SUPPORT MATERIAL
BIOLOGY
CLASS-IX
FUNDAMENTAL UNIT OF LIFE

All living forms are composed of microscopic units called as 'Cells'.

- A cell is the basic structural and functional unit of all life forms.
- Study of structure and composition of cell is called as 'Cytology'.
- Cell was first observed by Robert Hooke in a dead cork slice in the year 1665.
- First living cell was discovered by A. V. Leeuwenhoek.
- Its consistency differs under different condition. It exists in sol-gel states.
- Protoplasm is an aggregate of various chemicals such as water, ions, salts and other organic molecules like proteins, carbohydrates, fats, nucleic acids, vitamins etc.

Cell Theory :

Two biologists, Schleiden and Schwann gave the Cell theory which states that :

(i) All plants and animals are composed of cells.
(ii) Cell is the basic unit of life.
(iii) All cells arise from pre-existing cells.

- Viruses are the exceptions of cell theory.

On the Basis of Number of Cells :

Characteristics	**Unicellular organism**	**Multicellular organism**
Cell number	Single cell	Large number of cells
Function	All functions are performed by single cell	Different cells perform different specific functions.
Division of labour	Not performed	Cells specified to perform different functions.
Reproduction	Involves the same single cell	Specialised cells, germ cells take part in reproduction.
Life span	Short	Long

On the Basis of Type of Organization

Prokaryotic Cells	**Eukaryotic Cells**
1)Very minute in size.	1) Fairly large in size.
2)Nuclear region (nucleoid) not surrounded by a nuclear membrane.	2) Nuclear material surrounded by a nuclear membrane.
3)Single chromosome present.	3) More than one chromosome present.
4)Nucleolus absent.	4) Nucleolus present.
5)Membrane bound cell organelles are are absent.	5) Membrane bound cell organelles present.
6)Cell division by fission or budding	6) Cell division by mitosis or meiosis.

(no mitosis).

Fundamental Unit Of Life: Cell

Cell Shape : Cells are of variable shapes and sizes. Their shape is according to the function. Generally cells are spherical but they may be elongated (nerve cell), branched (pigmented), discoidal (RBC), spindle-shaped (muscle cell) etc.

Cell Size : Size of cell is variable depending upon the type of organism. Some are microscopic while some are visible with naked eyes. Their size may vary from 0.2 mm to 18 cm.

- Size of a typical cell in a multicellular organism ranges from 20-30 mm.

- The largest cell is ostrich egg (15 cm in diameter with shell & 8 cm in diameter without cell).
- The longest cell is nerve cell (upto 1 m or more).
- Smallest cells so far known are PPLOs e.g., mycoplasma (0.1 mm in diameter).
- Human egg is 0.1 mm in diameter.

Components of Cell

There is an occurrence of division of labour within a cell as they all got certain specific components called 'Cell organelles'. Each of them perform a specific function.

The three basic components of all the cells are :

(i) Plasma membrane
(ii) Nucleus
(iii) Cytoplasm

Cell Membrane :

(a) Cell membrane is also called as plasma membrane or plasmalemma.
(b) It is the limiting boundary of each cell which separates the cytoplasm from its surroundings.
(c) It is found in both plant as well as animal cells.
(d) It is the outermost covering of a cell in case of animals and lies below the cell wall in case of plants.
(e) It is made up of proteins and lipids where proteins are sandwiched between bilayer of lipids.
(f) Plasma membrane is selectively permeable in nature. It allows or permits the entry and exit of some materials in and out of the cell.
(g) Singer and Nicholson gave the fluid mosaic model of plasma membrane. According to them, it consists of a protein layer sandwiched between two layers of lipids. It is in quasifluid state. It is 75A thick.
(h) It is flexible and can be folded, broken and reunited.

Functions of Plasma Membrane :

(a) It regulates the movement of molecules inside and outside the cell.
(b) It helps in maintaining the distinct composition of the cell.

(ii) Transportation of molecules across the Plasma Membrane :

This can be done by following ways :

• **Diffusion :** Movement of solutes or ions from higher concentration to lower concentration is called as diffusion. It does not require energy therefore, it is called as passive transport.
• **Osmosis :** The movement of solvent or water from higher concentration (solvent) to lower concentration (solvent) through a semipermeable membrane is called as osmosis Or the movement of solvent or water from lower concentration to higher concentration of solution through a semipermeable membrane is called as osmosis.
• **Osmosis can also be called as 'Diffusion of solvents'.**
• **Endomosis :** Movement of solvent into the cell is called as Endomosis.
• **Exosmosis :** Movement of solvent outside the cell is called as Exomosis.

Types of Solutions on the Basis of Concentration

(a) Isotonic Solution : When the concentration of the solution outside the cell is equal to the concentration of cytoplasm of the cell, it is called as isotonic solution.

(b) Hypertonic Solution : When the concentration of the solution outside the cell is more than the inside the cell. Due to this, cell looses water and becomes plasmolysed.

(c) Hypotonic Solution : When the concentration of the solution outside the cell is lesser than that of cytoplasm of cell. Due to this, cell swells up and bursts.

Cell Wall

• It is the outermost covering of the plant cells.
• It is absent in animal cells.
• Cell wall is rigid, strong, thick, porous and non-living structure. It is made up of cellulose and hemicelluloses. Cell walls of two adjacent cells are joined by a layer called middle lamellae.

Functions of Cell Wall :

(a) It provides definite shape to the cell.
(b) It provides strength to the cell.
(c) It is permeable and allows entry of molecules of different sizes.
(d) It has the characteristics of repair and regeneration.

Nucleus

• Nucleus is the most important cell organelle which directs and controls all its cellular activities.
• It is called as 'Headquarter of the cell'.
• It was discovered by Robert Brown in 1831.
• In Eukaryotes, a well-defined nucleus is present while in Prokaryotes, a well-defined nucleus is absent.
• Prokaryotes contain a primitive nucleus.
• It has double layered covering called as nuclear membrane.
• Nuclear membrane has pores which regulate the movement of materials in & out of the cell.
• Besides nuclear membrane, nucleus also contains nucleolus and chromatin material and the substance filled inside the nucleus is nucleolus.
• Chromosomes or chromatin material consists of DNA which stores and transmits hereditary information for the cell to function, grow and reproduce.

Functions of Nucleus :

(a) It controls all the metabolic activities of the cell and regulates the cell cycle.

(b) It helps in transmission of hereditary characters from parents to off springs.

Cytoplasm

• Cytoplasm was discovered by Kolliker in 1862.
• It is the site of both biosynthetic and catabolic pathways.
• It can be divided into two parts :

(i) Cytosol : Aqueous soluble part contains various fibrous proteins forming cytoskeleton.

(ii) Cell organelles : Living part of the cells having definite shape, structure and function bounded by plasma membrane.

Endoplasmic Reticulum

• It is the network of membranes present in the cytoplasm.
• It was discovered by Porter, Claude and Fullam.
• These are present in all cells except prokaryotes and mammalian erythrocytes.

Endoplasmic reticulum is of two types :

Smooth ER	**Rough ER**
• Made of tubules mainly.	• Made of clstemae and vesicles.
• Helps in steroid, lipids and	• Helps in protein synthesis.Polysaccharide synthesis.
• Ribosomes are absent.	• Contains ribosome on its surface.
• Helps in membrane biogenesis.	

Functions of ER :

(a) It is the only organelle which can move within a cell so it serves as a channel for the transport of materials between various regions of cytoplasm and between cytoplasm and nucleus.
(b) It also functions as a cytoplasmic framework to provide space for some of the biochemical activities. It forms endoskeleton of cell.
(c) It helps in synthesis of fats, steroids, cholesterol etc.
(d) SER plays a crucial role in detoxification of drugs and poisonous by-products.

Golgi Apparatus

Golgi apparatus consists of a system of membrane bounded vesicles arranged parallel to each other in stacks called Cisternae along with some large and spherical vacuoles. It was discovered by Camilo Golgi. In plants Golgi membrane is bounded. It is single membrane bounded. It is absent in prokaryotes, mammalian RBC's & sieve cells.

Functions of Golgi apparatus :

(a) It helps in formation of lipids.
(b) It helps in formation of middle lamellae.
(c) It is secretary in nature.
(d) It helps in melanin synthesis.
(e) Lipids and proteins synthesized in endoplasmic reticulum are packed at Golgi complex. They provide the site for assembly of new membrane material.

Mitochondria

It is a rod shaped structure found in cytoplasm of all eukaryotic cells except mammalian RBC's.
• These are also absent in prokaryotes.

• It was first seen by Kolliker in insect cells.
• Maximum mitochondria are found in metabolically active cells.
• It is also called as 'Power House of the Cell' or the 'Storage Battery'.
• It is double membranous structure where outer membrane has specific proteins while inner membrane is folded inside to form chambers called Cristae.

Functions of Mitochondria :

(a) Its main function is to produce and store the energy in the form of ATP.
(b) It is the site of Kreb cycle of respiration.

Ribosomes

Ribosomes are the sites of protein synthesis. All structural and functional proteins (enzymes) coded by the nuclear DNA are synthesized upon cytoplasmic ribosomes. The DNA codes are transcripted into messenger RNA (mRNA) molecules in the chromosomes of the nucleus.

Functions of Ribosomes :

(a) Ribosomes are the main site of protein synthesis. Synthesized proteins is transported by endoplasmic reticulum.

Plastid

• It is double membranous discoidal structure, found only in plant cells.
• Besides being discoidal of rhombic in plant cells, they occur in variable shapes like in algae. They can be 'U'-shaped, spiral, coiled, ribbonshaped etc.

Depending upon the type of pigment present in them, they are of following three types :

(i) Leucoplast – White, found in underground parts
(ii) Chromoplast – Red, brown
(iii) Chloroplast – Green in colour, found in aerial parts of plants

These are found only in plant cell. It helps in the process of photosynthesis so it is called the 'Kitchen of Plants'.

Chloroplast have following two parts :

(i) Grana : It constitutes the lamellar system. These are found layered on top of each other. These stacks are called Grana. Each granum of the chloroplast is formed by superimposed closed compartments called Thylakoids.

Function : They are the sites of light reaction of photosynthesis as they contain photosynthetic pigment chlorophyll. In each thylakoid, Quantasomes are present which are called as Photosynthetic units.

(ii) Stroma : It is a granular transparent substance also called as matrix. Grana are embedded in it. Besides Grana they also contain lipid droplets, starch grains, ribosomes etc.

Function : This is the site of dark reaction of photosynthesis. Also helps in protein synthesis due to presence of ribosomes.

Vacuoles

• These are membrane bounded regions in the cytoplasm containing water and other substances.
• They are bounded by a single membrane called Tonoplast.
• In animal cells vacuoles are smaller in size and numerous while in plant cells a single large vacuole is found which occupies about 90% of the volume of cell.

Functions :

It helps in maintaining osmotic pressure in a cell & stores toxic metabolic products of plant cell.

Lysosome

- They are tiny sac-like granules containing enzymes of intracellular digestion.
- They are bounded by a single membrane.
- They occur in animal cells and a few plant cells.
- They do not have a definite shape or size.

Functions :

(a) Their main function is phagy = digestion.
(b) They are kind of waste disposal system.
(c) They help in digesting foreign materials & cells.

Suicidal Bag : During disturbances in cellular metabolism i.e., in case of cell damage, lysosomes burst and their enzymes are released into the cytoplasm and they digest their own cell. So they are also called 'Suicidal Bag'.

Differences between Animal cell and Plant cell

Plant Cell	Animal Cell
• Contain chloroplasts for photosynthesis.	• No chloroplasts
• Have a cell wall to maintain structure and rigidity.	• No cell wall
• Usually do not contain lysosomes and Peroxisomes.	• Contain cilia and/or flagella
• Cells are square and rigid or geometric shaped. many shapes.	• Cells are fluid and flexible,
• Limited movement.	• Cells can move around.
• Have one large central vacuole.	• Has small vacuoles.

SUPPORT MATERIAL
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CLASS-IX
TISSUE

PLANT TISSUE – Meristematic & Permanent

Meristematic Tissue

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

Main features of Meristematic tissues are :

- Thin primary cell wall (cellulosic).
- Intercellular spaces are absent (compact tissue).
- Generally vacuols are absent, dense cytoplasm & prominent nuclei are present.
- Large numbers of cell organelles are present.
- Active metabolic state, stored food is absent.
- Actively dividing cells are present in growing regions of plants e.g., root & shoot tips.

Classification on the Basis of Origin

(A) Primary (Promeristem)

- Derived directly from the meristems of embryo.
- They consist of cells derived from primary meristem.
- They add to primary growth of plants.

(B) Secondary

- Formed by permanent tissues.
- These are having cells derived from primary permanent tissue.
- They usually add to the diameter of plants.

Permanent tissue differentiation Secondary meristem

Classification on the Basis of Location

(A) Apical Meristem

- It is present at the growing tips of stems and roots.
- Cell division in this tissue leads to the elongation of stem & root, thus it is involved in primary growth of the plant.

(B) Intercalary Meristem

- It is present behind the apex.
- It is the part of apical meristem which is left behind during growth period.
- These are present at the base of leaf & internode region.
- These lead to the increase in the length of leaf (Primary) e.g., in grass stem, bamboo stem, mint stem etc.

(C) Lateral Meristem

- It is also called as secondary meristem.
- It occurs along the sides of longitudinal axis of the plant.
- It gives rise to the vascular tissues.
- Causes growth in girth of stem & root.
- They are responsible for secondary growth.

PERMANENT TISSUE

• The permanent tissues are composed of those cells which have lost their capability to divide.
• They have definite shape, size and thickness. The permanent tissue may be dead or living.
• The division & differentiation of the cells of meristematic tissues give rise **Tissue** t0 permanent tissues.
• In cell differentiation, developing tissue and organs change from simple to more complex forms to become specialized for specific functions.
• The cells of permanent tissue loose the capacity to divide and attain a permanent shape, size and function.

Depending upon the Structure and Composition, the Permanent tissues are classified into two types :

(A) Simple Permanent Tissues

• These are made up of same type of cells which are similar structurally and functionally.
• They include two types of tissue :

(a) Protective Tissues : These tissues are primarily protective in function. They consist of :

(i) Epidermis

• Epidermis forms one cell thick outermost layer of various body organs of plants such as leaves, flowers, stems and roots.
• Epidermis is covered outside by cuticle. Cuticle is a waterproof layer of waxy substance called as cutin which is secreted by the epidermal cells.
• Cuticle is very thick in xerophytes.
• Cells of epidermis of leaves are not continuous at some places due to the presence of small pores called as stomata.
• Each stomata is guarded by a pair of bean-shaped cells called as guard cells. These are the only epidermal cells which possess chloroplasts, the rest being colourless.

Functions of Epidermis

• The main function of epidermis is to protect the plant from desiccation and infection.
• Cuticle of epidermis cuts the rate of transpiration and evaporation of water and prevents wilting.
• Stomata in epidermis allow gaseous exchange to occur during photosynthesis respiration.
• Stomata also helps in transpiration.

(ii) **Cork or Phellem**

• In older roots and stems, tissues at the periphery become cork cells or phellem cells.
• Cork is made up to dead cells with thick walls and do not have any intercellular spaces.
• The cell walls in cork deposit waxy substance called as suberin.
• The cells of cork become impermeable to water and gases due to the deposition of suberin.
• The cork cells are without any protoplasm but are filled with resins or tannins.

Functions of Cork :

• Cork is protective in function. Cork cells prevent desiccation, infection and mechanical injury.
• Imperviousness, lightness, toughness, compressibility and elasticity make the cork commercially valuable.
• Cork is used for insulation, as shock absorber in linoleum.
• Cork is used in the making of a variety of sport goods such as cricket balls, table tennis, shuttle cocks, wooden paddles etc.

(b) Supporting Tissues : These are supportive in function and are of three types :

Tissue

(i) Parenchyma : It is the fundamental tissue.

- Tissue first time evolved in bryophyte.
- Thin walled cells, oval or spherical in structure.
- Cell wall mainly composed of cellulose & pectin.
- Large central vacuole for food & water storage.
- Primary function is food storage.
- Some parenchyma involved in excretory substance storage are so called as idioblast, storing such as resin, tannin, gums & oils.
- In typical parenchyma chlorophyll is absent.
- Chloroplast containing parenchyma tissue are chlorenchyma which perform photosynthesis e.g., mesophyll of leaves.
- In hydrophytic plants aerenchyma (a type of parenchyma containing air spaces) provides buoyancy.
- Parenchyma provides turgidity to cells.

(ii) Collenchyma : It is the living mechanical tissue.

- Elongated cells with thick corners.
- Localized cellulose & pectin thickening.
- Provides flexibility to plant parts & easy bending of various parts of plant.
- Present only in herbaceous dicot stem.
- Present at thin margin of leaves.
- Few chloroplasts may be present.
- Gives mechanical strength & elasticity to the growing stems.

(iii) Sclerenchyma : (Scleras – hard) Strengthening tissue.

- Composed of extremely thick walled cells with little or no protoplasm.
- Cells are dead & possess very thick lignified walls.
- Lignin is water-proof material.
- Intercellular spaces are absent.

Cells of sclerenchyma are of two types :

Sclereids :

- These are also called grit cells or stone cells.
- These are small cells, where lumen is so small due to higher thickening of cell wall, as present in drup fruit (mango, coconut, walnut) in legume seeds (Macrosclereid).

Fibers :

- They are very long, narrow, thick, lignified cells. Lumen is large as compared to sclereids. Generally 1-3 mm long.
- In the thick walls of both the fibres and sclereids are present thin areas called as pits.

Sclrenchyma Fibres

- These are used in the manufacture of ropes, mats & certain textile fibres.
- Jute and coir are obtained from the thick bundle of fibres.

Difference between Parenchyma, Collenchyma and Sclerenchyma

Features	Parenchyma	Collenchyma	Sclerenchyma
1. Cell shape:	Isodiametric polyhedral.cells which are	Circular, oval or polygonal in shape.	Variable in shape. Fibres and sclereids.

oval, sphericalor		
2. Cell wall: Thin cellulosic cell wall.	Uneven thickening on their cell wall.	Lignified secondary cell wall present.
3. Cytoplasm: Abundant	Present	Absent
4. Nucleus: Present (Living tissue)	Present (Living tissue)	Absent (Dead tissue)
5. Vacuoles: Large vacuole	Vacuolated	Absent
6.Intercellular spaces:Present	Absent	Absent
7. Occurrence :Basically packing tissue, all soft part of plantpith,cortex, medullary ray	Dicot stems, petiole and beneath the epidermis	bundle sheath, pericycle, seed, pulp of fruits
8. Functions: Food storage, photosynthesis.	Provide tensile strength, Mechanical support,	Protection from stress and strain, mechanical strength.

(B) Complex Permanent Tissues

• It consists of more than one type of cells which work together as a unit.

• It helps in transportation of organic materials, water & minerals.

• It is also known as conducting or vascular tissue.

• Xylem & phloem together form vascular bundles.

Xylem : Also known as wood and is a vascular and mechanical tissue.

Thick walled cells are found in the form of tubular passages.

Xylem consists of four types of cells called as elements :

(i) Tracheids :

• They are elongated angular dead cells (primitive elements) mainly involved in conduction of water and minerals in gymnosperms.

(ii) Vessles : 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.

(iii) Xylem parenchyma :

• They are small & thick walled parenchymatous cells subjected for storage of starch (food).

(iv) Xylem sclerenchyma :

• Thy are non-living fibres with thick walls and narrow cavities provide mechanical support.

• Except xylem parenchyma all other xylem elements are dead.

• The annual rings present in the trunk of a tree are xylem rings.

• By counting the number of annual rings, we can determine the age of a tree.

Phloem : They also consist of both parenchymatous and schlerenchymatous cells.

Phloem consists of four types of element :

(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 as sieve plates.

• Nucleus of sieve cell degenerates at maturity. However, cytoplasm persists, because of protoplasmic continuation of sieve tube with companion cell through plasmodesmata.
• Sieve cells possess slime protein or protein which is concerned with growth and repair of sieve cells.

(ii) **Companion cells :**

• Companion cells have dense cytoplasm and prominent nuclei.

* *Sieve cells & companion cells are so called sister cells because they originate from single mother cell.*

(iii) **Phloem fibre :**

• They give mechanical support to sieve tubes.

(iv) **Phloem parenchyma :**

• They store food and help in radial conduction of food.
• In xylem, only unidirectional movement is possible while in phloem bidirectional movement can occur.
• In phloem, except phloem sclerenchyma all elements are living.

ANIMAL TISSUE

EPITHELIAL TISSUE

• Always grows on some other types of tissue.
• Cells of epithelium are set very close to each other and the tissue rests on a non-cellular basement membrane.
• Consists of single layer of cells.
• Blood vessels are absent and non-nervous in nature.
• It covers all the organs and lines the cavities of hollow organs like stomach.
• It is primarily protective in function.

Types of Epithelium

Epithelium tissues are classified as :

(a) Squamous epithelium : Also called pavement epithelium.

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

(b) Cubical epithelium :

• They are cube like cells that fit closely, cells look like squares in section, but free surface appears hexagonal.
• It is found in kidney tubules, thyroid vesicles & in glands (salivary glands, sweat glands).
• It forms germinal epithelium of gonads (testes & ovaries).
• It involves in absorption, excretion & secretion. It also provides mechanical support.

(c) Columnar epithelium :

• Columnar means ‘pillar-like’ epithelium. It forms lining of stomach.
• Small intestine & colon, forming mucous membranes.
• Border of micro villi is present at the free surface end of each cell which increases absorption efficiency in small intestine.

(d) Ciliated epithelium :

- Cells may be cubical or columnar.
- On its free surface are present protoplasmic outgrowths called cilia.
- It helps in the movement of ova in the fallopian tube.

CONNECTIVE TISSUE

- The cells of the connective tissue are widely spaced and embedded in an intercellular matrix.
- The mature of matrix decides the function of tissue.
- White and yellow fibres are present in the matrix.
- Their basic function is to provide support to different organs & keeping them in place.

(a) Fluid or vascular tissue :

Blood and lymph

- Blood is a connective tissue, fluid matrix of blood is plasma having wandering or floating cells, called corpuscles, blood helps in the transportation of various materials such as nutritive substances, gases, excretory products, hormones etc.

Plasma

- Form 55% part of blood. Constitution : 90-91% : water, 7% : protein (Albumin, fibrinogen, globulin), 0.9% : inorganic salt etc. Corpuscles
- Forms 45% part of blood.

RBCs

- They are also called as erthyrocytes, containing red coloured respiratory pigment called haemoglobin that helps in transportation of oxygen.

WBCs (Leucocytes : They are also called as 'Soldiers of the body'.)

- They are irregular, amoeboid, phagocyte cells that protect our body by engulfing bacterial & other foreign particles. They are of five types :

Monocytes, Lymphocytes, Basophiles, Neutrophiles, Eosinophils.

Blood platelets or thrombocytes

- They are spindle shaped cells which are involved in clotting of blood.

(b) Skeletal Tissue

It is hard connective tissue that forms supportive framework of the body. It is of two types :

Bone

- Matrix of bone is very hard because of salts such as calcium phosphate, $CaCO_3$ (60-70%) etc. and a protein ossein.
- Bone cells (osteoblasts) are embedded in this hard matrix.
- Matrix is deposited in the form of concentric layers of lamellae formed round a central canal, the done cells occupy small spaces between the concentric layers of matrix.
- The long bones are usually hollow containing cavity called as marrow cavity. It is full of bone marrow.

Cartilage

- This tissue is elastic, less harder as compared to bones.
- Elasticity is due to presence of chondrin (protein). Cells are called as chondroblast, which are widely spaced and matrix is reinforced by fibres.
- It occurs at joint of bones, in the nose, ear, trachea & larynx.
- It provides flexibility and great tensile strength.

(c) Connective tissue

It is the most abundant type of connective tissue. It is further divided into following types :

(i) Yellow fibrous connective tissue

• They are very elastic due to the presence of a network of yellow fibres in its matrix called as ligament which attaches bone to bone.

(ii) White fibrous connective tissue

• They are very little matrix containing abundant white fibres forming layers.

• Bundles of this tissue are called as tendons, which attaches muscles to the bones.

(d) Aerolar tissue :

• It is the most distributed connective tissue in the body.

• This tissue fills spaces inside organs and is found between the skin & muscles, around blood vessels, nerves and in the bone marrow.

(e) Adipose tissue :

• These are oval and round cells, filled with fat globules.

• The cells are called as adipocytes.

• It is found in subcutaneous layer below the skin, around the heart, brain and below the eyeballs. It acts as an insulator and prevents loss of heat from the body.

MUSCULAR TISSUE

• Movements are brought about in our body with the help of muscular tissues.

• They are long fibre-like cells called muscle fibres.

• They are capable of contraction or relaxation.

Types of Muscular Tissue

(a) Striated muscles

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

• Muscle fibres or cells are multinucleated and unbranched.

• Each fibre is enclosed by thin membrane which is called as sarcolemma.

Cytoplasm is called as sarcoplasm.

• These muscles get tired and need rest

(b) Cardiac muscle fibres

• They are only involuntary muscles.

• Only found in the walls of heart.

• Their structure is in between the striated and non-striated muscles.

• They are uninucleated and branched. Branches are united by intercalated disc.

• In these muscles rhythmic contraction and relaxation occurs throughout the life.

(c) Non-striated muscles

• They are involuntary muscles also called as smooth muscles.

• These muscle fibres are uninucleated and spindle shaped.

• They are not enclosed by membrane but many fibres are joined together in bundles.

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

• Peristaltic movements in alimentary canal are brought about by smooth muscles.

NERVOUS TISSUE

• They are highly specialized tissue due to which the animals are able to perceive and respond to the stimuli.
• Their functional unit is called as nerve cell or neuron.
• Cell body is cyton covered by plasma membrane.
• Short hair like extensions rising from cyton are Dendron which are further subdivided into dendrites.
• Axon is long, tail like cylindrical process with fine branches at the end. Axon is covered by a sheath.
• Axon of one neuron is very closely placed to the dendrons of another neuron to carry impulses from one to another neuron in the form of electrochemical waves. This close proximity is called as synapse.