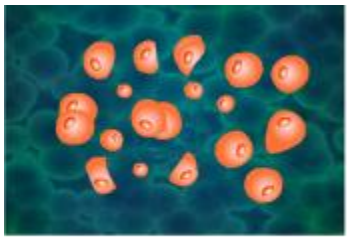
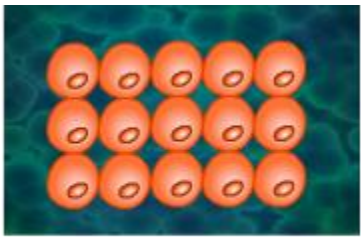
Tissues

Tissues: An Overview

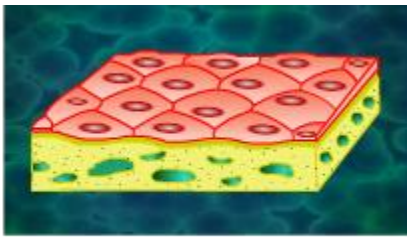
All living organisms are made up of millions of cells. These cells perform all the functions of the body—whether it is the beating of the heart or the movement of the hands. Let us find out how these cells perform so many different functions.



Cluster of different cells



Grouping of similar cells



Tissue

What can you conclude from the figures given above?

The given figures show that: **cells having similar structures combine to perform the same function**. **This combination or cluster of cells is known as a tissue**. For example, nerve cells combine to form the nervous tissue.

There are *n* number of cells in multicellular organisms. These cells **make up the tissues, which in turn combine to make up the different organs. The different organs form the different organ systems and these organ systems unite to form the organism.**

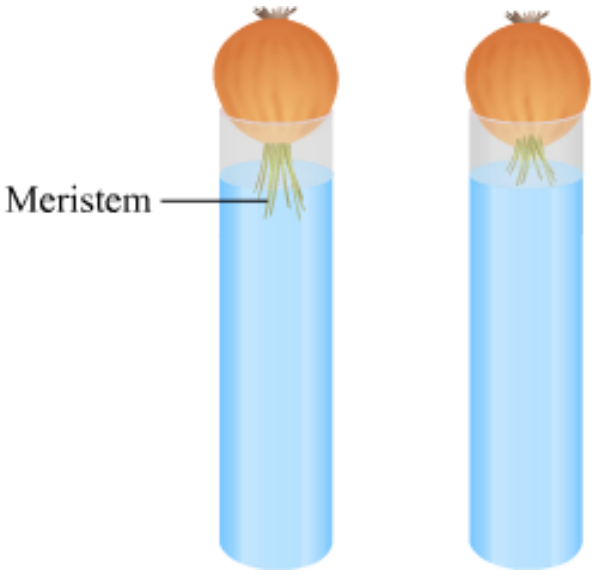
Cells → Tissues → Organs → Organ systems → Organism/Individual

On the other hand, unicellular organisms have only a single cell. This sole cell performs all cellular functions. For example, *Amoeba*. So, division of labour is a feature of multicellular organisms rather than of unicellular organisms.

The tissues present in one organism are different from the tissues present in another. For example, the tissues present in animals are broadly classified as **epithelial, connective, muscular** and **nervous tissues**. In contrast, the tissues present in plants are broadly classified as **meristematic** and **permanent**.

Meristematic Tissues

Meristematic tissue, also known as **meristem**, is composed of immature and continuously dividing cells. In plants, the shoot and root tips are made up of meristematic tissues.

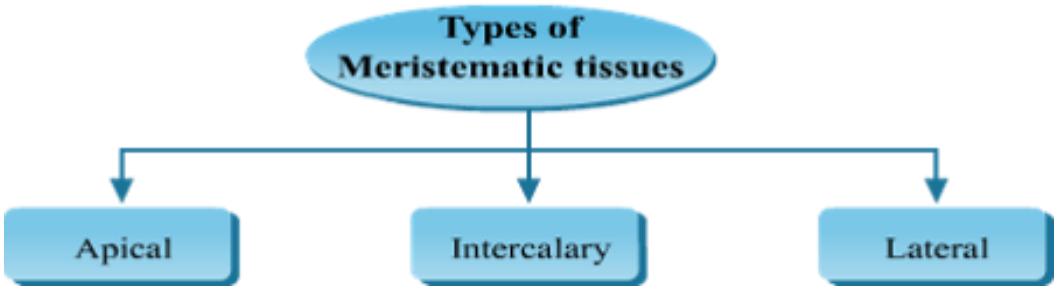


Let us observe meristematic tissues.

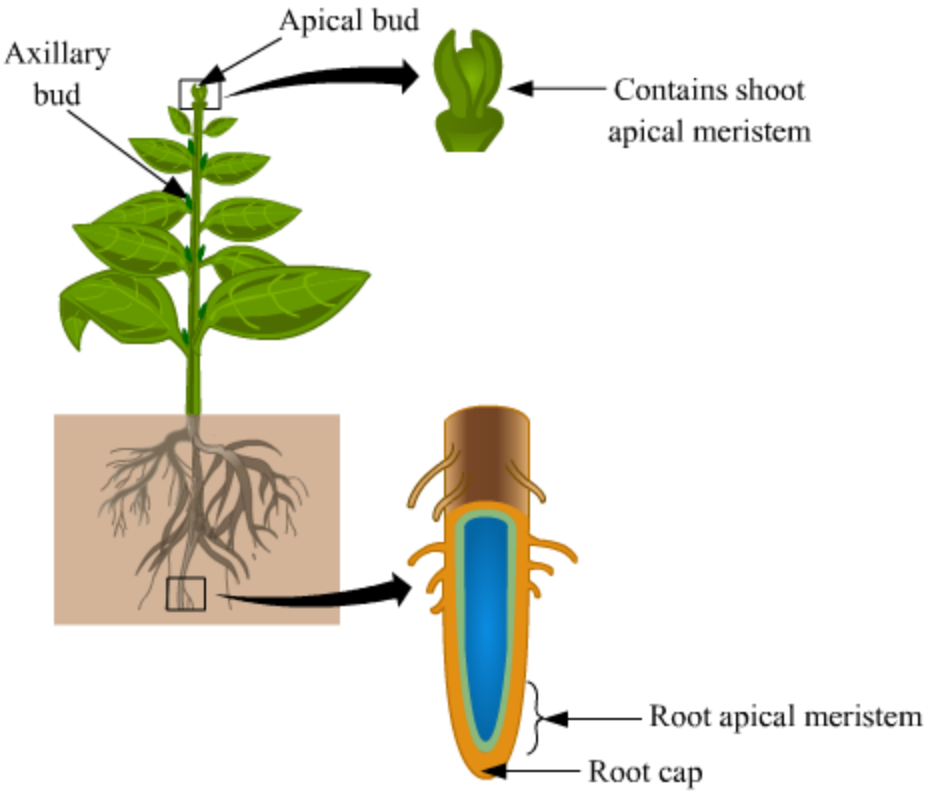
Characteristics of meristematic tissues:

- Meristems are made up of immature or **undifferentiated** cells.
- Their cells are small in size.
- Their cells are highly active metabolically and contain a dense cytoplasm.
- Intercellular space is negligible and is often absent in case of meristematic tissues.
- The cell wall is thinner and has a prominent nucleus.

Types of Meristematic Tissues



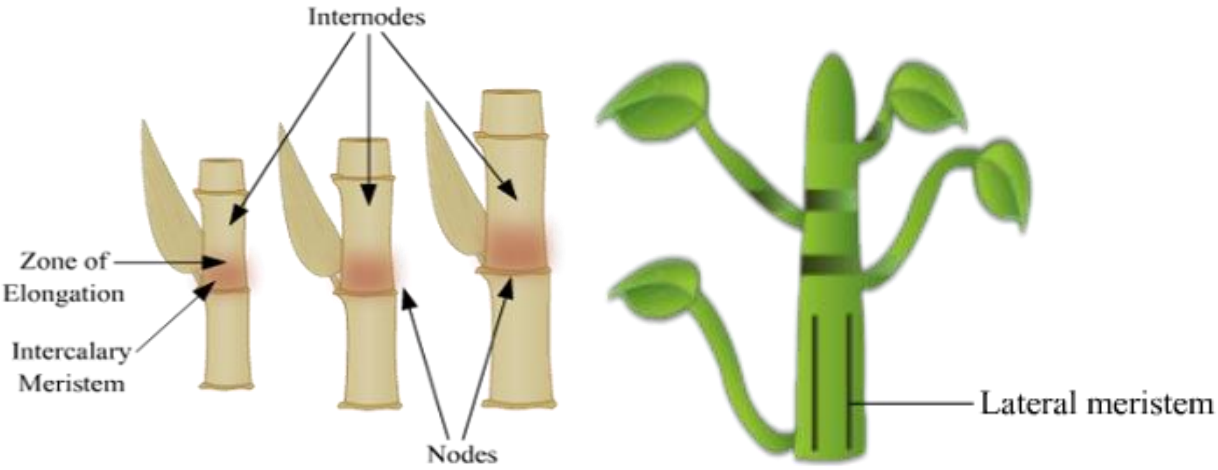
Apical meristems: They are present at the tips of stems, roots and branches. They are responsible for the axial growth in a plant.



Types of Meristematic Tissues

Intercalary meristems: They are present at the base of the **internodes**. They are responsible for the growth of the internodal region.

Lateral meristems: They are present on the lateral side of stems and roots. They are responsible for the radial growth of plants. **Vascular cambium** and **cork cambium** are examples of lateral meristem.



Solved Examples

Easy

Example 1: **Why do meristematic cells have small vacuoles or no vacuoles?**

Solution: The function of meristematic cells is to divide rapidly and produce new mass of cells. Vacuole is a cell organelle used for storing waste substances, water, etc. Since meristematic cells are actively dividing and young cells, they do not have any waste material to store. So, vacuoles are usually small or not present at all in meristematic cells.

Hard

Example 2: **Why are meristematic cells referred to as undifferentiated cells?**

Solution: Meristematic cells are undifferentiated cells because they are in a dividing state and their nature of work has not been decided. When cells perform a particular function, they are said to be differentiated.

Did You Know?

1. **Permanent tissues like xylem and phloem are derived from meristematic tissues.**
2. **The study of tissues is known as histology.**

Simple Permanent Tissues

Simple Permanent Tissues: An Overview

Are flowers, stems and roots composed of the same types of tissues or cells?

No. Since different plant parts perform different functions, their constituent cells also differ from one another.

A flower cannot change into a leaf and a leaf cannot change into a stem. Therefore, the component tissues of a flower and a leaf are permanent and do not differentiate.

Permanent tissues are composed of mature cells that have lost their power of division. Cells in a permanent tissue attain definite shape, size and functions. They may be dead or living. Permanent tissues are derived from meristematic tissues.

Permanent tissues are broadly classified into two major groups.

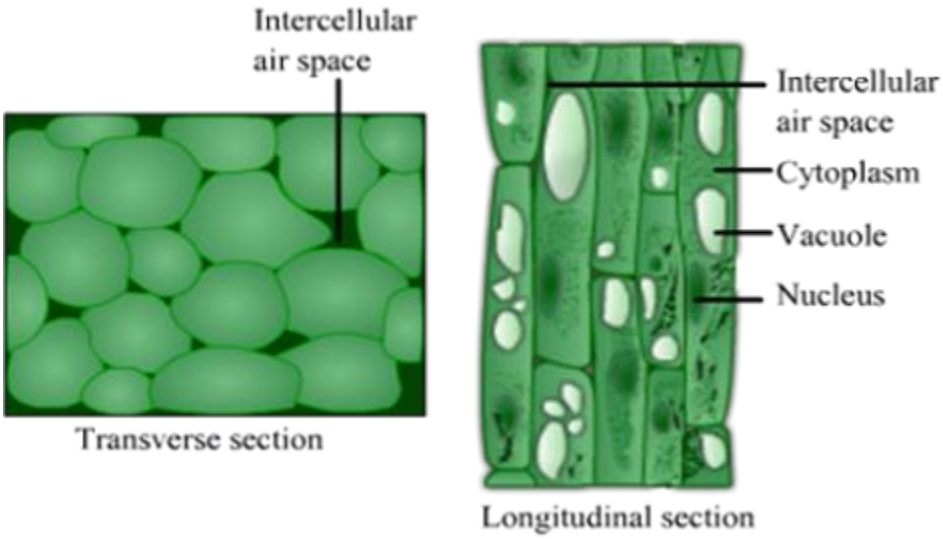
- **Simple permanent tissues**: In these, similar types of cells are grouped together to perform the same types of functions.

- **Complex permanent tissues**: In these, different types of cells are grouped together to perform specific functions.

  Let us explore and find out more about simple permanent tissues.

  Types of Simple Permanent Tissues

  Parenchyma



  Structure: Parenchyma is the most common plant tissue. It is composed of unspecialized cells with relatively thin cell walls. The cells in parenchyma tissues are loosely packed living cells. Hence, there are large spaces between them.

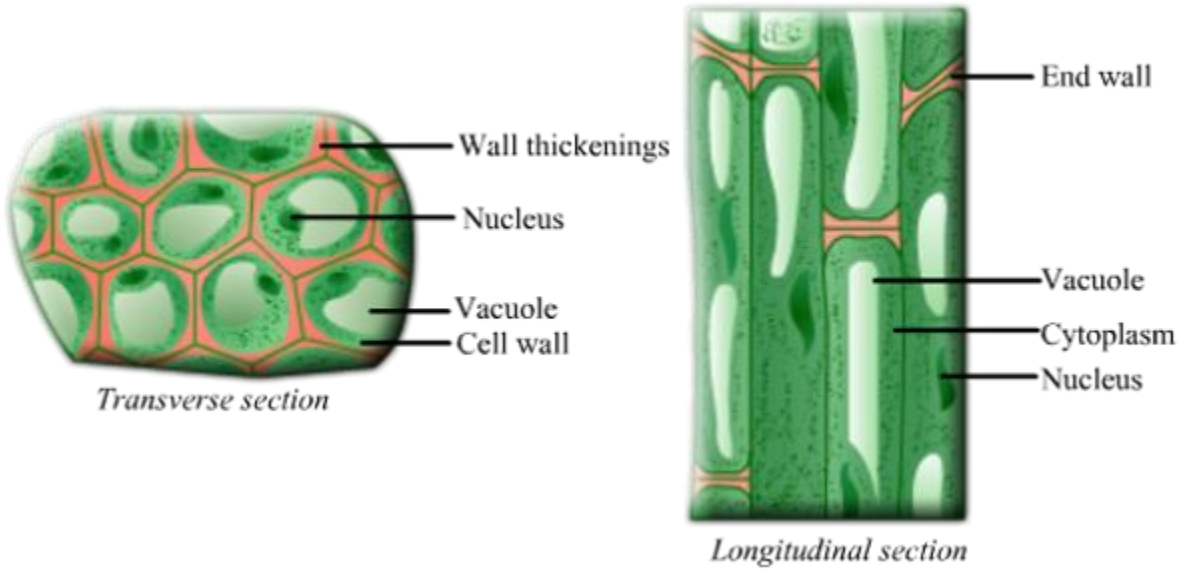
  The cell wall in this tissue is made up of **cellulose**. A large central vacuole and a distinct nucleus are present in the dense cytoplasm. The shape of the cell may be oval, round or polygonal.

  Location: Parenchyma tissues form bulk of the parts of herbaceous plants. It is also found in the flowers, fruits and leaves of woody plants. These tissues are found in the soft areas of stems, leaves, roots, etc.

  Functions: Its most important function is of storage i.e storage of food and water. It provides support to the stems of herbaceous plants. It plays the role of a packaging tissue by filling the spaces between the other tissues.

  The intercellular air spaces in parenchyma permit gaseous exchange. When parenchyma contains chlorophyll and performs photosynthesis, it is called chlorenchyma**.** Parenchyma is called aerenchyma when it contains large air cavities. It gives buoyancy to the aquatic plants and helps them to float.

Collenchyma

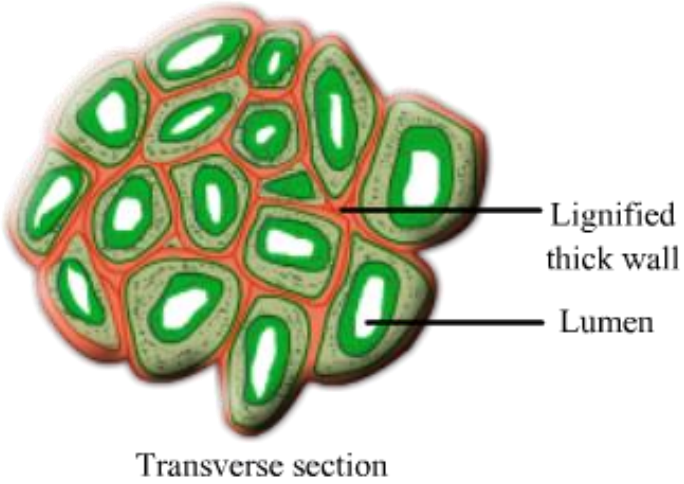


Structure: The cells of collenchyma are living and elongated. They have a large central vacuole and a prominent nucleus. The cell wall is irregularly thickened at the corners and there are very little spaces between the cells.

Location: Collenchyma is located beneath the epidermis in the stems and leaves of dicot plants. This tissue is usually not present in monocot stems and roots.

Functions: Collenchyma tissue is flexible; thus, it helps in providing mechanical strength to the parts of a plant where it is located. It provides elasticity to the plant parts by allowing them to bend easily without detaching from the main plant body. It also helps in storage and photosynthesis.

Sclerenchyma



Structure: Sclerenchyma consists of long and narrow dead cells. The cells of this tissue are thick-walled due to the deposition of **lignin**. The walls are so thick that there are no intercellular spaces.

Sclerenchyma consists of two types of cells:

(i) Sclerenchyma fibres: These are elongated, dead cells with pointed ends. The intercellular spaces in tissue are almost absent. All the cells have thick lignified cell walls. These cells are present in stems, around the vascular bundles, and in the veins of leaves.

(ii) Sclereids: Sclereids, also known as stone cells, are the short sclerenchymatous cells, that vary greatly in shape and size. Just like fibres, they also have thick lignified cell walls. They usually occur in hard parts of plant body, such as hard covers of seeds and nuts. They are also found in pulp of some fruits, such as *Pyrus.*

Functions: Some important functions of sclerenchyma are as follows:

- Sclerenchyma is tough and rigid; hence, it provides mechanical strength to a plant.
- It gives flexibility and elasticity to the various parts of a plant.

Solved Examples

Medium

Example 1:

Differentiate between the three types of simple permanent tissues.

Solution:

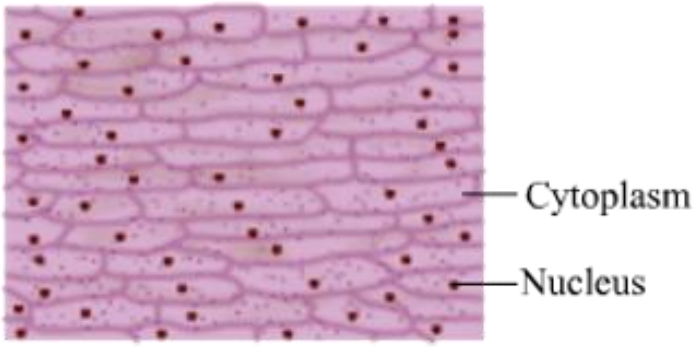
Parenchyma	Collenchyma	Sclerenchyma
It is composed of living, thin-walled cells.	It is composed of living, thin-walled cells with thickenings at the corners of the cells.	It is composed of dead cells with uniform thickenings of the cell wall.
Its cells may be oval, round or polygonal.	It has elongated cells, but they appear circular, oval or angular in transverse section.	It has long and narrow cells.

The cell wall is made up of cellulose.	Cellulose thickenings are present.	Lignin thickenings are present.
It forms the basic packing tissue. It also stores nutrients and water.	It allows various parts of a plant to bend without breaking. It also provides mechanical support to plants.	It makes a plant hard and stiff.

Epidermis

In animals, skin is present all over the body. It insulates the body and protects it from the environment. **Have you ever wondered what protects plants from the environment? Do plants also have skin?**

Epidermis is the plant tissue that forms the outermost layer of a plant and covers the whole plant body.



Onion Peel

Do you know that the epidermis of plants is also a simple permanent tissue? Let us explore the **characteristics and function of plant epidermis.**

Features:

- The cells of the epidermal tissue form a single continuous layer without any intercellular spaces.
- Epidermal tissues are present on the entire surface of a plant as an outer covering to protect all the parts of the plant.
- The cells of the epidermis are relatively flat. Their outer and side walls are often thicker than the inner wall.

Function: The epidermal tissue protects against loss of water, mechanical injury and invasion by parasitic fungi.

Specialization in Epidermis

Pull out a plant from a field and observe its roots closely.

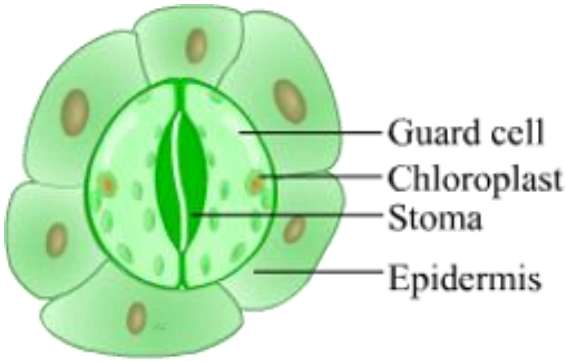
The roots will have many smaller **root hair**. Root hairs are the sites where soil, water and minerals are absorbed. They increase the area for absorption. The epidermal cells present in root hairs perform this function.

Observe a cactus plant (or any other desert plant). On feeling the plant surface, you will find that it is covered with a waxy layer of **cutin**. This waxy layer is water proof and prevents water loss through transpiration. This is an adaptation to prevent loss of water. Deserts experience scanty rainfall, so desert plants like cactus need to conserve water.

Large trees have a hard covering called bark. Are these epidermal cells too?

The outer layer of a young plant changes as it matures. Tissues called **secondary meristems** replace the epidermis, forming several layers of thick cork or **bark**. They are dead cells without any intercellular space.

Stomata



- The epidermal tissues on the leaves of a plant have minute openings called the stomata.
- Each stoma is surrounded or enclosed by two kidney-shaped cells called the guard cells.
- These stomata are necessary for the exchange of gases between the atmosphere and plants. They also help in the process of **transpiration**.
- These pores remain open during the day and close at night.

Did You Know?

- **In floating leaves, the stomata are found on the upper side.**

- **Around 1000 to 100000 stomata are present per square centimetre on the surface of a leaf.**

Solved Examples

Medium

Example 2:

Do permanent tissues divide? Give reason for your answer.

Solution:

The cells of a permanent tissue do not have the ability to divide because they are already differentiated. The cells are specialized to perform specific functions and do not undergo further division.

Easy

Example 3:

How does the epidermis protect a plant against water loss?

Solution:

The epidermal cells on the aerial parts of a plant often secrete a waxy, water-resistant layer on the outer surface. This layer reduces the loss of water from the plant.

Observing Stomata in a Leaf Peel

Protective Tissues

The outermost layer of various parts of plant such as the stem, roots, flowers, and leaves, transform to protective tissues.

As the name suggests, the function of protective tissues is to protect the plant from external injuries. The two types of protective tissues are epidermis and cork.

Epidermis

It is present on the outer surface of the entire plant body. The cells of epidermal tissue form a continuous layer without any intercellular spaces. The epidermis has minute openings in the leaves. These openings are called the stomata.

Each stoma is surrounded or enclosed by two kidney-shaped cells called the **guard**

cells. The concave side of the guard cells has a minute opening. These openings are called stoma opening. Stomata are necessary for plant cells as they allow exchange of gases with the atmosphere. Transpiration also occurs through the stomata.

Epidermis is usually one celled thick and is covered with a waterproof coating called cuticle.

Functions of epidermis

- It is a protective tissue of the plant body.
- It protects the plant against mechanical injury.
- It allows exchange of gases through the stomata.
- Cuticle helps to reduce evaporation of water.
- It prevents the plant from parasitic infection.

Cork

The outer protective layer or bark of a tree is known as cork. It is made up of dead cells.

How is cork formed?

When plants grow older, the outer protective layer undergoes changes and the secondary meristem replaces it. The cells on the outer layer are cut off from the secondary layer. This cut off layer forms the cork or the bark of a tree. The walls of the cork cells are thickened due to the deposition of suberin, which also imparts impermeability to the cork cells against water and gases.

Functions of cork

- It prevents loss of water by evaporation.
- It protects the plant against mechanical injury, temperature extremes, etc.

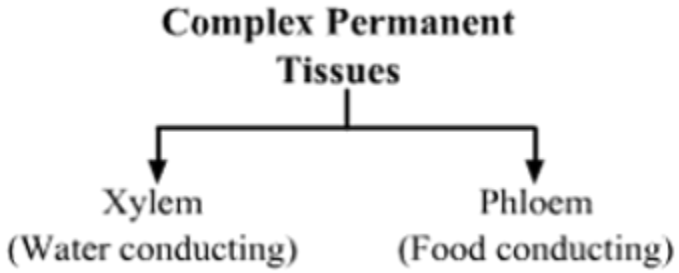
Complex Permanent Tissues

Complex permanent tissues are made up of more than one type of cells. All these cells work in a coordinated manner to perform one common function.

These tissues are conducting tissues that take part in the transport function of plants.

They are of two types—**xylem (**which transports water) and **phloem (**which transports food materials**).**

The presence of this vascular tissue is an important feature of all complex terrestrial plants.



Solved Examples

Medium

Example 1: **Give some points of difference between meristematic and permanent tissues.**

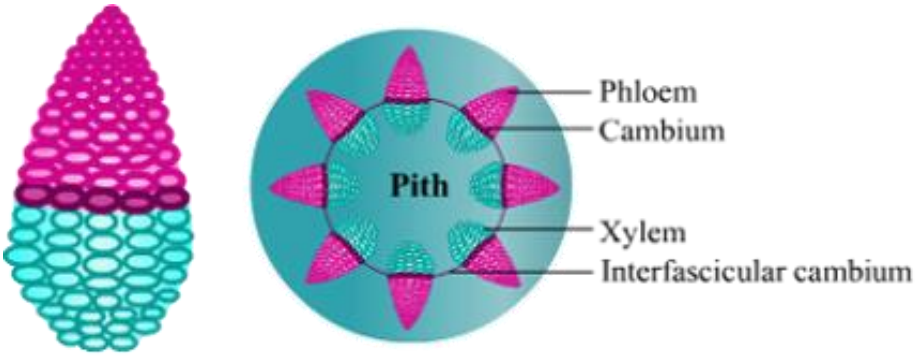
Solution:

Meristematic tissue	Permanent tissue
The cells of the tissue divide repeatedly.	The cells are formed from meristematic tissues and do not have the power of division.
The cells are always living.	The cells may be living or dead.
These cells usually do not contain vacuoles.	These cells contain a large centrally located vacuole.
It is restricted to certain parts of the plant body.	It is found throughout the plant body.
It is responsible for the growth of plant.	It performs functions such as storage,

	conduction, protection, photosynthesis, etc.

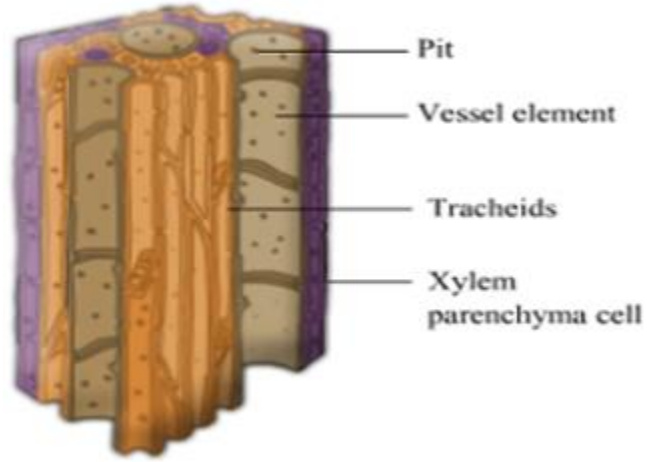
Types of Complex Permanent Tissues

Xylem



Xylem and phloem are conducting tissues and constitute a **vascular bundle**. Vascular or conductive tissue is a distinctive feature of complex plants. This tissue makes possible their survival in the terrestrial environment.

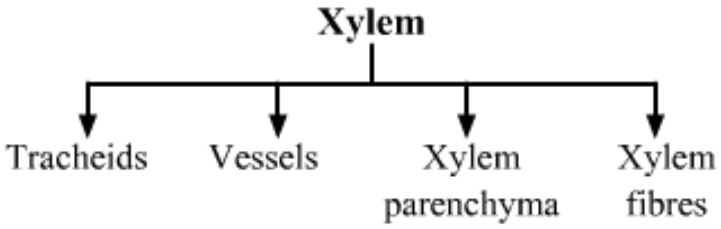
Xylem

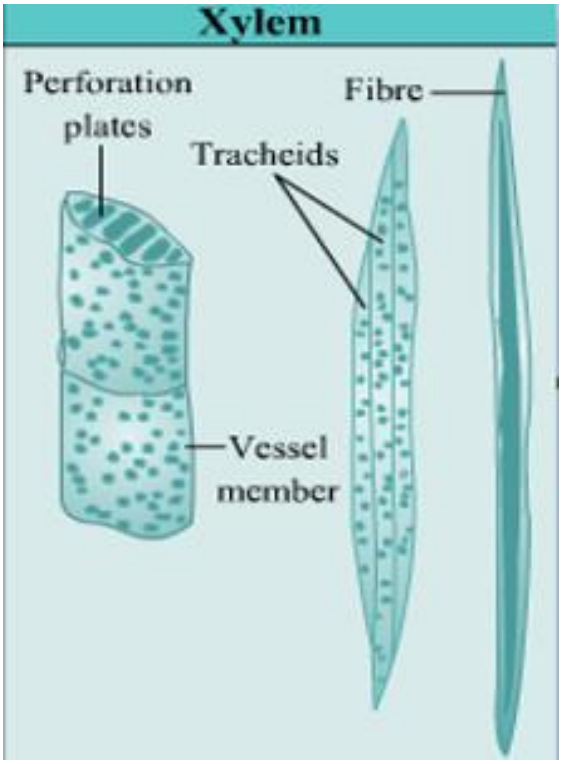


Xylem is mainly concerned with the conduction of water and minerals. It also provides mechanical support to a plant. It forms a continuous channel through the roots, stems, leaves and other aerial parts. The cells of xylem have thick walls, and many of them are dead cells.

Parts of Xylem

The different parts of xylem are as follows:





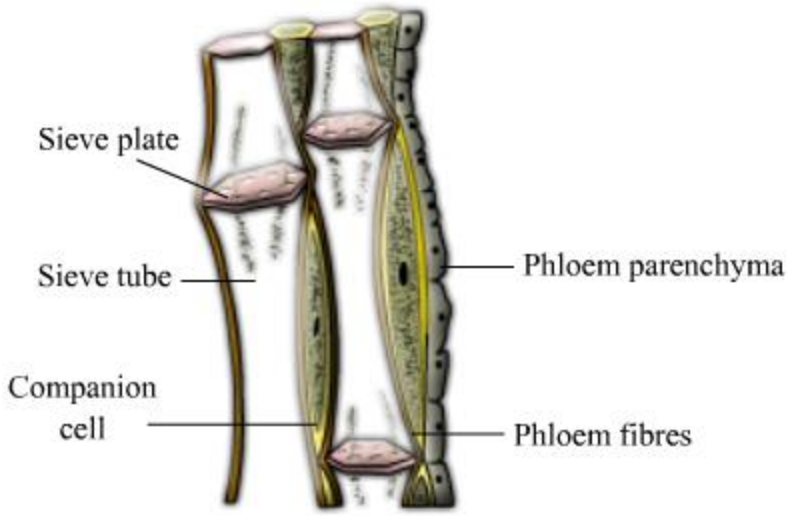
Functions of different parts of xylem are :

Tracheids and vessels allow the transport of water and minerals vertically.

Xylem parenchyma cells store food and help in the sideways conduction of water.

Xylem fibres are mainly supportive in function.

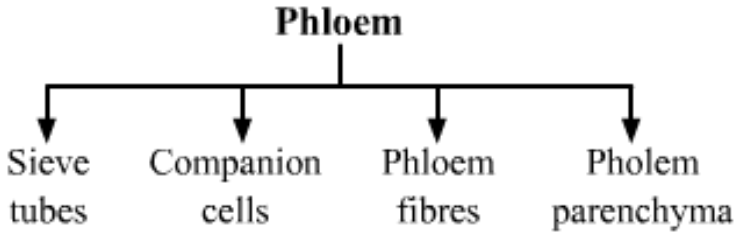
Phloem



Phloem is the chief food-conducting tissue of plants. It is responsible for the **translocation** of organic solutes. It is present in the innermost layer of the bark in a tree.

Parts of Phloem

The different parts of phloem are as follows:



Functions of different parts of phloem are :

- **Sieve tubes** are tubular cells with perforated walls.
- **Companion cells** are elongated cells that are always associated with sieve tubes. They helps to control the metabolic activities of sieve tubes.
- **Phloem parenchyma** cells are associated with the phloem tissue. They pack other types of cells together.
- **Phloem fibres** are non-living cells and are supportive in function.
- Sieve tubes and the companion cells are involved in the translocation of organic substances.

- **Phloem parenchyma and phloem fibres play only a supporting role in the process.**

Solved Examples

Medium

Example 1: **Give some points of difference between xylem and phloem.**

Solution:

Xylem	Phloem
It is composed of tracheids, vessel elements, xylem parenchyma and xylem fibres.	It is composed of sieve tubes, companion cells, phloem parenchyma and phloem fibres.
Most of the components of xylem tissue are dead (tracheids, vessels and fibres).	Most of the components of phloem tissue are living (companion cells, parenchyma and seive tubes).
It transports water and minerals from the roots to the aerial parts of a plant.	It transports food and nutrients from the leaves to the storage organs and the growing parts of a plant.
In its case, the movement of materials is unidirectional (i.e., from the roots to the other plant parts).	In its case, the movement of materials is bidirectional (i.e., both up and down the stems).
It also gives mechanical strength to a plant due to the presence of lignified cells.	It is made up of soft-walled cells; so, it does not provide mechanical strength.

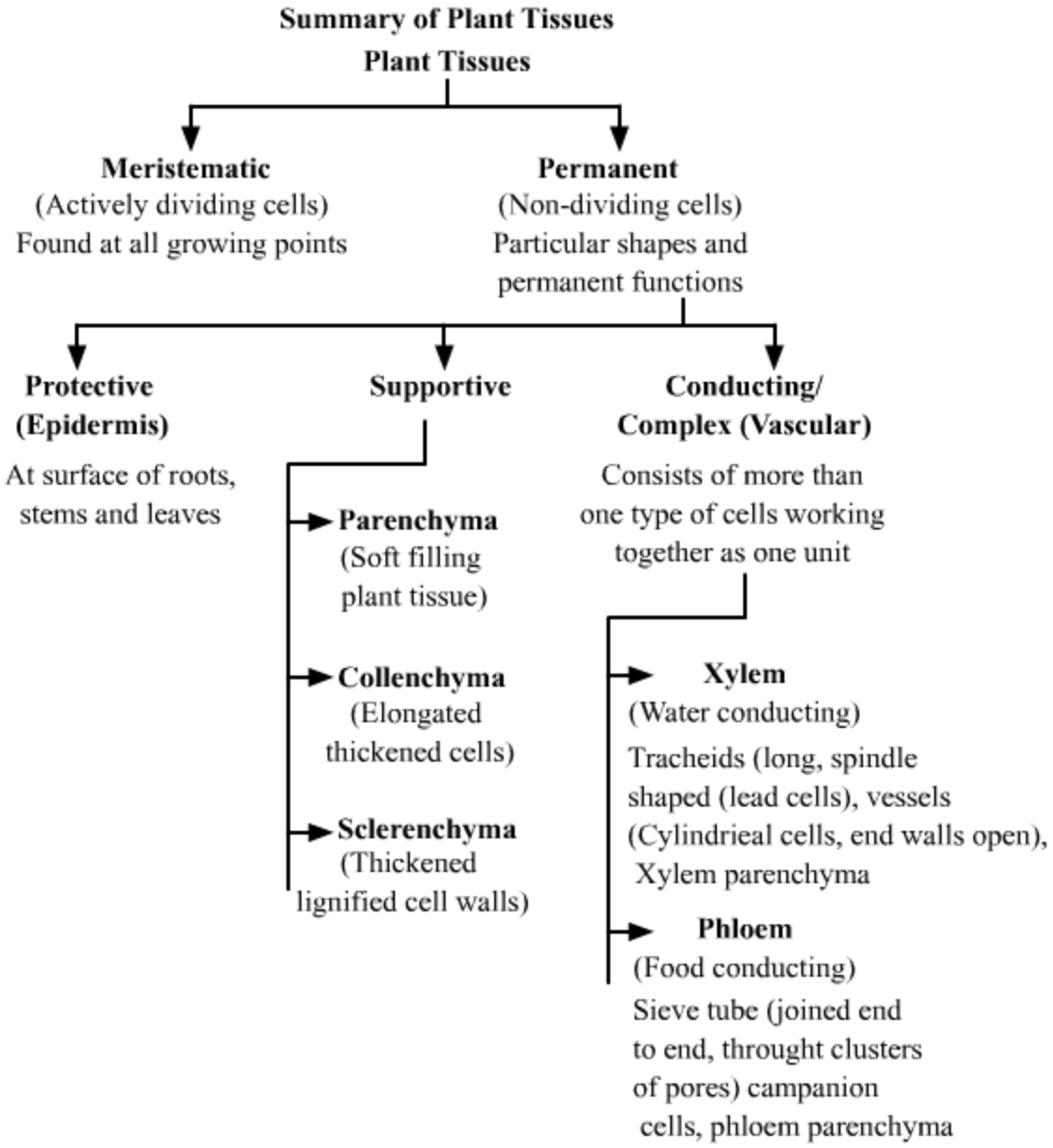
Did You Know?

Sieve tubes and the companion cells are called **essential elements**. This is because they are directly involved in the translocation of organic substances.

Phloem parenchyma and phloem fibres are called **associated elements** as they are not directly involved in this translocation.

Xylem

Different Types of Plant Tissues



Epithelial Tissues: An Overview

Epithelial Tissues

- They form barriers to keep the different body systems or different organ systems separate.
- The skin, the lining of the mouth, the lining of blood vessels, **lung alveoli** and **kidney tubules** are all made up of epithelial tissues.
- The cells of an epithelial tissue are tightly packed and form a continuous sheet.

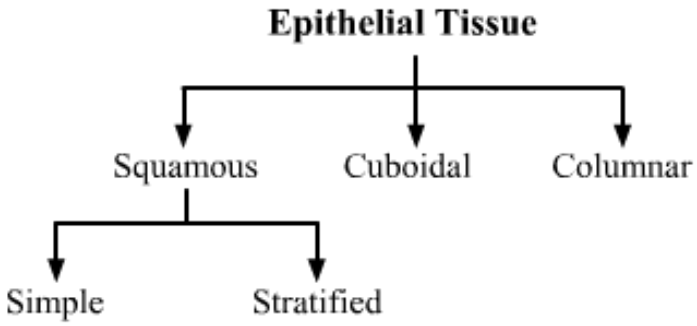
- The cells have only a small amount of cementing material between them and almost no intercellular spaces.
- The epithelium is usually separated from the underlying tissue by an **extracellular** fibrous **basement membrane**.
- Since the epithelium covers the body and all organs, all particles entering or leaving the body and the organs pass through it.
- Therefore, epithelial cells are an important media for the transportation of substances into and out of the body.

Did You Know?

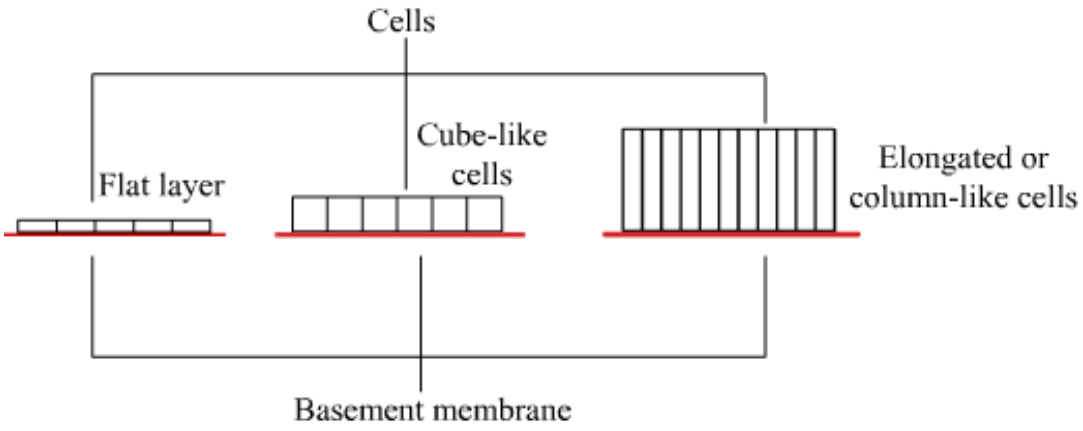
The muscles of the oesophagus contract in waves to push the food downward into the stomach. This means that even if you are standing upside down, the food will reach your stomach!!

Types of Epithelial Tissues

On the basis of shape and functionality, epithelial tissues are classified as squamous, cuboidal and columnar epithelium.



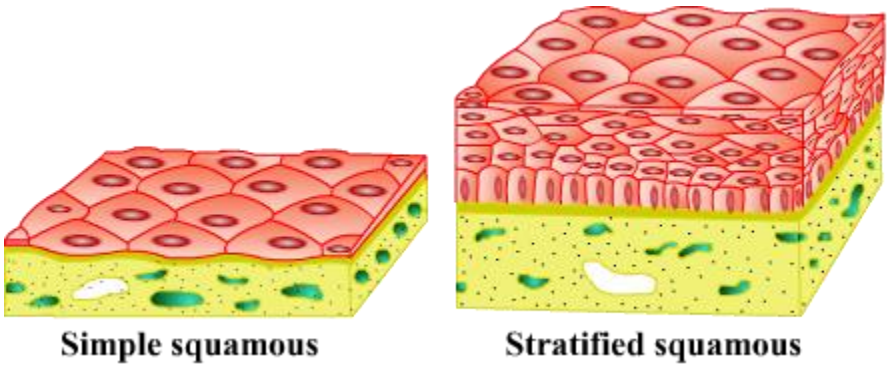
Epithelial cells can be flat (squamous), cube-shaped (cuboidal) or elongated (columnar).



Types of Epithelial Tissues

Squamous epithelium

- Simple squamous epithelium is a single layer of thin and flat cells.
- The cells are very thin with a delicate lining.
- Some examples of simple squamous epithelium are the lining of the mouth, oesophagus, lung alveoli and small blood vessels.
- The skin is also composed of simple squamous epithelium. Epithelial cells in the skin are arranged in many layers to prevent wear and tear. This type of multilayered epithelium is known as **stratified squamous epithelium**.

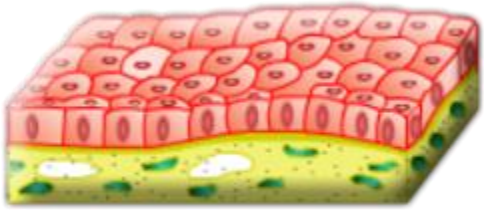


Types of Epithelial Tissues

Cuboidal epithelium

- Cuboidal epithelium consists of cube-like cells.
- These tissues are present in the lining of kidney tubules and ducts of salivary glands.

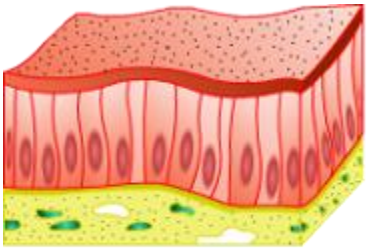
- Some special cuboidal cells form the surface of secretory glands and gland cells.



Cuboidal Epithelium

Columnar epithelium

- Columnar epithelium consists of elongated or column-like cells.
- These tissues are mainly found in the parts where absorption and secretion occur.
- Some examples of columnar epithelium are the inner linings of the intestine and stomach.

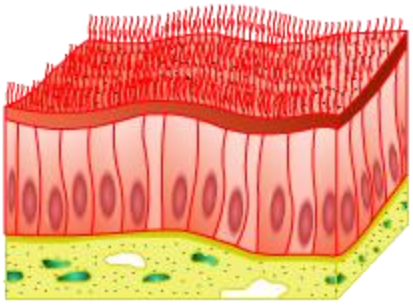


Columnar epithelium

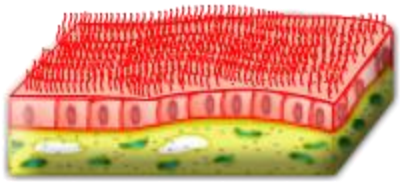
Types of Epithelial Tissues

Ciliated epithelium

- Ciliated epithelium consists of columnar/cuboidal cells that bear cilia on their surface.
- The cilia help in the movement of particles in a specific direction over the epithelium.
- This type of epithelium is present in the respiratory tract.



Ciliated columnar epithelium



Ciliated cuboidal epithelium

Glandular epithelium

- Glandular epithelium consists of columnar/cuboidal cells that have become specialised for secretion.
- When a portion of the epithelial tissue folds inward, glandular epithelium is formed.
- The function of glandular epithelium is to secrete chemicals, for example, the endocrine glands, which secrete hormones.

Solved Examples

Easy

Example1:

What are the different functions of epithelial tissues?

Solution:

Some important functions of epithelial tissues are as follows:

- Epithelial tissues are protective tissues of the animal body as they protect the underlying cells from injury, water loss, bacterial infection, etc.
- They form barriers to keep the different body systems separate.
- They regulate the exchange of materials between the different parts of the body, and also between the body and the external environment.

- They help in the absorption of various materials such as water and nutrients. For example, the lungs are lined with epithelial tissues and they help absorb oxygen.
- They also secrete chemicals, e.g., glandular epithelium.
- They allow the movement of particles in a particular direction, e.g., ciliated epithelium.

Medium

Example 2:

Why is there the need for different types of epithelial tissues?

Solution:

Different epithelial tissues have differing structures that correlate with their unique functions. So, for serving all the different functions, different types of epithelial tissues are required.

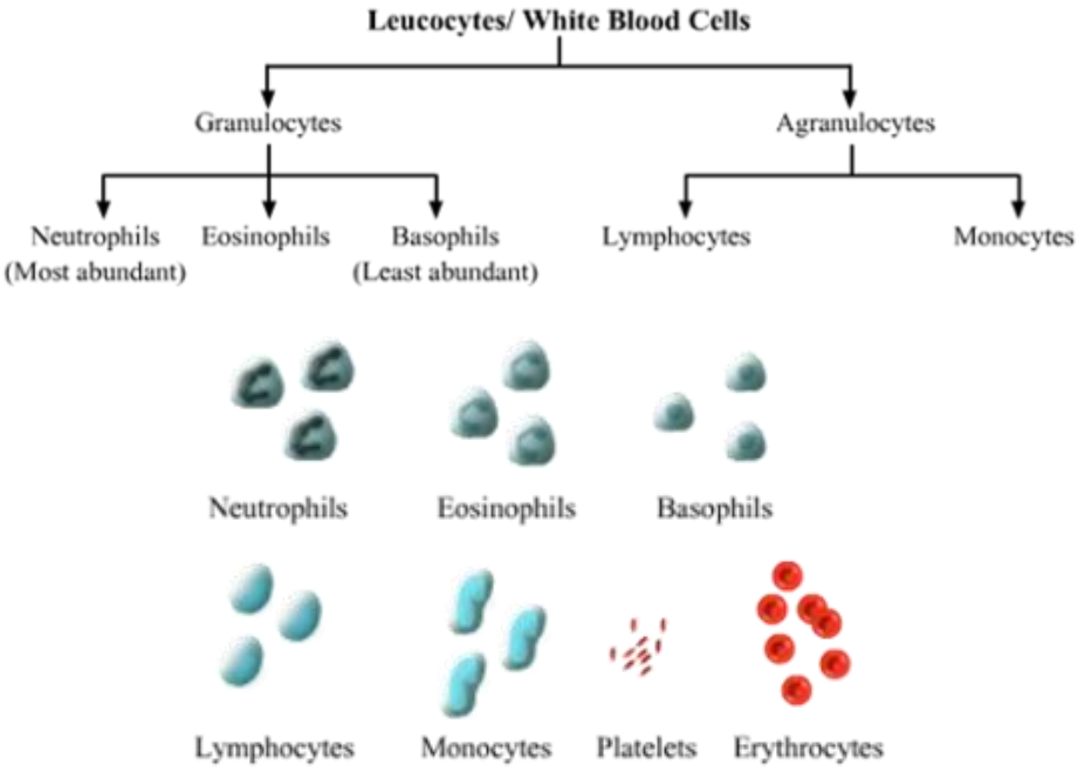
Connective Tissues

Did You Know?

Connective tissues are distributed throughout the body. They form sheaths around the organs. They constitute about thirty per cent of the total body weight. A connective tissue is basically composed of cells loosely packed in a **matrix**.

Components of Blood

- The human blood is a complex fluid connective tissue that has mainly two components— plasma and blood corpuscles.
- Plasma is a light yellowish viscous fluid. It contains about 92% water and about 7% proteins. The rest of it consists of organic and inorganic constituents like salts and **hormones**.
- Blood corpuscles make up around 45% of the total volume of blood. They mainly include **red blood cells** (erythrocytes), **white blood cells** (leukocytes) and **blood platelets**.
- Blood transports gases, digested food, hormones and waste materials to different parts of the body.



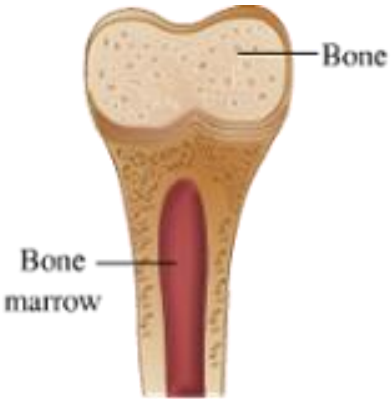
Other Connective Tissues

Can you suggest some more examples of connective tissues other than blood?

Here are some other connective tissues in our body.

- Bone
- Cartilage
- Ligaments
- Tendons
- Areolar connective tissue
- Adipose tissue
- Lymph

Let us learn about the above tissues in detail.

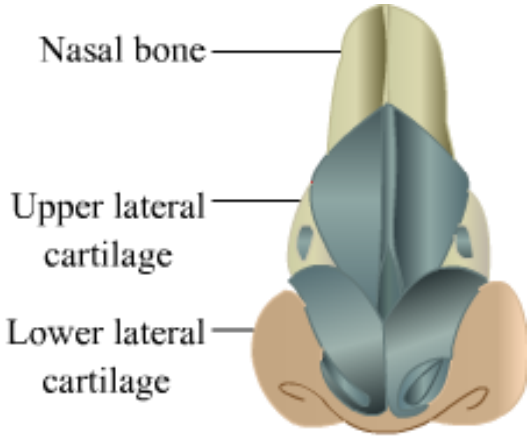


Bone

- Bone is a strong and non-flexible connective tissue. It forms the framework that supports the body.
- It also anchors the muscles and supports the main organs of the body. Bone cells are found embedded in a hard matrix composed of calcium and phosphorus compounds.

Other Connective Tissues

Cartilage



Cartilage in Nose

- Cartilage is a connective tissue that has widely spaced cells.
- The solid matrix of cartilage is composed of proteins and sugars.
- This tissue smoothens the bone surface at the joints and is present in the nose, ear, trachea and larynx.

Solved Examples

Medium

Example 1:

Differentiate between bone and cartilage.

Solution:

Bone	Cartilage
It is a strong and non-flexible connective tissue.	It is a flexible connective tissue.
It has a hard matrix made of proteins, calcium and phosphorus.	Its matrix is made of proteins and sugars.
It cannot be bent.	It can be bent.
Blood vessels are present in this tissue.	Blood vessels are absent from this tissue.
It provides shape and skeletal support to the body.	It provides support and flexibility to the body. It also smoothens bone surface at the joints.
It forms the skeleton.	It is found in the nose, ear, trachea and larynx.

Hard

Example 2:

Why is it not possible to fold our bones like cartilages?

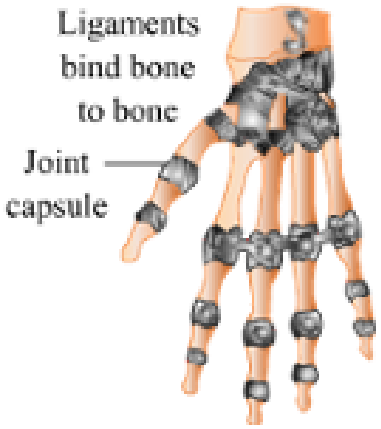
Solution:

Bone is a hard connective tissue in which the ground substance is very hard and contains calcium salts. On the other hand, cartilage is a firm and elastic skeletal connective tissue. Thus, while cartilages can be folded easily, bones cannot be folded at all.

Other Connective Tissues

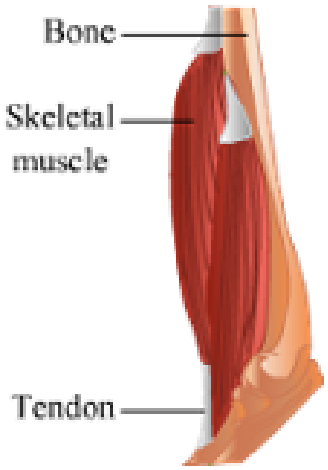
Ligaments

- Two bones are connected to each other by another type of connective tissue called ligament. These tissues are very elastic and strong.



Tendons

- Bones are connected to muscles by tendons; hence, they are placed under the category of connective tissues. Tendons are fibrous tissues with great strength but limited flexibility.



Solved Examples

Easy

Example 1:

Distinguish between ligament and tendon.

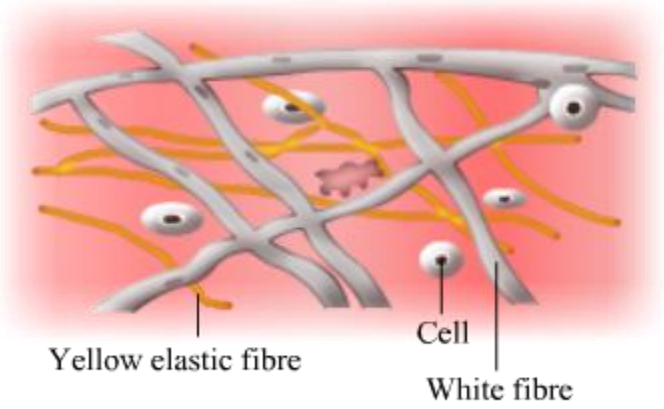
Solution:

Ligament	**Tendon**

It connects two bones.	It is a fibrous tissue that connects a muscle to a bone.
It is elastic and flexible.	It has great strength but limited flexibility.

Other Connective Tissues

Areolar connective tissue

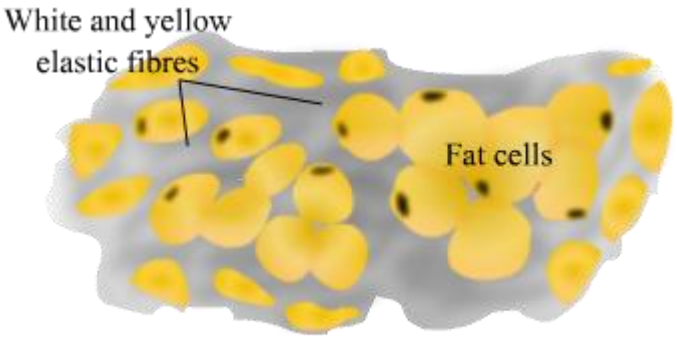


Areolar Connective Tissue

- Areolar connective tissue is found between the skin and muscles, around the blood vessels and nerves and in the bone marrow.
- It fills the space inside the organs and supports the internal organs.
- It also supports organs because of the presence of cells (**macrophages** and **mast cells**) which help repair tissues.

Other Connective Tissues

Adipose tissue

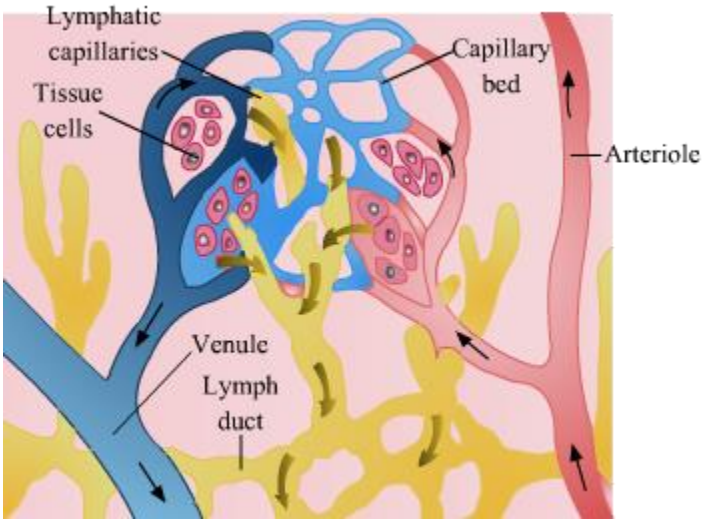


Adipose Tissue

- The tissue wherein fat is deposited as **fat globules** is known as adipose tissue.
- It is found below the skin and between the internal organs.
- The stored fat layer allows this tissue to act as an insulator and protect the body from cold.

Other Connective Tissues

Lymph



- Lymph is a transparent, light yellowish fluid located in the intercellular spaces of our body.
- It is part of the defensive mechanism of the body as it kills bacteria and other pathogens with the help of white blood cells.

- It also helps in carrying digested fats from the intestine. In this way, it moves to all parts of the body and, thus, connects every part of the body.

- It is similar to blood plasma in composition, except that it does not contain RBC's and has very little proteins.

Did You Know?

1. **While the human adult has 206 bones, babies are born with 300 bones.**

   The reason for this is that many bones in babies are composed of smaller component bones which later get fused to form individual bones, e.g., bones in the skull. The bones harden and fuse as a child grows.

2. **In the morning, we are about 1 cm taller than in the evening.**

   As the day passes, the cartilages between our bones get compressed due to standing, sitting and other activities. This compression in the cartilages makes us a little shorter by evening.

Muscular Tissues

What do you observe in the above two animations?

It is clear that the movements of two human organs are displayed—one is the heart and the other is the hand. Now, can you guess what makes these movements possible?

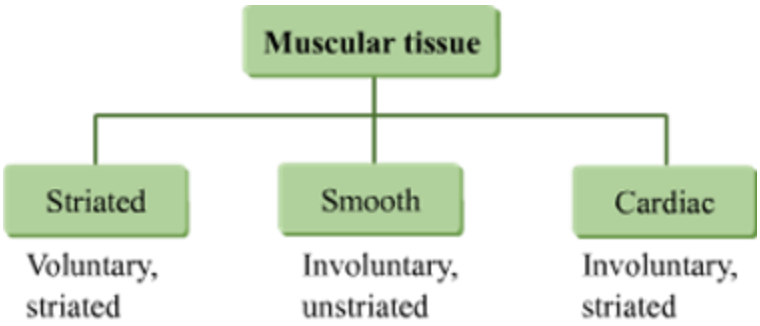
Muscles, made up of muscular tissues, make it possible for the different body parts to move.

Let us learn about muscular tissues in detail.

Types of Muscular Tissues

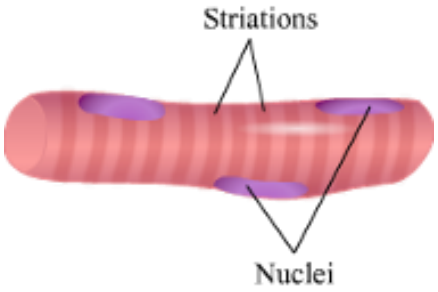
You have learnt in the previous lesson how the heart and hand have totally different tissues. This implies that the muscular tissues making up these organs must be of different types.

Muscular tissues can be classified into three categories, as is shown in the figure.



Striated Muscles

- Striated muscles are named so because they show alternate light and dark bands or **striations** when stained appropriately.
- They are also called **skeletal muscles** because they are found attached to the bones which form the skeleton.
- They are voluntary muscles because their movement is under our will.

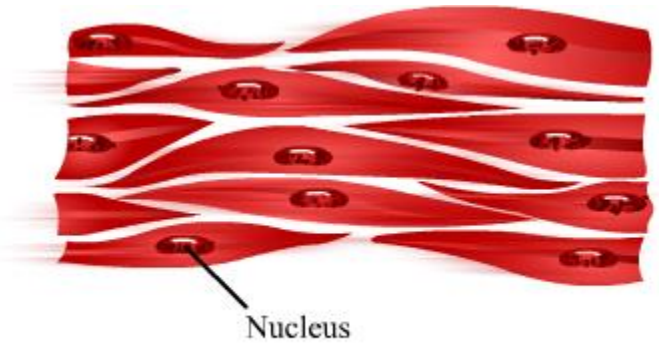


Structure: The cells of striated muscular tissues are long, cylindrical, unbranched and multinucleate (i.e., having many nuclei).

Location: Striated muscles are located in the body wall, tongue, limbs and pharynx.

Smooth Muscles

- Unstriated or smooth muscles are called so because they do not show any alternate light and dark bands (or striations) when stained.
- They are involuntary muscles as they are involved in involuntary actions of the body, i.e., the actions that we cannot control according to our will.



Smooth muscles

Structure: The cells of smooth muscular tissues are long with pointed ends (or spindle-shaped) and uninucleate (i.e., having a single nucleus).

Location: Smooth muscles are located in the alimentary canal, urinary bladder, blood vessels and ducts of glands.

Solved Examples

Medium

Example 1:

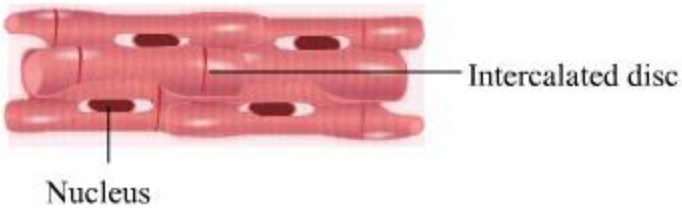
How do muscles cause movement?

Solution:

Muscles move by contracting and relaxing. They contain special proteins called contractile proteins. These contract and relax to induce movement.

Cardiac Muscles

- As the name clearly suggests, cardiac muscles are the muscles of the heart.
- They are striated, but involuntary in action. So, they resemble striated muscles structurally and smooth muscles functionally.
- They show **rhythmic** contraction and relaxation throughout life.



Cardiac muscles

Structure: The cells of cardiac muscular tissues are cylindrical, branched and uninucleate.

Location: Cardiac muscles are exclusively present in the heart. They control the rhythmic beating of the heart.

Did You Know?

1.All the muscle fibres of our body are present inside our body from the time of our birth. If due to any reason they get damaged, they cannot be replaced.

2. Tongue is the strongest muscle in the human body.

Neural Tissues

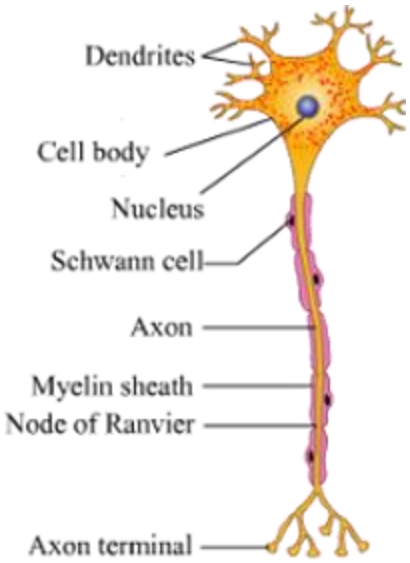
Nervous Tissues: Features

- Cells of the nervous tissues are highly specialized for becoming stimulated and then transmitting the **stimulus** very rapidly from one place to another within the body.
- The cells of these tissues are called **nerve cells or neurons**.
- They are present in the brain, spinal cord and nerves.
- The neurons act as postmen in the body, delivering messages accurately; the brain acts as the post office where all messages are collected, and which controls how the messages are delivered.
- Neurons are responsible for both collecting and delivering messages in our body.

Function:

The most important function of the nervous tissues is to control all the body activities by coordinating with the different body parts.

Neurons



The fundamental unit of the nervous system is the nerve cell. Let us learn more about it.

- **A neuron** consists of a **cell body** and an **axon**.
- The cell body or cyton contains a nucleus and cytoplasm.
- The axon elongates from the cell body and branches into many dendrites.
- Several nerve fibres with connective tissues form a **nerve.**

Dendrite:It receives information from the axon of an adjacent neuron and conducts it toward the cell body.

Axon: It conducts messages away from the cell body.

Cell body: It contains a nucleus, mitochondria and other organelles. It is concerned with the maintenance and growth of the cell.

Whiz Kid

Glial cells are non-conducting supportive cells of the nervous system. They provide nutritional support and insulation to the neurons present in the central and autonomous nervous systems.

There is an insulated sheath that surrounds the axon of a neuron. This is called myelin sheath. It consists of fat-containing cells called **Schwann cells** and helps in the fast transmission of nerve impulses.

The myelin sheath is not continuous over the axon and has some gaps exposing the axon. A gap between two adjacent myelin sheaths is called **node of Ranvier**.

Parts of a Neuron

Did You Know?

- An individual nerve cell may be up to a metre long.
- Signals are transmitted through a neuron at a velocity of 1.2 miles/hour to 250 miles/hour.
- There are as many neurons in the human brain as there are stars in the Milky Way, i.e., around hundred billion.
- The number of ways in which information travels in the human brain is greater than the number of stars in the universe

Solved Examples

Easy

Example 1:

Where is the nucleus located in a neuron—in the axon, cyton or dendrite?

Solution:

In a nerve cell, the nucleus is located in cytoplasm of the cell body or cyton. Cell organelles like mitochondria and Golgi bodies are also present in the cytoplasm.

Hard

Example 2:

How are two neurons connected to each other?

Solution:

The axon endings of one nerve cell are loosely placed on the cell body or cyton of another nerve cell, thereby forming a loose connection called **synapse**. Electric signals are transmitted from one neuron to the next across such synapses through the release of chemicals called **neurotransmitters**.

A released neurotransmitter crosses a synapse and starts a similar electrical impulse in the dendrite of the adjacent neuron. In this way, impulses are transmitted from one neuron to another and, ultimately, to the brain.

Nerves

A nerve is made up of a bundle of axons/nerve fibres which are enclosed in a tubular medullary sheath. This sheath prevents the mixing of impulses in the adjacent fibres.

They are of three types:

Sensory nerves: They bring impulses from the sense organs to the brain or the spinal cord, for example, auditory nerve of the ear.

Motor nerves: They carry impulses from brain/spinal cord to the muscles or glands, for example, nerves to the muscle of eyes.

Mixed nerves: They carry both sensory and motor signals.