Prevent bleeding
- **W**BC - White (warriors against infection)

📚 Study Material Information

This comprehensive study material on **Tissue** (Chapter 2, Class 9 Biology) covers all plant and animal tissues as per the latest CBSE curriculum. It includes detailed explanations, comparisons, functions, and practice questions for thorough exam preparation.

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"The beautiful thing about learning is that no one can take it away from you."

- B.B. King