Biology

Class - IX

Chapter - Tissues (NOTES)

Tissue: A group of cells that are similar in structure and/or work together to achieve a particular function forms a tissue.

I. Plant tissues Plant tissues are of two types Meristematic and Permanent tissues

Meristematic Tissue These are simple living tissues having thin walled compactly arranged immature cells which are capable of division and formation of new cells.

Features of meristematic tissues:

- Thin primary cell wall
- Intercellular spaces are absent (compact tissue)
- Generally vacuoles are absent, dense cytoplasm and prominent nuclei are present
- Large numbers of cell Organelles are present.
- Actively dividing cells are present in growing regions of plants. Ex. root and shoot tips.

on the basis of their position in the plant body, meristematic tissue are of three types - apical, lateral and intercalary

Apical meristem - Apical meristem is present at the tips of roots, shoots, branches and leaves. They form growing parts at the apices of roots and stems are are responsible for increase in length, also called primary growth

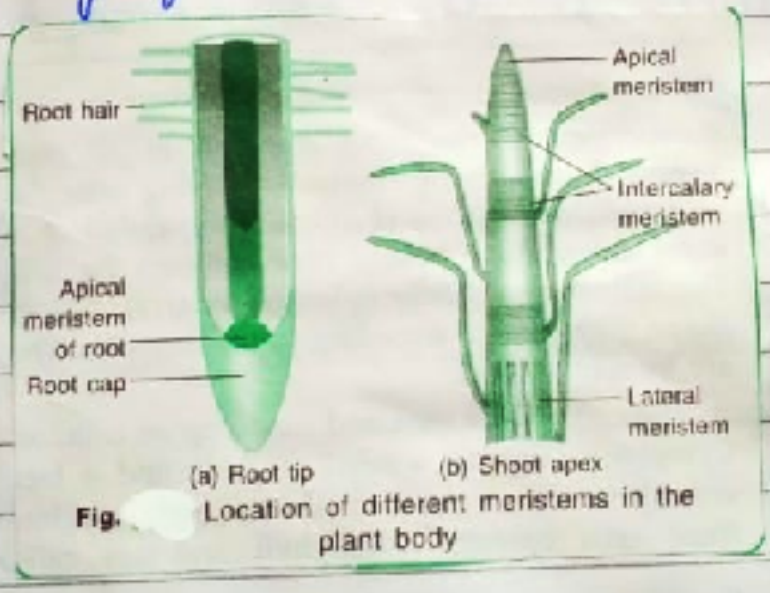

Fig. Location of different meristems in the plant body

Lateral meristem - Lateral meristem is present along the lateral side of the stems and roots. They divide only in a radial direction cork cambium, which lies beneath the bark and primary cambium, lying in between xylem and phloem in a dicot stem, are examples of lateral meristem. Lateral meristems are responsible for

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secondary growth. i.e. the growth in thickness of stem and root.

Intercalary meristem - Intercalary meristem is present between the permanent tissues of the plant. They may be present at the base of internodes. e.g grasses and wheat, at the base of the nodes, e.g mint plant, or at the base of leaves e.g. Pinus. The activity of these meristems results in the elongation of the part of the plant where they are present.

Permanent Tissue - A permanent tissue is a group of cells which are derived from meristematic tissues but have lost the power of division. They have a definite shape, size and function. Permanent tissues are of two types - Simple permanent tissues and complex permanent tissues.

Simple permanent tissue - Simple permanent tissues are of three types: parenchyma, collenchyma and sclerenchyma.

1 Parenchyma -

- Parenchyma is the most common of all plant tissue.
- Parenchyma first time evolved in bryophyte.
- Thin walled cells, Oval or Spherical in structure
- cell wall mainly composed of cellulose and pectin
- cytoplasm contains a small nucleus and a large central vacuole.
- In leaves and other green regions, these cells contain chlorophyll are called Chlorenchyma.

Place of occurrence: This tissue is present in all the Organs of the plants. i.e. roots, stems, leaves, flowers, fruits and seeds.

Function of parenchyma:

- The main function of parenchymatous tissue is storage of food, e.g. Starch in the parenchyma of cortex of potato tuber.
- In fleshy stems and leaves, parenchyma cells serve as water storage tissue e.g Euphorbia, Opuntia
- Parenchyma serves as packing tissue to fill the spaces between other tissues.

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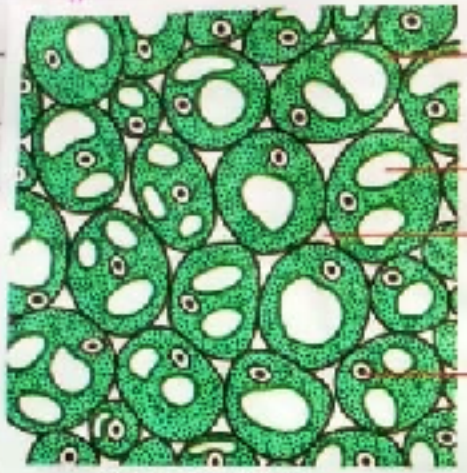
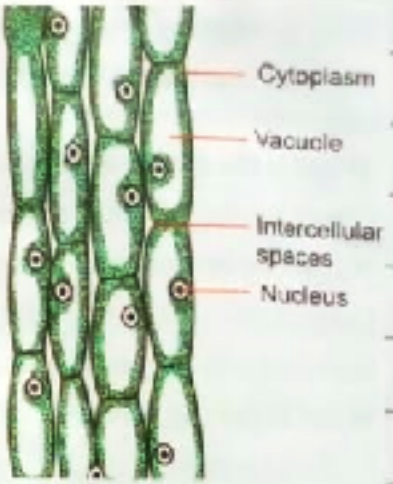
- Parenchymatous tissue stores waste materials of plants such as gum, resin tannin etc
- The intercellular air spaces of parenchy cells allow gaseous exchange.



Transverse section



Longitudinal Section

Parenchyma Tissue

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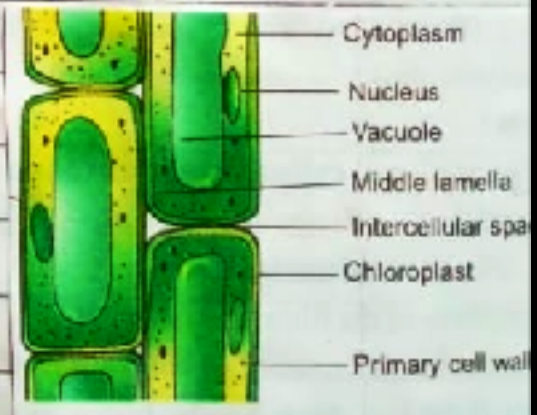

Longitudinal section of collenchyma tissu

Collenchyma Tissue

II collenchyma :

collenchyma is the living mechanical tissue.
The cells are relatively longer than wide.
The cell wall at the corner of the cells thickens due to the disposition of cellulose and pectin.

Place of occurrence: collenchyma is usually found in 3-4 layers beneath the epidermis in stems, petioles and leaves of dicot plants. It is usually absent in monocot stems, roots and leaves.

Functions of collenchyma:

- It provides mechanical support, protection and elasticity to the plant organs
- Due to its peripheral position in stem, it helps leaves in bending and pulling due to action of wind.
- chloroplast containing collenchyma cells are responsible for photosynthesis and manufacture sugar and starch.

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III Sclerenchyma :-

The cells of sclerenchymatous tissue are thick walled due to deposition of lignin along the cell wall. Such cell walls are called lignified. On maturity, the cells of sclerenchyma die and have no protoplasmic contents. There are two types of sclerenchymatous cells: fibres and sclereids.

(i) Fibres :

The fibre cells of sclerenchyma are elongated, narrow, tapering at both ends with lignified cell wall.

Place of occurence: They are found in the cortex and vascular tissue of roots, stems and leaves.

Functions of fibres:

- The main function is to provide mechanical support to the plant.
- They help in conduction when present in the secondary xylem.

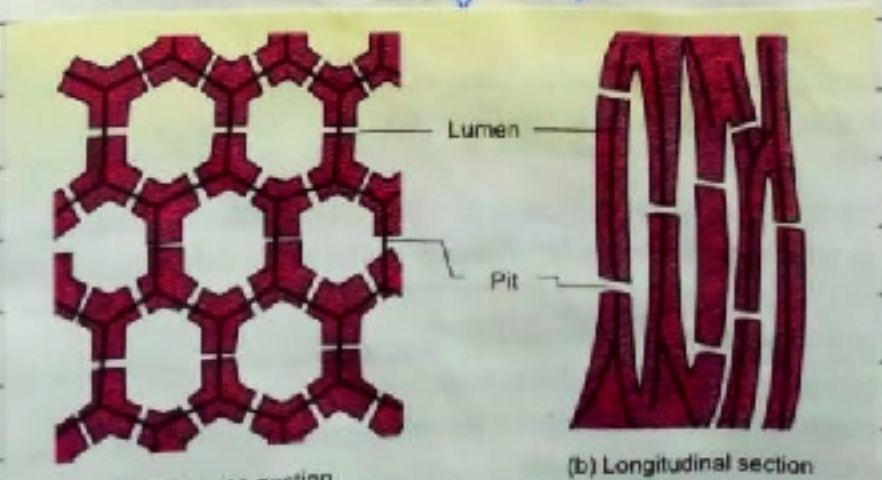

Fig. Sclerenchyma tissue

ii **Sclereids :** These are also called Stone cell or grit cells. These are highly lignified and become dead on maturity. Due to lignin deposition, the cell contents are very much reduced.

Place of occurrence :

Sclereids are very common in hard seed coats, hard wall of nuts, in wood and in the pulp of guava and pear. They form an important part of the bark of trees.

Functions of sclereids :

- Provide mechanical strength and rigidity to the plants.
- Provide strength to seed coverings.

complex permanent tissue :

A complex tissue consists of different types of cells of common origin which work together as a unit to perform a common function. The two main types of complex tissues are xylem and phloem.

Xylem :

xylem is a vascular as well as mechanical tissue. It is mainly responsible for conduction of water and dissolved minerals from roots

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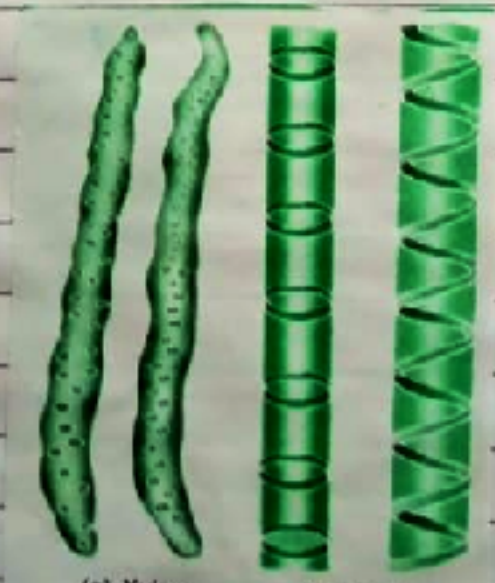
to the top of the plant. Here it is called water conducting tissue.

Xylem consists of four types of cells called as elements. Tracheids, Vessels, xylem parenchyma and xylem sclerenchyma.

i **Tracheids:** They are dead, elongated cells mainly involved in conduction of water and minerals in gymnosperms.

ii **Vessels:** They are advance element, generally found in angiosperms. vessels are cylindrical tube like structures placed one above the other end to end which form a continuous channel for efficient conduction of water



(a) Xylem tracheids (b) Xylem vessels

Fig. 2.24 Xylem elements

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iii **Xylem parenchyma:** They are small and thick walled parenchymatous cells. They store food materials and help in conduction of water.

iv **Xylem Sclerenchyma:** They are non living fibres with thick walls and narrow cavities provide mechanical support. The annual rings present in the trunk of a tree are xylem rings.

Phloem: Phloem is a living conducting tissue. The main function of phloem is the transport of food product from green parts and storage organs of the plant to other organs.

Phloem is a complex tissue made up of four kinds of cells, which are sieve tubes, companion cells, phloem fibre and phloem parenchyma.

i **Sieve tubes:**

Sieve tubes are slender tube like structures made up of elongated thin walled cells placed end to end. The end walls of sieve tube cells are perforated by numerous pores called sieve plates. Nucleus of sieve cell degenerates at maturity.

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Sieve cells are responsible for conduction of prepared food.

ii **Companion cells**: Companion cells have dense cytoplasm and prominent nuclei. Sieve tube and companion cells have close cytoplasmic connection with each other. Companion cells help the sieve tube in conduction of the prepared food.

iii **Phloem fibres**: They are thick-walled fibres with simple pits. Characteristically, they are sclerenchymatous fibres but because of their presence in phloem, they are called phloem fibres. These fibres are used by man for making ropes and rough cloth.

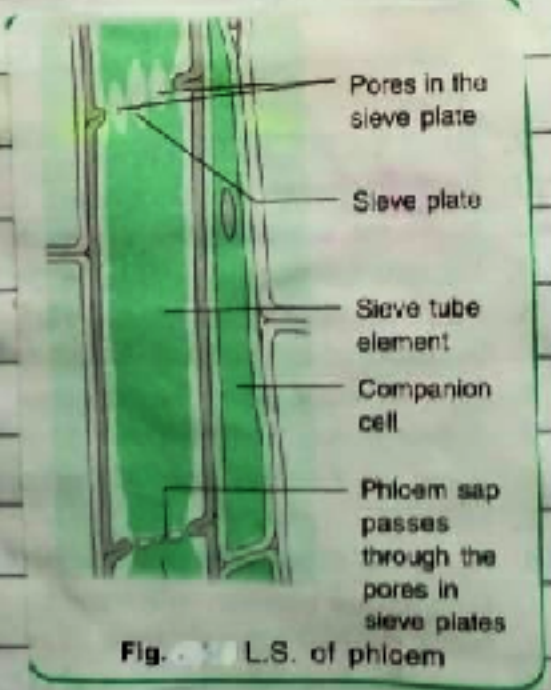

Fig. L.S. of phloem

IV **Phloem parenchyma** Intermingled with sieve tubes are living parenchymatous cells called phloem parenchyma. They store food and assist in the transport of food material.

II Animal tissues

On the bases of the structure of cells and their function, animal tissues are classified in to four major types- Epithelial tissue, Connective tissue, muscular tissue and nervous tissue

(1) Epithelial tissue:

The epithelial tissue is composed of one or more layers of cells and is the simplest among all types of tissue. It forms the outer covering of the body and lining of the internal organs and hence, is also called covering tissue or epithelium

Single layered epithelium is called simple epithelium and multilayered epithelium is called compound or stratified epithelium

Types of epithelial tissue:

On the bases of the shape of cells and their function, the epithelial tissue is further classified into various types.

i Squamous epithelium: • Squamous epithelium is made up of thin, flat irregular or polygonal cells with round and flat nuclei.

- Cells arranged end to end like tiles on a floor.
- It forms the delicate lining of cavities (mouth, oesophagus, nose, alveoli etc) blood vessels and covering of the tongue and skin
- Epithelial cells are arranged in many layers to prevent wear and tear of skin. This pattern is stratified squamous epithelium.

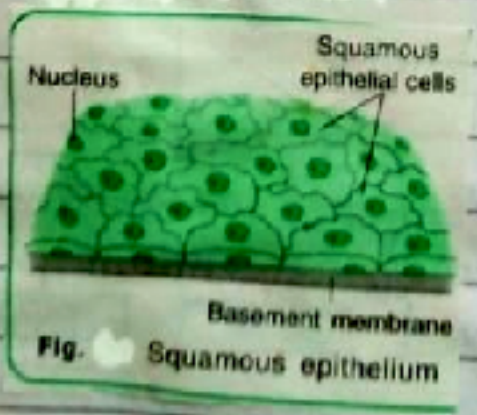

Fig. Squamous epithelium

ii Cuboidal epithelium:

- Cuboidal epithelium is composed of cube like cells of almost equal height and width
- The cells appear square like in vertical section but their free surface seems to be hexagonal
- It is found in kidney tubules, thyroid vesicles and in glands (Salivary and Sweat gland)
- It involves in absorption, excretion and secretion. It also provides mechanical support

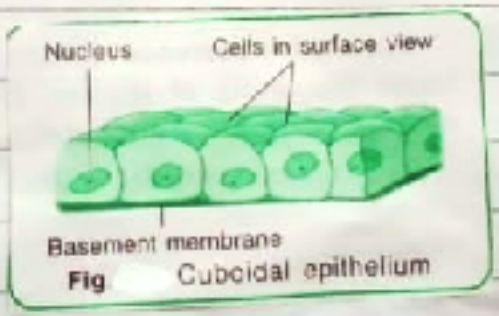

Fig Cuboidal epithelium

iii Columnar epithelium:

- Columnar means 'pillar like' epithelium
- It forms lining of stomach
- Small intestine and colon forming mucous membranes
- Border of microvilli is present at the free surface end of each cell which increases absorption efficiency in small intestine

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Adipose tissues are present below the skin, between internal organs around blood vessels and kidneys and in yellow bone marrow

Adipose tissue act as a food reservoir by storing fat. It acts as an insulator and regulates body temperature

Skeletal tissue:

Skeletal connective tissue forms the endoskeleton of the body of vertebrates. It includes cartilage and bone

Cartilage: This tissue is elastic, less harder as compared to bones Elasticity is due to presence of chondrin (protein).
It occurs at joints of bones, in the nose, ear trachea and larynx
It provides flexibility and great tensile strength

Bone: Bones are the hardest tissues which form the endoskeleton of the body and give firm support to the body
matrix of bone is very hard because of salt such as calcium phosphate, calcium carbonate, sodium chloride etc which give rigidity and strength to the bone.

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the structural framework and mechanical support to different tissues. Connective tissue constitutes about 30 percent of the total body mass.

Types of connective tissue:

Areolar or loose connective tissue

Areolar connective tissue is the most abundant of all types of connective tissues. It has large amount of matrix. The matrix contains white collagen fibres and yellow elastin fibres. This tissue is present under the skin, in between and around muscles, bone marrow, nerves and blood vessels. It fills the space between different tissues and organs hence is called packing tissue. The primary function is to bind tissues. It binds skin with muscles. It helps in healing of wounds and repair of tissues after injury.

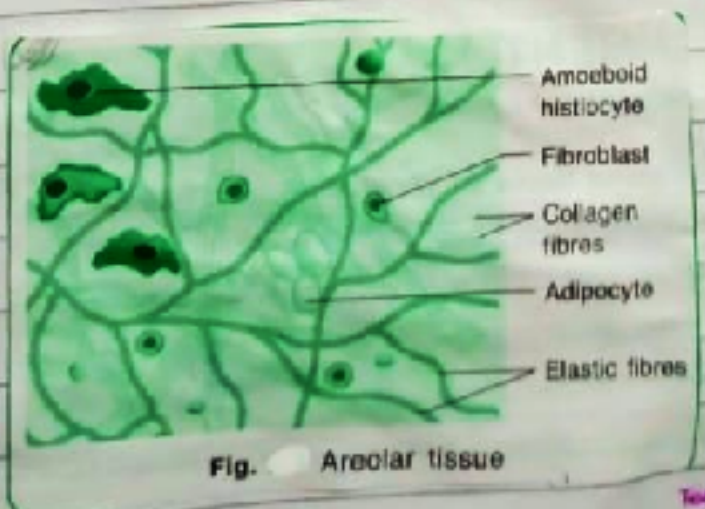

Fig. Areolar tissue

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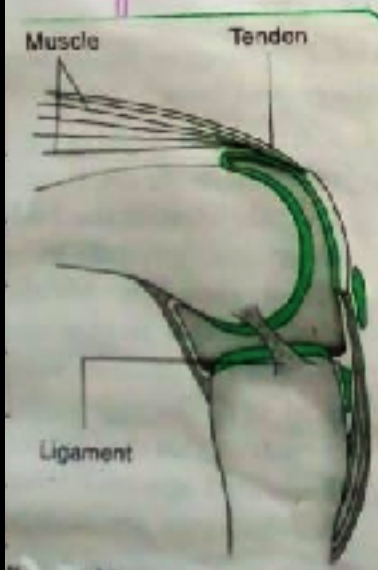
Dense connective tissue: It is a fibrous connective tissue. It is the chief component of ligaments and tendons.

→**Ligaments:** These are elastic structures made up of yellow elastic fibrous tissues which connect one bone to another. They give strength to the joints and permit normal movement. Sprain is caused by excessive pulling of ligaments.

→**Tendons:** Tendons are cord like, strong structures that join skeletal muscles to bones.

Adipose tissue: It consists of large number of oval and rounded adipose cells called adipocytes that are filled with fat globules



Ligament (joining bone to bone) and tendon (joining muscle to bone)

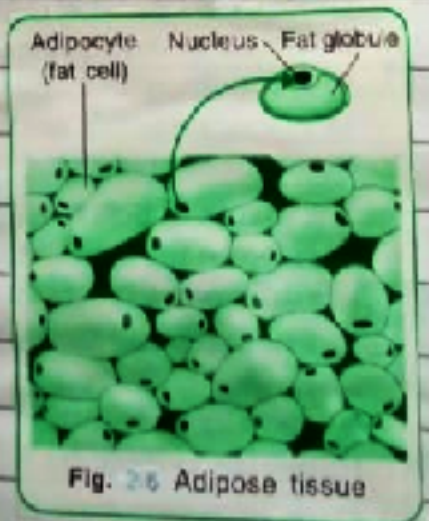


Fig. 2.6 Adipose tissue

Adipose tissues are present below the skin, between internal organs around blood vessels and kidneys and in yellow bone marrow

Adipose tissue act as a food reservoir by storing fat. It acts as an insulator and regulates body temperature

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Fluid connective tissue (Vascular tissue) L3

Fluid connective tissue is a special type of connective tissue which maintains a link among the different parts of the body. Fluid connective tissue consists of two basic components - blood and lymph.

(•) Blood:

Blood is a connective tissue. Blood has two main components, plasma - which is fluid, and corpuscles which are blood cells.

Plasma: It forms 55% part of blood. It constitute of 90-91% of water, 7% of protein, 0.9% of inorganic salts.

Corpuscles forms 45% part of blood. There are three types of corpuscles or blood cells - red blood cells (RBCs) white blood cells (WBCs) and platelets.

(•) Lymph:

Like blood, it is also a fluid connective tissue. Lymph is actually filtered blood which is similar to blood in composition except that it is devoid of RBC, platelets and some blood protein. It helps in the transport of nutrients. Nutrients that filter out from blood capillaries into lymph are transported back by lymph into blood through heart.

(37) Muscular tissue

Muscular tissue constitutes all the muscles of the body of an animal. This tissue is distinguished from other by its unique ability to contract and thereby perform mechanical work. It is responsible for the movement of organs and locomotion of body in response to stimuli

Types of muscular tissue: On the basis of structure, location and function, muscular tissue is classified into three types (unstriated, striated and cardiac) muscles

Unstriated muscles -

They are involuntary muscles also called as smooth muscles

These muscle fibres are uninucleated and spindle shaped

Such muscles are found in the walls of stomach, intestine, urinary bladder iris of eye etc

Peristaltic movements in alimentary canal are brought about by smooth muscles

Striated muscles:

They are also called as voluntary muscles because these are under the control of one's will

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muscle fibres or cells are multinucleated and unbranched

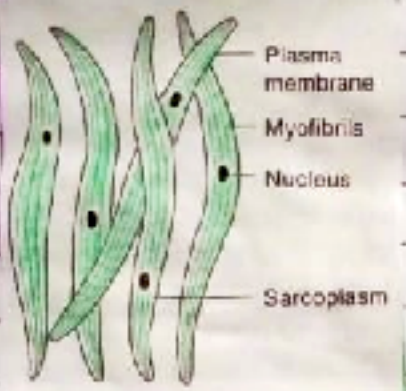

Fig. Unstriated muscles

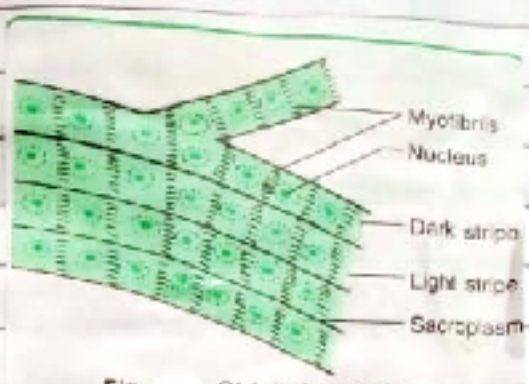

Fig. Striated muscles

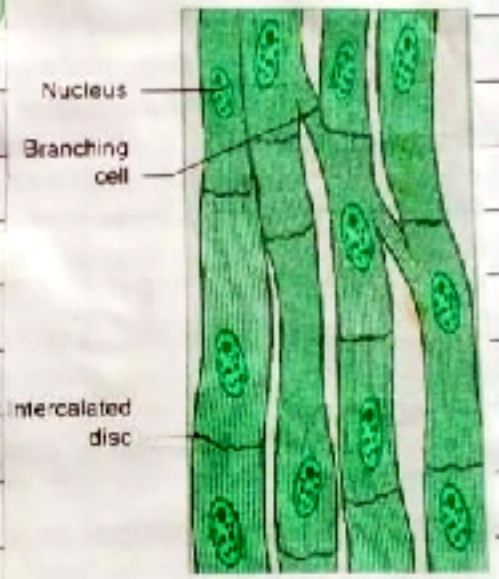

Fig. Cardiac muscles

Cardiac muscles.

They are only involuntary muscles
Only found in the walls of heart
they are uninucleated and branched.
In these muscles rhythmic contraction and relaxation occurs throughout the life

(4) Nervous tissue :

Nervous tissue is a specialized type of tissue responsible for the reception of stimuli and transmission of impuls to different parts of the body

Neurons Or nerve cells :

Neurons are the structural units of the nervous tissue: All neurons have a cell body called cyton; several dendrits and an axon.

- cyton contains a nucleus and many hair like projections called dendrons. Dendrons further branch out to form dendrites. From the distal part of the cyton arises a very long process called axon.
- The nerve cell receive stimuli from with in or out side the body
- Responsible for control and coordination