Ratna Sagar

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Rama Sagar
Education, Our Mission!

Revised and Updated

LIVING SCIENCE BIOLOGY

D K Rao • J J Kaur

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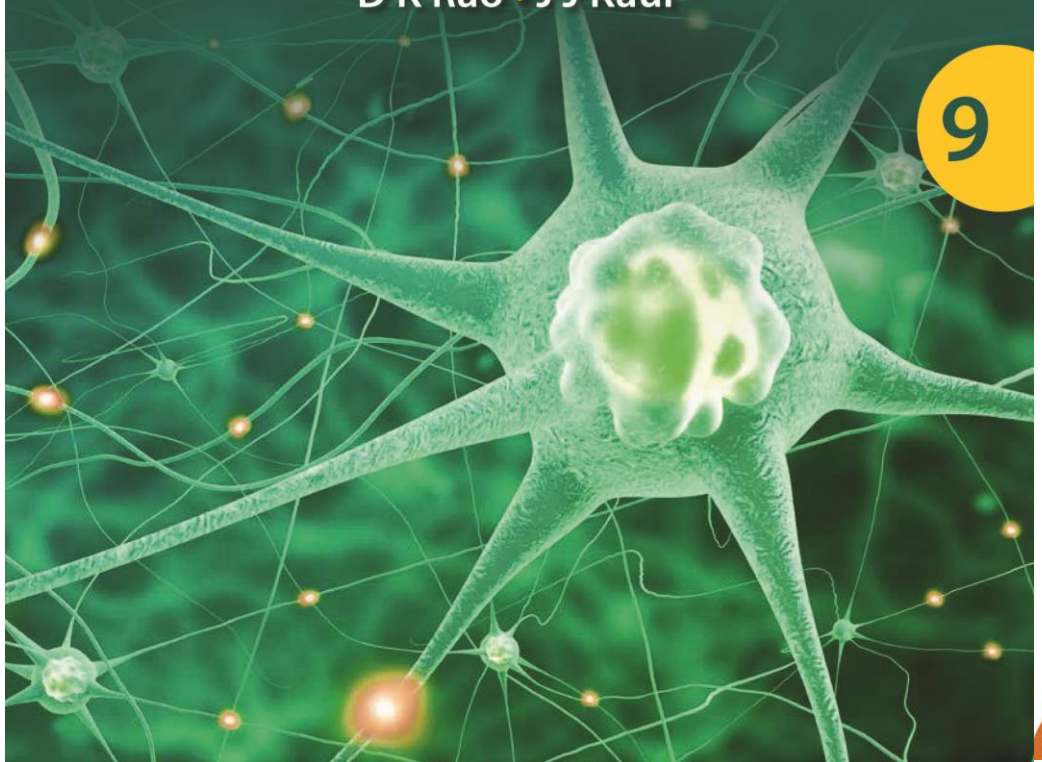


ICSE
Living Science
Biology

Class 9

Chapter 2 Tissues – The Building Blocks of Life

LEARNING OBJECTIVES

Plant tissues

- Meristematic tissue
- Permanent tissue

Animal tissues

- Epithelial tissue
- Muscular tissue
- Connective tissue
- Nervous tissue

What are tissues?

The cells having a similar role form a unit called **tissue**. Various tissues of an organism work in coordination with each other to perform life processes. **Tissues are a group of similar cells performing the same function and having a common origin.** The study of tissues and their functions is known as **histology**

Plant tissues

Plant tissues are divided into following two types on the basis of their stage of development and dividing capacity.

1. Meristematic tissue **2.** Permanent tissue

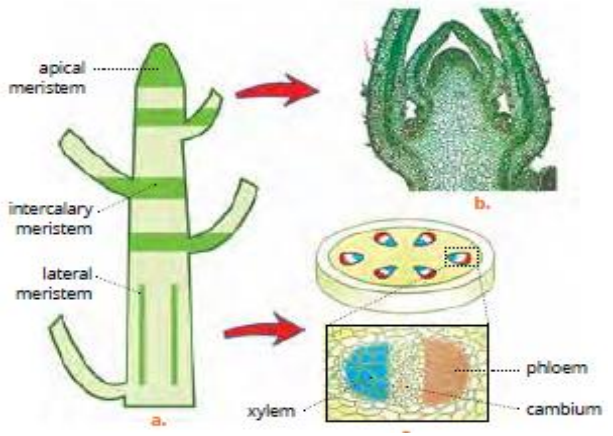
Meristematic tissue

A meristematic tissue is a group of young cells that have the capacity of active cell division. This tissue is found in all the growing parts of a plant, such as root tip and shoot tip.

Types of meristems

According to their positions in the plant body, meristems are categorized into three types:

1. Apical meristem **2.** Intercalary meristem **3.** Lateral meristem



a. Location of different types of meristematic tissues **b.** Apical meristematic tissue **c.** Lateral meristematic tissue

Apical meristem

It is located at the growing tips (apices) of stem, roots and their branches, in the growing young leaves and also on the tip of axillary buds. Due to the growth of apical meristems, there is increase in the length of stems and roots.

Intercalary meristem

Intercalary meristems help in elongation of the organs and are present mostly at the base of nodes, internodes and leaves.

Lateral meristem (Cambium)

Lateral meristem occurs on the sides of roots and stems and is **responsible for increase in the diameter (girth) of the plant** roots and stem. These tissues are also **responsible for growth in thickness by the addition of secondary tissue** and this phenomenon is called **secondary growth**.

Permanent tissue

A permanent tissue is made up of cells which have lost their ability to multiply and in which growth has either stopped completely or for the time being. These cells may be dead or living. On the basis of functions performed, the permanent tissues can be **1.** supporting, **2.** conducting, and **3.** protective. On the basis of composition, permanent tissues can be simple or complex.

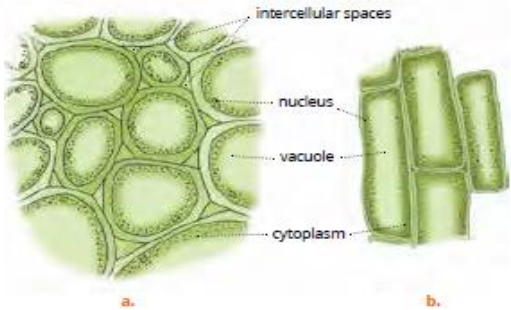
Supporting tissue (Simple permanent tissue)

There are three types of supporting tissues in plants:
1. Parenchyma, **2.** Collenchyma, and **3.** Sclerenchyma.

Parenchyma

It **stores food material** as in potato, sweet potato, etc.

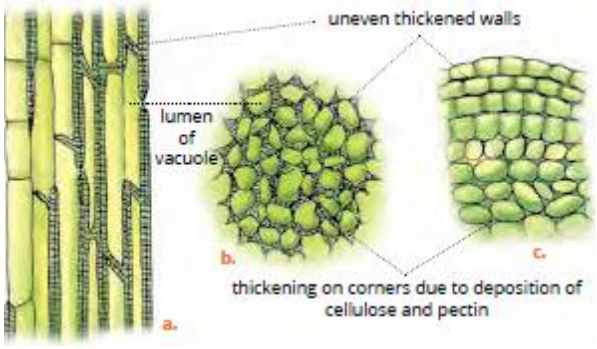
❖ It provides temporary support to the plants by keeping the cells rigid.
❖ Parenchyma cells form the **basic packing tissue** and protect the internal tissues.



❖ In the leaves of green plants, parenchyma tissue contains chloroplasts, and is called **chlorenchyma**. Chlorenchyma, thus, helps in photosynthesis.
❖ In many aquatic plants, parenchyma cells have well-developed air spaces and the tissue is known as **aerenchyma**. In hydrophytes, aerenchyma helps to keep up buoyancy.

Collenchyma

❖ It supports parts of the plant by providing tensile strength and rigidity due to thickening of the walls.
❖ It **provides elasticity to the plant**.

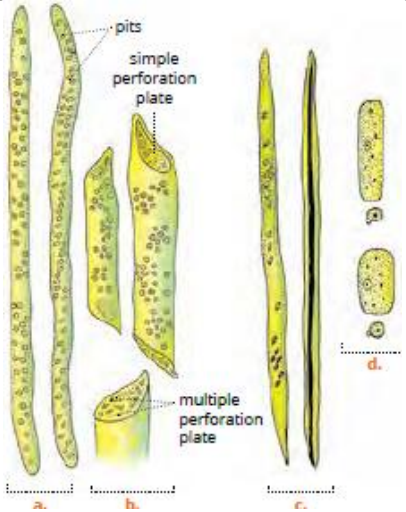


Sclerenchyma

❖ Sclerenchyma **provides mechanical strength to the plant parts**.
❖ It **protects the plant from environmental forces** like strong winds.
❖ It makes plant hard and stiff. The husk of coconut is made up of sclerenchyma tissue.

Conducting tissue (Complex permanent tissue)

Complex tissues are made up of more than one type of cells which work in close coordination to perform a common function. These tissues, also called vascular tissues, provide a channel for movement of water and dissolved minerals up and down the plant. The main complex tissues in vascular plants are **xylem** and **phloem**.



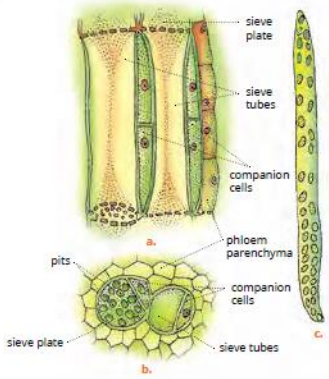
Xylem

Xylem is a complex tissue. It forms a part of the vascular bundle. It is mainly concerned with the **conduction of water and minerals**. It also provides mechanical support to the plant. Xylem consists of four types of cells – vessels, tracheids, xylem fibres and xylem parenchyma.

Phloem

Phloem is the chief **food-conducting tissue of plants**. Unlike xylem, materials can move in both directions in phloem. It is responsible for downward (also upward) movement of food prepared in leaves to other parts of the plant. The basic components of phloem are – sieve tubes, companion cells, phloem parenchyma and phloem fibres. Except phloem fibres which are dead, all other members of the phloem tissue are living.

Phloem fibres are dead sclerenchyma fibres. They provide mechanical strength. The textile fibres of flax, hemp and jute are phloem fibres. Xylem and phloem together form vascular bundle. For example veins, which are in continuity with conducting tissue of stem and roots.



Animal tissues

Four major types of tissues are found in animals. They are:
1. Epithelial tissue **2.** Muscular tissue **3.** Connective tissue **4.** Nervous tissue

Epithelial tissue

An epithelium is a tissue composed of one or more layers of thin, protective, continuous sheet of cells covering the external surface of body and internal body organs.

Characteristics of epithelial tissue

❖ The cells of epithelium are closely-placed and form continuous sheets, having no space between them.
❖ Blood vessels are absent in the epithelial tissue.

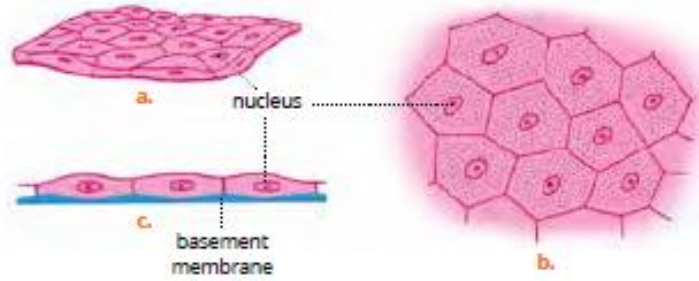
Types of epithelium

Based on the structure and organization of the cells, the epithelial tissue is classified into five types as follows:

1. Squamous epithelium **2.** Cuboidal epithelium **3.** Columnar epithelium
4. Stratified epithelium **5.** Glandular epithelium

Squamous epithelium

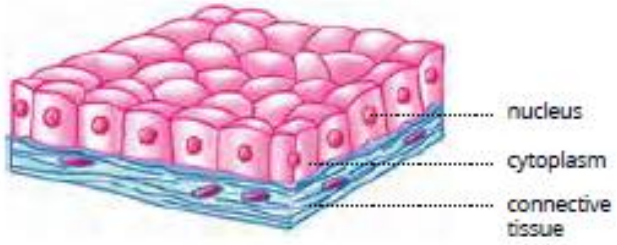
It is formed by flattened, polygonal cells which are closely fitted together like tiles in a mosaic floor. It protects the underlying parts from mechanical injury, germs and drying up.

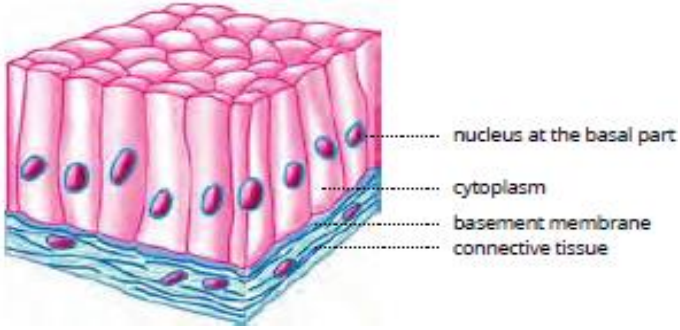


Squamous epithelium; **a.** layer **b.** surface view **c.** vertical section

Cuboidal epithelium

It is made up of cuboidal cells, which are more or less square-shaped, that are of equal height and width. In the surface view, they look polygonal in shape. The nuclei are round in shape and lie in the centre of the cells.

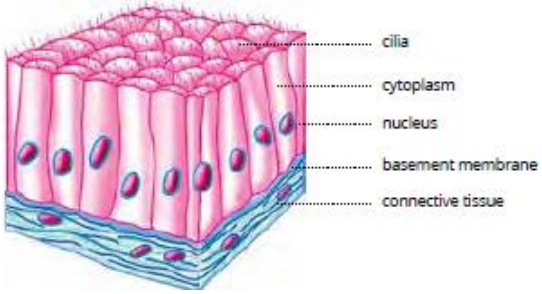


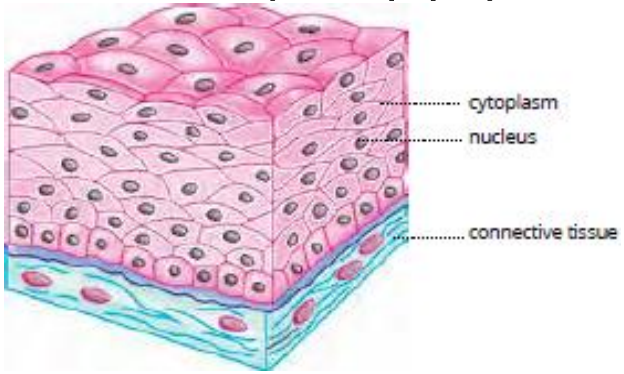


Columnar epithelium

Columnar means pillar-like. It is formed of tall pillar-like or brick-like cylindrical cells, lying side by side. The cells are much taller than they are wide. Their nuclei lie in the basal part .

Columnar ciliated epithelium: It consists of columnar cells with cilia on their free surface which keeps lashing and moving the material entering the organs . It lines the trachea (windpipe).



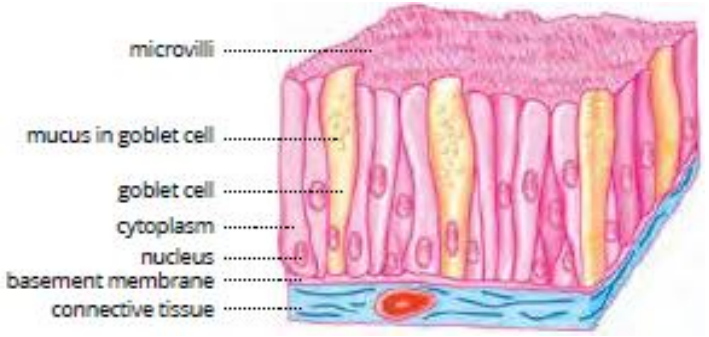


Stratified epithelium

It consists of epithelial cells arranged in several layers or strata of similar or different kinds of epithelial cells. It is found in skin and the cornea

Glandular epithelium

It contains some large sized cells which secrete mucus. These cells are found in the mucous membranes of stomach, intestine and rectum. The glandular epithelium is also folded inward to form tubular hollow glands such as sweat glands, tear glands and the liver



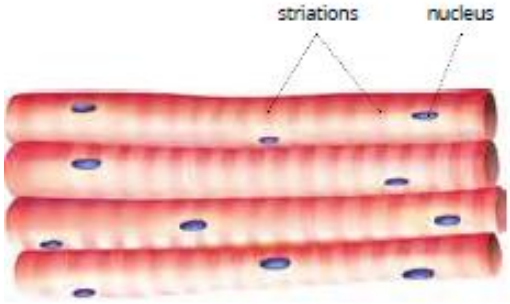
Muscular tissue

The muscle tissue consists of long, narrow cells called **muscle fibres**. The adjacent muscle fibres are held together by connective tissue.

Types of muscular tissue

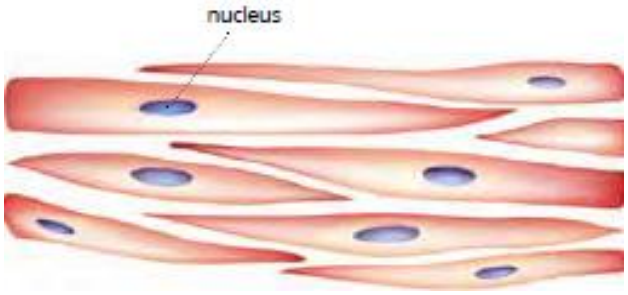
In human beings, three types of muscles are present.

1. Striated muscles (voluntary muscles) **2.** Unstriated muscles (involuntary muscles) **3.** Cardiac muscles



Striated muscles

These muscles are also called **skeletal muscles** as these are attached to bones. Their movement is under our will, hence they are called **voluntary muscles**.

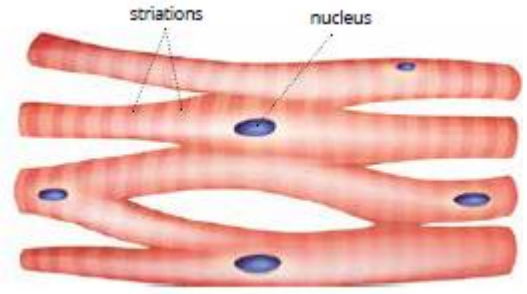


Unstriated muscles

These muscles are also called **smooth muscles** as they lack transverse striations or bands. Their movement is not under our will and hence these are called **involuntary muscles**.

Cardiac muscles

These muscles are exclusively present in the heart. These muscles are involuntary and work rhythmically tirelessly, contracting and relaxing endlessly from early embryonic stage until death. These muscles are cylindrical, striated and short. Cardiac muscles are **branched**.



Connective tissue

Connective tissue is a binding and supporting tissue. It is distributed throughout the body and forms about 30% of the body weight. Cells of connective tissue are loosely packed. It is non-living and also called packing tissue.

Functions of connective tissue

- ❖ It binds one another, for example, muscles with skin, muscles with bones.
- ❖ It forms a supporting framework of cartilage and bones in the body.
- ❖ It forms a protective sheath around delicate organs such as spleen, kidneys, testes, etc.

Types of connective tissue

The major connective tissues in the human body are:

1. Connective tissue proper **2.** Supportive connective tissue **3.** Fluid connective tissue (blood and lymph)

Connective tissue proper

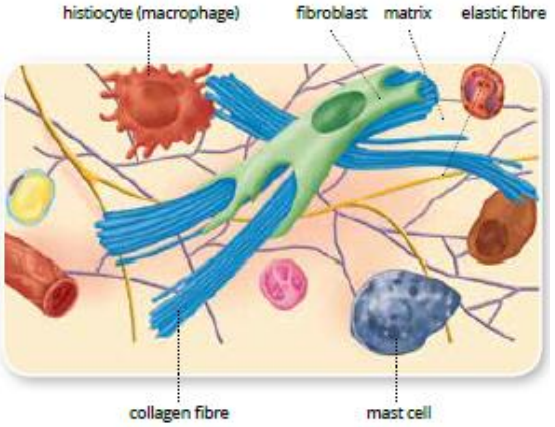
It helps in packing and binding the organs. It is of three types:

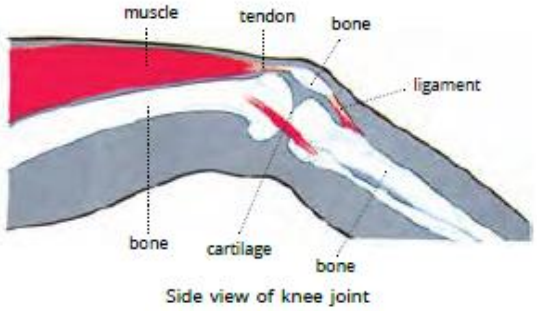
Areolar connective tissue: It is most widely distributed connective tissue. It is found beneath the epidermis of skin .

Functions

❖ Areolar connective tissue binds the skin with muscles, attaches blood vessels and nerves to the surrounding tissues.

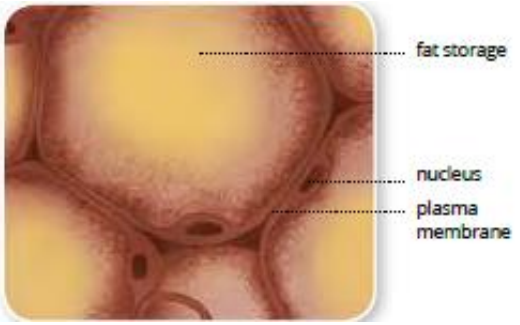
❖ It **makes the skin elastic to withstand stretching**.





Side view of knee joint

Fibrous connective tissue (Tendons and ligaments): It consists of fibre forming cells – tendons and ligaments. Tendons are tough and inelastic. They connect muscles with bones . Ligaments are elastic due to the presence of yellow elastic fibres in matrix, and connect one bone with another bone.

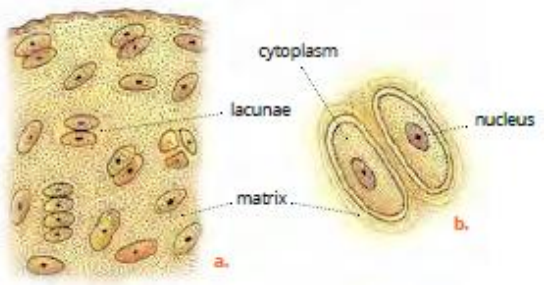


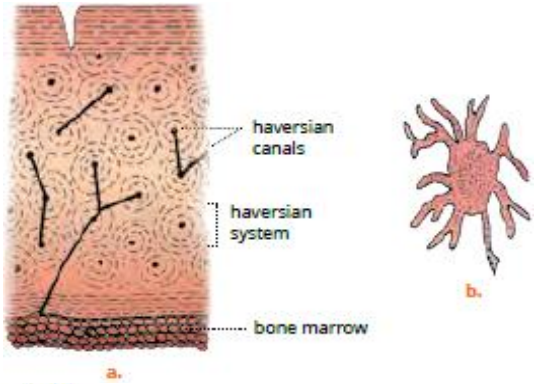
Adipose (fat) tissue: Adipose tissue acts as a padding under the skin which acts as an insulation for retaining body heat

Supportive connective tissue – cartilage and bone
It forms the internal supportive framework of body.

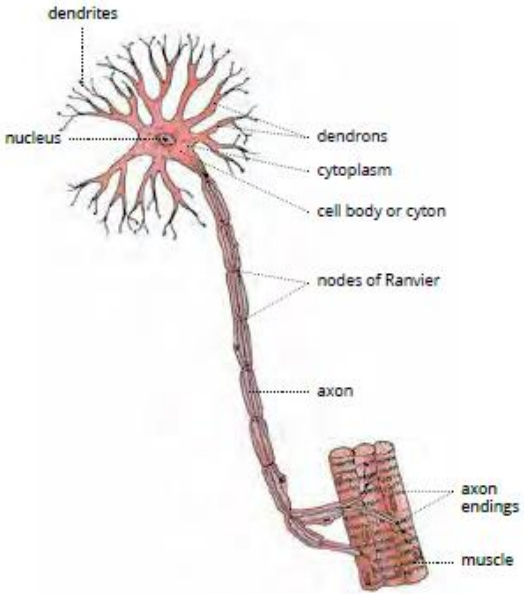
Cartilage: Cartilage is a non-porous tissue and consists of matrix. It has no nerves or histiocyte (macrophage) fibroblast matrix elastic fibre.

blood vessels. Cartilage cells, called **chondrocytes**, are present in fluid-filled spaces called **lacunae**. Cartilage is semi-transparent and elastic. Cartilage is present in the larynx, trachea, at the end of bones, nasal septum, and in-between ribs and sternum.





Bone: Bone is a rigid and hard porous tissue. The bone cells are called **osteocytes**. These are star-shaped. Each cell is enclosed in a small cavity called the **lacuna**. It has a good supply of blood vessels and nerves and consists of inorganic salts and living cells



Nervous tissue

Nervous tissue consists of nerve cells or **neurons**. A bundle of nerve cells form nerves. A neuron or nerve cell is a **structural and functional unit of the nervous system** . A typical nerve cell consists of:

❖ Cell body or cyton ❖ Axon ❖ Dendrons and dendrites

Cell body or **cyton** has a prominent nucleus and cytoplasm.

SUMMARY...

- Group of one type of cells working together as a unit and having a common origin and function is called a tissue.
- Meristematic tissue is dividing tissue present in the growing regions of plants such as root and stem tips.
- According to their positions in plants, meristems are divided into apical meristem, intercalary meristem, and lateral meristem.
- A permanent tissue is one in which growth is either stopped completely or for the time being. They are classified as simple and complex tissues.
- Parenchyma, collenchyma and sclerenchyma are three types of simple permanent tissues whereas xylem and phloem are complex permanent tissues.
- Xylem is a complex plant tissue. Its components are vessels, tracheids, xylem fibres and xylem parenchyma. Only xylem parenchyma is the living component.
- Phloem is a chief food-conducting tissue of a plant. Its components are sieve tubes, companion cells, phloem parenchyma and phloem fibres. Except phloem fibres, all other components are living.
- Epidermis and cork are the protective tissues in plants.
- In epithelial tissue, cells are closely placed and form a continuous sheet.

❖ The muscular tissue consists of long narrow cells, called muscle fibres, held together by connective tissue.

❖ Striated muscles are voluntary muscles. Their movement is under our will and show characteristic alternating light and dark bands.

❖ Smooth muscles and cardiac muscles are involuntary. Their movement is not under our will.

❖ Connective tissue is a binding and supporting tissue. It forms about 30% of the body weight.

❖ Cartilage cells are present in fluid-filled spaces called lacunae.

❖ Bone cells are star-shaped and are called osteocytes. In mammalian bone, the bone cells are present in concentric rings around the Haversian canals.

❖ Blood and lymph are liquid connective tissue, they flow to all body parts, hence these are called connective tissues.

❖ Blood is red in colour as it has RBCs in it, lymph is pale yellowish in colour as it lacks RBCs.

❖ Nervous tissue consists of nerve cells. Each nerve cell consists of a cell body or cyton, an axon, and dendrons and dendrites.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