

LEARNING OUTCOMES

Learners....

1.The Fundamental unit of life

1. Explain the structure and function of cellwall, nucleus and cell organelles.
2. Prepare temporary mounts of onion and cheek cells.
3. Differentiate between prokaryotes and eukaryotes.
4. Draw labelled diagrams of plant cell and animal cell.
5. Conduct experiments related to osmosis.

2.Tissues

1. Explain various types of plant tissues and animal tissues.
2. Identify the type of tissues present in different parts of plants and animals
3. Differentiate the three types of muscle fibre on the basis of their structure and location in the body.
4. Draw labelled diagrams of neuron and muscle cells.
5. Make the flow charts of plant tissues and animal tissues.

Chapter 1



THE FUNDAMENTAL UNIT OF LIFE

While examining a thin slice of cork, Robert Hooke saw that the cork resembled the structure of a honeycomb consisting of many little compartments. Cork is a substance which comes from the bark of a tree. This was in the year 1665 when Hooke made this chance observation through a self-designed microscope. Robert Hooke called these boxes cells. **Cell** is a Latin word for 'a little room'.

This may seem to be a very small and insignificant incident but it is very important in the history of science. This was the very first time that someone had observed that living things appear to consist of separate units. The use of the word 'cell' to describe these units is being used till this day in biology.

Let us find out about cells.

avoid air bubbles while putting the cover slip with the help of a mounting needle. Ask your teacher for help. We have prepared a temporary mount of onion peel. We can observe this slide under low power followed by high powers of a compound microscope.

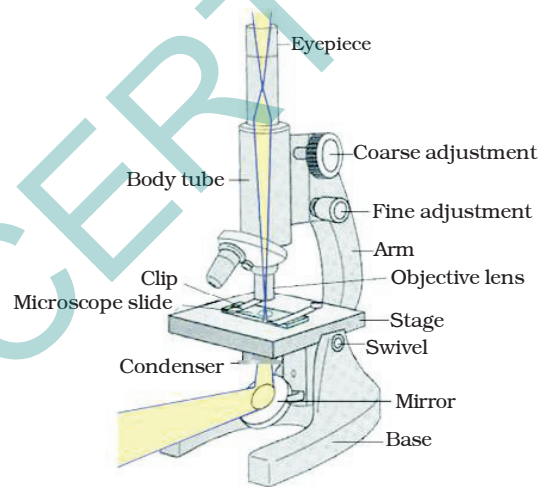


Fig. 1.1: Compound microscope

1.1 What are Living Organisms Made Up of?

Activity 1.1

- Let us take a small piece from an onion bulb. With the help of a pair of forceps, we can peel off the skin (called epidermis) from the concave side (inner layer) of the onion. This layer can be put immediately in a watch-glass containing water. This will prevent the peel from getting folded or getting dry. What do we do with this peel?
- Let us take a glass slide, put a drop of water on it and transfer a small piece of the peel from the watch glass to the slide. Make sure that the peel is perfectly flat on the slide. A thin camel hair paintbrush might be necessary to help transfer the peel. Now we put a drop of safranin solution on this piece followed by a cover slip. Take care to

What do we observe as we look through the lens? Can we draw the structures that we are able to see through the microscope, on an observation sheet? Does it look like Fig. 1.2?

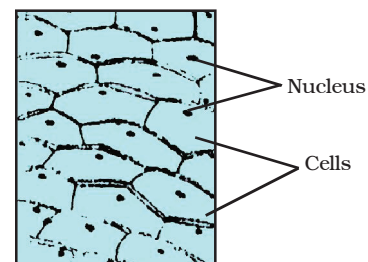


Fig. 1.2: Cells of an onion peel

We can try preparing temporary mounts of peels of onions of different sizes. What do we observe? Do we see similar structures or different structures?

What are these structures?

These structures look similar to each other. Together they form a big structure like an onion bulb! We find from this activity that onion bulbs of different sizes have similar small structures visible under a microscope. The cells of the onion peel will all look the same, regardless of the size of the onion they came from.

These small structures that we see are the basic building units of the onion bulb. These structures are called cells. Not only onions, but all organisms that we observe around are made up of cells. However, there are also single cells that live on their own.

More to know

Cells were first discovered by Robert Hooke in 1665. He observed the cells in a cork slice with the help of a primitive microscope. Leeuwenhoek (1674), with the improved microscope, discovered the free living cells in pond water for the first time. It was Robert Brown in 1831 who discovered the nucleus in the cell. Purkinje in 1839 coined the term 'protoplasm' for the fluid substance of the cell. The cell theory, that all the plants and animals are composed of cells and that the cell is the basic unit of life, was presented by two biologists, Schleiden (1838) and Schwann (1839). The cell theory was further expanded by Virchow (1855) by suggesting that all cells arise from pre-existing cells. With the discovery of the electron microscope in 1940, it was possible to observe and understand the complex structure of the cell and its various organelles.

The invention of magnifying lenses led to the discovery of the microscopic world. It is now known that a single cell may constitute a whole organism as in *Amoeba*,

Chlamydomonas, *Paramoecium* and bacteria. These organisms are called **unicellular** organisms (uni = single). On the other hand, many cells group together in a single body and assume different functions in it to form various body parts in **multicellular** organisms (multi = many) such as some fungi, plants and animals. Can we find out names of some more unicellular organisms?

Every multi-cellular organism has come from a single cell. How? Cells divide to produce cells of their own kind. **All cells thus come from pre-existing cells.**

Activity 1.2

- We can try preparing temporary mounts of leaf peels, tip of roots of onion or even peels of onions of different sizes.
- After performing the above activity, let us see what the answers to the following questions would be:
 - (a) Do all cells look alike in terms of shape and size?
 - (b) Do all cells look alike in structure?
 - (c) Could we find differences among cells from different parts of a plant body?
 - (d) What similarities could we find?

Some organisms can also have cells of different kinds. Look at the following picture. It depicts some cells from the human body.

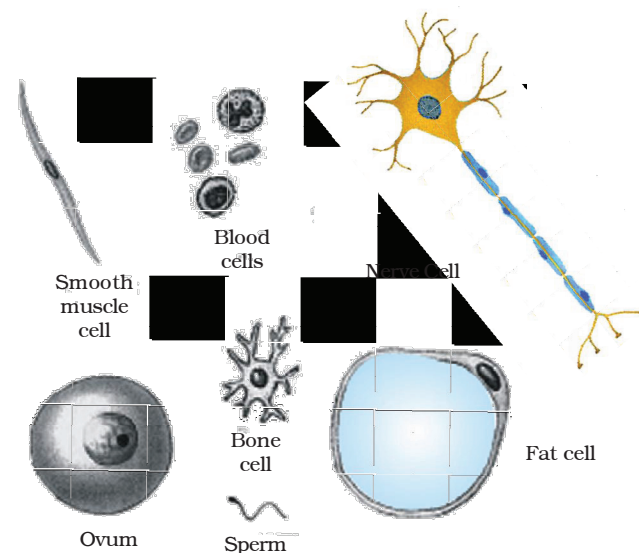


Fig. 1.3: Various cells from the human body

The shape and size of cells are related to the specific function they perform. Some cells like *Amoeba* have changing shapes. In some cases the cell shape could be more or less fixed and peculiar for a particular type of cell; for example, nerve cells have a typical shape.

Each living cell has the capacity to perform certain basic functions that are characteristic of all living forms. How does a living cell perform these basic functions? We know that there is a division of labour in multicellular organisms such as human beings. This means that different parts of the human body perform different functions. The human body has a heart to pump blood, a stomach to digest food and so on. Similarly, division of labour is also seen within a single cell. In fact, each such cell has got certain specific components within it known as cell organelles. Each kind of cell organelle performs a special function, such as making new material in the cell, clearing up the waste material from the cell and so on. A cell is able to live and perform all its functions because of these organelles. These organelles together constitute the basic unit called the cell. It is interesting that all cells are found to have the same organelles, no matter what their function is or what organism they are found in.



Questions

1. Who discovered cells, and how?
2. Why is the cell called the structural and functional unit of life?

1.2 What is a Cell Made Up of? What is the Structural Organisation of a Cell?

We saw above that the cell has special components called organelles. How is a cell organised?

If we study a cell under a microscope, we would come across three features in almost

every cell; plasma membrane, nucleus and cytoplasm. All activities inside the cell and interactions of the cell with its environment are possible due to these features. Let us see how.

1.2.1 PLASMA MEMBRANE OR CELL MEMBRANE

This is the outermost covering of the cell that separates the contents of the cell from its external environment. The plasma membrane allows or permits the entry and exit of some materials in and out of the cell. It also prevents movement of some other materials. The cell membrane, therefore, is called a **selectively permeable membrane**.

How does the movement of substances take place into the cell? How do substances move out of the cell?

Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called **diffusion**. We have studied the process of diffusion in earlier chapters. We saw that there is spontaneous movement of a substance from a region of high concentration to a region where its concentration is low.

Something similar to this happens in cells when, for example, some substance like CO_2 (which is cellular waste and requires to be excreted out by the cell) accumulates in high concentrations inside the cell. In the cell's external environment, the concentration of CO_2 is low as compared to that inside the cell. As soon as there is a difference of concentration of CO_2 inside and outside a cell, CO_2 moves out of the cell, from a region of high concentration, to a region of low concentration outside the cell by the process of diffusion. Similarly, O_2 enters the cell by the process of diffusion when the level or concentration of O_2 inside the cell decreases. Thus, diffusion plays an important role in gaseous exchange between the cells as well as the cell and its external environment.

Water also obeys the law of diffusion. The movement of water molecules through such a selectively permeable membrane is called *osmosis*.

The movement of water across the plasma membrane is also affected by the amount of substance dissolved in water. Thus, osmosis is the net diffusion of water across a selectively permeable membrane toward a higher solute concentration.

What will happen if we put an animal cell or a plant cell into a solution of sugar or salt in water?

One of the following three things could happen:

1. If the medium surrounding the cell has a higher water concentration than the cell, meaning that the outside solution is very dilute, the cell will gain water by osmosis. Such a solution is known as a hypotonic solution.

Water molecules are free to pass across the cell membrane in both directions, but more water will come into the cell than will leave. The net (overall) result is that water enters the cell. The cell is likely to swell up.

2. If the medium has exactly the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an isotonic solution.

Water crosses the cell membrane in both directions, but the amount going in is the same as the amount going out, so there is no overall movement of water. The cell will stay the same size.

3. If the medium has a lower concentration of water than the cell, meaning that it is a very concentrated solution, the cell will lose water by osmosis. Such a solution is known as a hypertonic solution.

Again, water crosses the cell membrane in both directions, but this time more water leaves the cell than enters it. Therefore the cell will shrink.

Thus, osmosis is a special case of diffusion through a selectively permeable membrane. Now let us try out the following activity:

Activity _____ 1.3

Osmosis with an egg

- (a) Remove the shell of an egg by dissolving it in dilute hydrochloric acid. The shell is mostly calcium carbonate. A thin outer skin now encloses the egg. Put the egg in pure water and observe after 5 minutes. What do we observe?
The egg swells because water passes into it by osmosis.
- (b) Place a similar de-shelled egg in a concentrated salt solution and observe for 5 minutes. The egg shrinks. Why? Water passes out of the egg solution into the salt solution because the salt solution is more concentrated.

We can also try a similar activity with dried raisins or apricots.

Activity _____ 1.4

Put dried raisins or apricots in plain water and leave them for some time. Then place them into a concentrated solution of sugar or salt. You will observe the following:

- (a) Each gains water and swells when placed in water.
- (b) However, when placed in the concentrated solution it loses water, and consequently shrinks.

Unicellular freshwater organisms and most plant cells tend to gain water through osmosis. Absorption of water by plant roots is also an example of **osmosis**.

Thus, **diffusion** is important in exchange of gases and water in the life of a cell. In additions to this, the cell also obtains nutrition from its environment. Different molecules move in and out of the cell through a type of transport requiring use of energy.

The plasma membrane is flexible and is made up of organic molecules called lipids and proteins. However, we can observe the structure of the plasma membrane only through an electron microscope.

The flexibility of the cell membrane also enables the cell to engulf in food and other material from its external environment. Such processes are known as **endocytosis**. *Amoeba* acquires its food through such processes.

Activity _____ 1.5

- Find out about electron microscopes from resources in the school library or through the internet. Discuss it with your teacher.

Questions

- How do substances like CO_2 and water move in and out of the cell? Discuss.
- Why is the plasma membrane called a selectively permeable membrane?

1.2.2 CELL WALL

Plant cells, in addition to the plasma membrane, have another rigid outer covering called the cell wall. The cell wall lies outside the plasma membrane. The plant cell wall is mainly composed of **cellulose**. Cellulose is a complex substance and provides structural strength to plants.

When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as plasmolysis. We can observe this phenomenon by performing the following activity:

Activity _____ 1.6

- Mount the peel of a Rhoeo leaf in water on a slide and examine cells under the high power of a microscope. Note the small green granules, called chloroplasts. They contain a green substance called chlorophyll. Put a strong solution of sugar or salt on the mounted leaf on the slide. Wait for a minute and observe under a microscope. What do we see?
- Now place some Rhoeo leaves in boiling water for a few minutes. This kills the cells. Then mount one leaf on a slide and observe it under a microscope. Put a strong solution of sugar or salt on the mounted leaf on the slide. Wait for a minute and observe it again. What do we find? Did plasmolysis occur now?

What do we infer from this activity? It appears that only living cells, and not dead cells, are able to absorb water by osmosis.

Cell walls permit the cells of plants, fungi and bacteria to withstand very dilute (hypotonic) external media without bursting. In such media the cells tend to take up water by osmosis. The cell swells, building up pressure against the cell wall. The wall exerts an equal pressure against the swollen cell. Because of their walls, such cells can withstand much greater changes in the surrounding medium than animal cells.

1.2.3 NUCLEUS

Remember the temporary mount of onion peel we prepared? We had put iodine solution on the peel. Why? What would we see if we tried observing the peel without putting the iodine solution? Try it and see what the difference is. Further, when we put iodine solution on the peel, did each cell get evenly coloured?

According to their chemical composition different regions of cells get coloured differentially. Some regions appear darker than other regions. Apart from iodine solution we could also use safranin solution or methylene blue solution to stain the cells.

We have observed cells from an onion; let us now observe cells from our own body.

Activity _____ 1.7

- Let us take a glass slide with a drop of water on it. Using an ice-cream spoon gently scrape the inside surface of the cheek. Does any material get stuck on the spoon? With the help of a needle we can transfer this material and spread it evenly on the glass slide kept ready for this. To colour the material we can put a drop of methylene blue solution on it. Now the material is ready for observation under microscope. Do not forget to put a cover-slip on it!
- What do we observe? What is the shape of the cells we see? Draw it on the observation sheet. See P.No. 166, Fig. 1

- Was there a darkly coloured, spherical or oval, dot-like structure near the centre of each cell? This structure is called nucleus. Were there similar structures in onion peel cells?

The nucleus has a double layered covering called nuclear membrane. The nuclear membrane has pores which allow the transfer of material from inside the nucleus to its outside, that is, to the cytoplasm (which we will talk about in section 1.2.4).

The nucleus contains chromosomes, which are visible as rod-shaped structures only when the cell is about to divide. Chromosomes contain information for inheritance of characters from parents to next generation in the form of DNA (Deoxyribo Nucleic Acid) molecules. Chromosomes are composed of DNA and protein. DNA molecules contain the information necessary for constructing and organising cells. Functional segments of DNA are called genes. In a cell which is not dividing, this DNA is present as part of chromatin material. Chromatin material is visible as entangled mass of thread like structures. Whenever the cell is about to divide, the chromatin material gets organised into chromosomes.

The nucleus plays a central role in cellular reproduction, the process by which a single cell divides and forms two new cells. It also plays a crucial part, along with the environment, in determining the way the cell will develop and what form it will exhibit at maturity, by directing the chemical activities of the cell. (See P.no.166 fig no.1,2 in annexure)

In some organisms like bacteria, the nuclear region of the cell may be poorly defined due to the absence of a nuclear membrane. Such an undefined nuclear region containing only nucleic acids is called a nucleoid. Such organisms, whose cells lack a nuclear membrane, are called **prokaryotes** (Pro = primitive or primary; karyote $\approx$ karyon = nucleus). Organisms with cells having a nuclear membrane are called **eukaryotes**.

Prokaryotic cells (see Fig. 1.4) also lack most of the other cytoplasmic organelles

present in eukaryotic cells. Many of the functions of such organelles are also performed by poorly organised parts of the cytoplasm (see section 1.2.4). The chlorophyll in photosynthetic prokaryotic bacteria is associated with membranous vesicles (bag like structures) but not with plastids as in eukaryotic cells (see section 1.2.5).

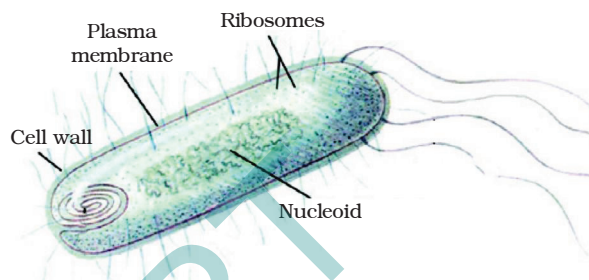


Fig. 1.4: Prokaryotic cell

1.2.4 CYTOPLASM

When we look at the temporary mounts of onion peel as well as human cheek cells, we can see a large region of each cell enclosed by the cell membrane. This region takes up very little stain. It is called the cytoplasm. The cytoplasm is the fluid content inside the plasma membrane. It also contains many specialised cell organelles. Each of these organelles performs a specific function for the cell.

Cell organelles are enclosed by membranes. In prokaryotes, beside the absence of a defined nuclear region, the membrane-bound cell organelles are also absent. On the other hand, the eukaryotic cells have nuclear membrane as well as membrane-enclosed organelles.

The significance of membranes can be illustrated with the example of viruses. Viruses lack any membranes and hence do not show characteristics of life until they enter a living body and use its cell machinery to multiply.

Question

1. Fill in the gaps in the following table illustrating differences between prokaryotic and eukaryotic cells.

Prokaryotic Cell	Eukaryotic Cell
1. Size : generally small (1-10 μm) 1 μm = 10^{-6} m	1. Size: generally large (5-100 μm)
2. Nuclear region: _____ and known as__	2. Nuclear region: well defined and surrounded by a nuclear membrane
3. Chromosome: single	3. More than one chromosome
4. Membrane-bound cell organelles absent	4. _____

1.2.5 CELL ORGANELLES

Every cell has a membrane around it to keep its own contents separate from the external environment. Large and complex cells, including cells from multicellular organisms, need a lot of chemical activities to support their complicated structure and function. To keep these activities of different kinds separate from each other, these cells use membrane-bound little structures (or 'organelles') within themselves. This is one of the features of the eukaryotic cells that distinguish them from prokaryotic cells. Some of these organelles are visible only with an electron microscope.

We have talked about the nucleus in a previous section. Some important examples of cell organelles which we will discuss now are: endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria and plastids. They are important because they carry out some very crucial functions in cells.

1.2.5 (i) ENDOPLASMIC RETICULUM (ER)

The endoplasmic reticulum (ER) is a large network of membrane-bound tubes and sheets. It looks like long tubules or round or oblong bags (vesicles). The ER membrane is similar in structure to the plasma membrane. There are two types of ER- **rough endoplasmic reticulum** (RER) and **smooth endoplasmic reticulum** (SER). RER looks rough under a microscope because it has particles called ribosomes attached to its surface. The ribosomes, which are present in all active cells, are the sites of protein manufacture. The manufactured proteins are then sent to various places in the cell depending on need, using the ER. The SER helps in the manufacture of fat molecules, or lipids, important for cell function. Some of these proteins and lipids help in building the cell membrane. This process is known as membrane **biogenesis**. Some other proteins and lipids function as enzymes and hormones. Although the ER varies greatly in appearance in different cells, it always forms a network system. (See P.no.166 fig no.3 in annexure)

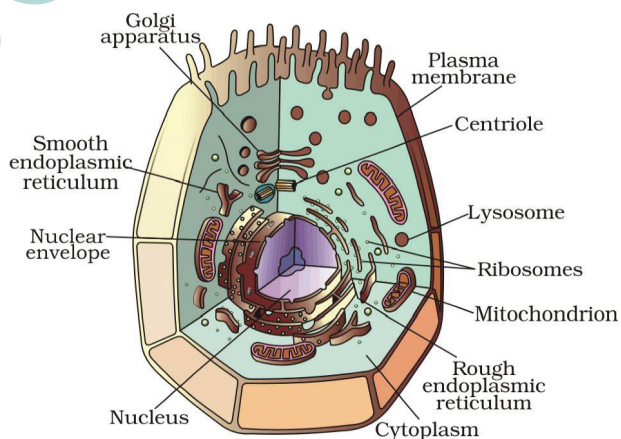


Fig. 1.5: Animal cell

Thus, one function of the ER is to serve as channels for the transport of materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus. The ER also functions as a cytoplasmic framework providing a surface

for some of the biochemical activities of the cell. In the liver cells of the group of animals called vertebrates SER plays a crucial role in detoxifying many poisons and drugs.

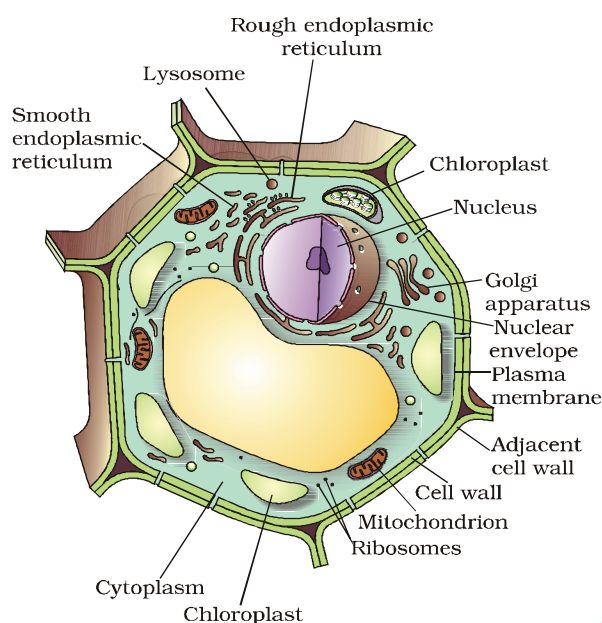


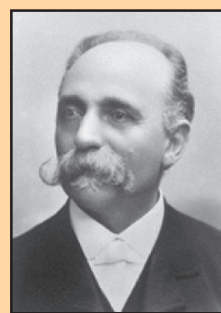
Fig. 1.6: Plant cell

1.2.5 (ii) GOLGI APPARATUS

The Golgi apparatus, first described by **Camillo Golgi**, consists of a system of membrane-bound vesicles (flattened sacs) arranged approximately parallel to each other in stacks called **cisterns**. These membranes often have connections with the membranes of ER and therefore constitute another portion of a complex cellular membrane system.

The material synthesised near the ER is packaged and dispatched to various targets inside and outside the cell through the Golgi apparatus. Its functions include the storage, modification and packaging of products in vesicles. In some cases, complex sugars may be made from simple sugars in the Golgi apparatus. The Golgi apparatus is also involved in the formation of lysosomes [see 1.2.5 (iii)]. (See P.no.166 fig no.4 in annexure)

Camillo Golgi was born at Corteno near Brescia in 1843. He studied medicine at the University of Pavia. After graduating in 1865, he continued to work in Pavia at the Hospital of St. Matteo. At that time most of his investigations



were concerned with the nervous system. In 1872 he accepted the post of Chief Medical Officer at the Hospital for the Chronically Sick at Abbiategrasso. He first started his investigations into the nervous system in a little kitchen of this hospital, which he had converted into a laboratory. However, the work of greatest importance, which Golgi carried out was a revolutionary method of staining individual nerve and cell structures. This method is referred to as the 'black reaction'. This method uses a weak solution of silver nitrate and is particularly valuable in tracing the processes and most delicate ramifications of cells. All through his life, he continued to work on these lines, modifying and improving this technique. Golgi received the highest honours and awards in recognition of his work. He shared the Nobel prize in 1906 with Santiago Ramon y Cajal for their work on the structure of the nervous system.

1.2.5 (iii) LYSOSOMES

Structurally, lysosomes are membrane-bound sacs filled with digestive enzymes. These enzymes are made by RER. Lysosomes are a kind of waste disposal system of the cell. These help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles. Foreign materials entering the cell, such as bacteria or food, as well as old organelles end up in the lysosomes, which break complex substances into simpler substances. Lysosomes are able to do this because they contain powerful digestive enzymes capable of breaking down all organic material. During the disturbance in cellular metabolism, for example, when the cell gets

damaged, lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are also known as the '**suicide bags**' of a cell.

1.2.5 (iv) *MITOCHONDRIA*

Mitochondria are known as the powerhouses of the cell. Mitochondria have two membrane coverings. The outer membrane is porous while the inner membrane is deeply folded. These folds increase surface area for ATP-generating chemical reactions. The energy required for various chemical activities needed for life is released by mitochondria in the form of **ATP (Adenosine triphosphate) molecules**. ATP is known as the **energy currency** of the cell. The body uses energy stored in ATP for making new chemical compounds and for mechanical work (See P.no.166 fig no.5 in annexure)

Mitochondria are strange organelles in the sense that they have their own DNA and ribosomes. Therefore, mitochondria are able to make some of their own proteins.

1.2.5 (v) *PLASTIDS*

Plastids are present only in plant cells. There are two types of plastids – **chromoplasts** (coloured plastids) and **leucoplasts** (white or colourless plastids). Chromoplasts containing the pigment chlorophyll are known as **chloroplasts**. Chloroplasts are important for photosynthesis in plants. Chloroplasts also contain various yellow or orange pigments in addition to chlorophyll. **Leucoplasts** are primarily organelles in which materials such as starch, oils and protein granules are stored.

The internal organisation of the Chloroplast consists of numerous membrane layers embedded in a material called the stroma. These are similar to mitochondria in external structure. Like the mitochondria, plastids also have their own DNA and ribosomes. (See P.no.166 fig no.6 in annexure)

1.2.5 (vi) *VACUOLES*

Vacuoles are storage sacs for solid or liquid contents. Vacuoles are small sized in animal cells while plant cells have very large vacuoles. The central vacuole of some plant cells may occupy 50-90% of the cell volume.

In plant cells vacuoles are full of cell sap and provide turgidity and rigidity to the cell. Many substances of importance in the life of the plant cell are stored in vacuoles. These include amino acids, sugars, various organic acids and some proteins. In single-celled organisms like *Amoeba*, the food vacuole contains the food items that the *Amoeba* has consumed. In some unicellular organisms, specialised vacuoles also play important roles in expelling excess water and some wastes from the cell.

Questions

1. Can you name the two organelles we have studied that contain their own genetic material?
2. If the organisation of a cell is destroyed due to some physical or chemical influence, what will happen?
3. Why are lysosomes known as suicide bags?
4. Where are proteins synthesised inside the cell?

Each cell thus acquires its structure and ability to function because of the organisation of its membrane and organelles in specific ways. The cell thus has a basic structural organisation. This helps the cells to perform functions like respiration, obtaining nutrition, and clearing of waste material, or forming new proteins.

Thus, the cell is the fundamental structural unit of living organisms. It is also the basic functional unit of life.

Cell Division

New cells are formed in organisms in order to grow, to replace old, dead and injured cells, and to form gametes required for reproduction. The process by which new cells are made is called **cell division**. There are two main types of cell division: **mitosis and meiosis**.

The process of cell division by which most of the cells divide for growth is called mitosis. In this process, each cell called mother cell

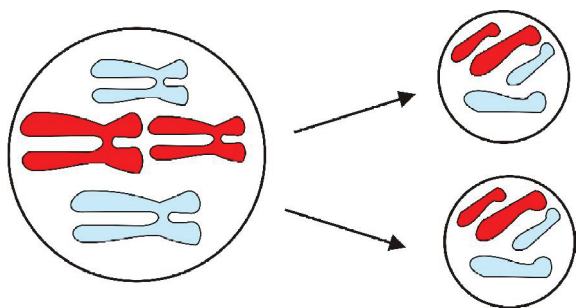


Fig. 1.7: Mitosis

divides to form two identical daughter cells (Fig. 1.7). The daughter cells have the same number of chromosomes as mother cell. It helps in growth and repair of tissues in organisms.

Specific cells of reproductive organs or tissues in animals and plants divide to form gametes, which after fertilisation give rise to

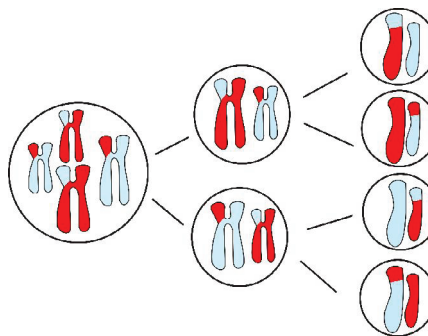


Fig. 1.8: Meiosis

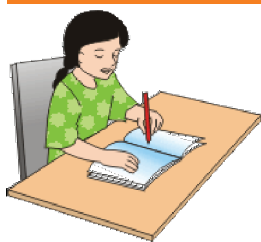
offspring. They divide by a different process called meiosis which involves two consecutive divisions. When a cell divides by meiosis it produces four new cells instead of just two (Fig. 1.8). The new cells only have half the number of chromosomes than that of the mother cells. Can you think as to why the chromosome number has reduced to half in daughter cells?



What you have learnt

- The fundamental organisational unit of life is the cell.
- Cells are enclosed by a plasma membrane composed of lipids and proteins.
- The cell membrane is an active part of the cell. It regulates the movement of materials between the ordered interior of the cell and the outer environment.
- In plant cells, a cell wall composed mainly of cellulose is located outside the cell membrane.
- The presence of the cell wall enables the cells of plants, fungi and bacteria to exist in hypotonic media without bursting.
- The nucleus in eukaryotes is separated from the cytoplasm by double-layered membrane and it directs the life processes of the cell.
- The ER functions both as a passageway for intracellular transport and as a manufacturing surface.
- The Golgi apparatus consists of stacks of membrane-bound vesicles that function in the storage, modification and packaging of substances manufactured in the cell.
- Most plant cells have large membranous organelles called plastids, which are of two types—chromoplasts and leucoplasts.

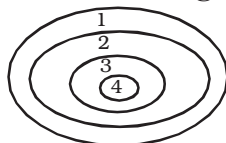
- Chromoplasts that contain chlorophyll are called chloroplasts and they perform photosynthesis.
- The primary function of leucoplasts is storage.
- Most mature plant cells have a large central vacuole that helps to maintain the turgidity of the cell and stores important substances including wastes.
- Prokaryotic cells have no membrane-bound organelles, their chromosomes are composed of only nucleic acid, and they have only very small ribosomes as organelles.
- Cells in organisms divide for growth of body, for replacing dead cells, and for forming gametes for reproduction.



Exercises

1. Make a comparison and write down ways in which plant cells are different from animal cells.
2. How is a prokaryotic cell different from a eukaryotic cell?
3. What would happen if the plasma membrane ruptures or breaks down?
4. What would happen to the life of a cell if there was no Golgi apparatus?
5. Which organelle is known as the powerhouse of the cell? Why?
6. Where do the lipids and proteins constituting the cell membrane get synthesised?
7. How does an *Amoeba* obtain its food?
8. What is osmosis?
9. Carry out the following osmosis experiment:
Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water. Now,
 - (a) Keep cup A empty
 - (b) Put one teaspoon sugar in cup B
 - (c) Put one teaspoon salt in cup C
 - (d) Put one teaspoon sugar in the boiled potato cup D.
 Keep these for two hours. Then observe the four potato cups and answer the following:
 - (i) Explain why water gathers in the hollowed portion of B and C.
 - (ii) Why is potato A necessary for this experiment?
 - (iii) Explain why water does not gather in the hollowed out portions of A and D.
10. Which type of cell division is required for growth and repair of body and which type is involved in formation of gametes?

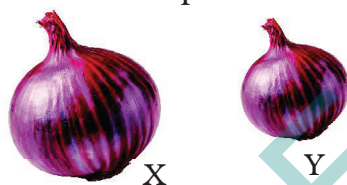
11. Observe the given diagram



If it represents a plant cell, which of the following best describes it? ()

- A) 1- Cell wall 2- Plasma membrane
3- Nucleus 4- Chromosome
- B) 1- Cell wall 2- Nucleus
3- Plasma membrane 4- Chromosome
- C) 1- Plasma membrane 2- Cell wall
3 - Chromosome 4- nucleus
- D) 1- Plasma membrane 2- Cell wall
3 - Nucleus 4- Chromosome

12. Observe the picture.



Which of the following statement is correct with respect to the above image ? ()

- A) Cells in onion X are big in size.
- B) The number of cells in both onions is the same.
- C) The number of cells in onion X is less than in onion Y.
- D) No relation between the size of the onion and the size of its cells

13. Four students made the following statement regarding the number of chromosomes in the daughter cells formed by meiosis ()

Vani	The daughter cells have half the number of chromosomes compared to the mother cell.
Rani	The daughter cells have double the number of chromosomes compared to the mother cell.
Ramesh	The daughter cells have the same number of chromosomes as the mother cell.
Suresh	The number of chromosomes in the daughter cells depends on the type of cell.

- A) Vani B) Rani C) Ramesh D) Suresh

ANNEXURE

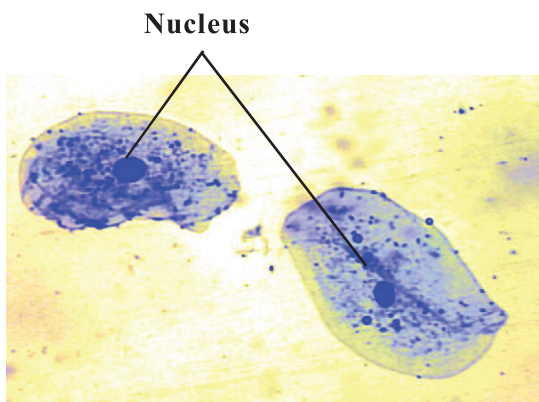


Fig No.1 Nucleus in Cheek Cells

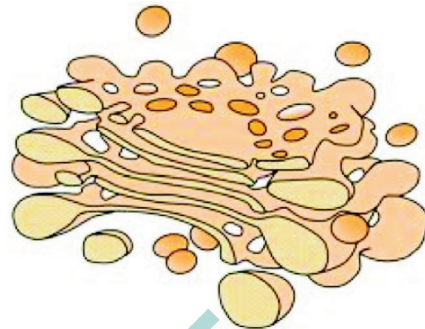
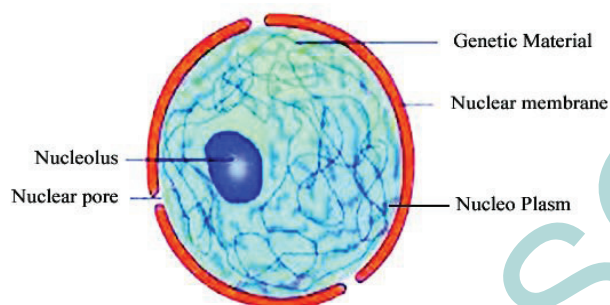


Fig No. 4 Golgi apparatus



**Fig No.2 Nucleus
(View through Electron microscope)**

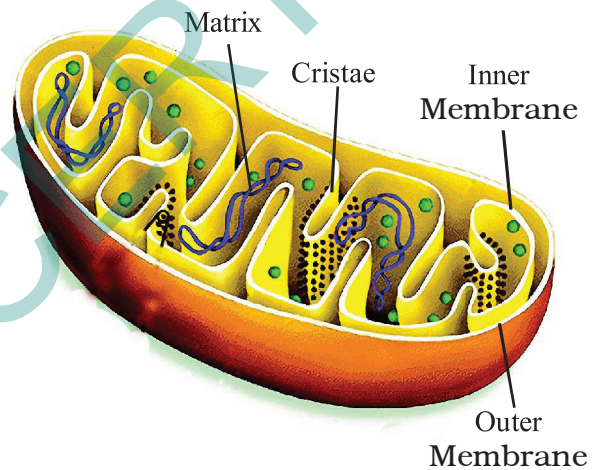


Fig No. 5 L.S. of Mitochondria

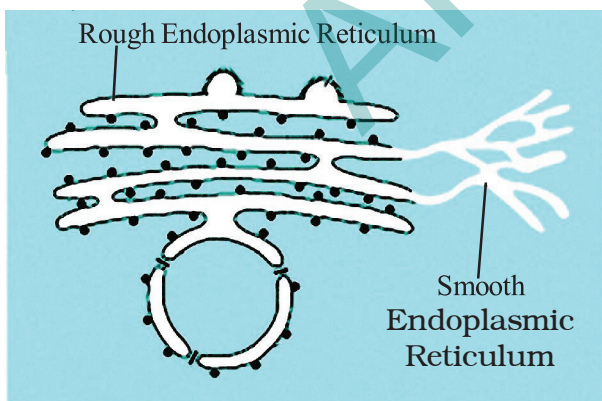


Fig No.3 Endoplasmic Reticulum

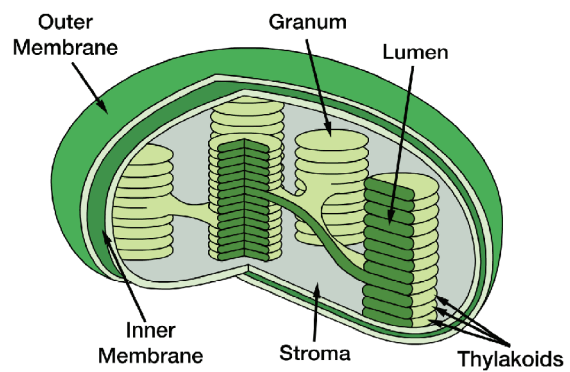


Fig No. 6 Chloroplast

Chapter 2



TISSUES

From the last chapter, we recall that all living organisms are made of cells. In unicellular organisms, a single cell performs all basic functions. For example, in *Amoeba*, a single cell carries out movement, intake of food, gaseous exchange and excretion. But in multi-cellular organisms there are millions of cells. Most of these cells are specialised to carry out specific functions. Each specialised function is taken up by a different group of cells. Since these cells carry out only a particular function, they do it very efficiently. In human beings, muscle cells contract and relax to cause movement, nerve cells carry messages, blood flows to transport oxygen, food, hormones and waste material and so on. In plants, vascular tissues conduct food and water from one part of the plant to other parts. So, multi-cellular organisms show division of labour. Cells specialising in one function are often grouped together in the body. This means that a particular function is carried out by a cluster of cells at a definite place in the body. This cluster of cells, called a tissue, is arranged and designed so as to give the highest possible efficiency of function. Blood, phloem and muscle are all examples of tissues.

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

2.1 Are Plants and Animals Made of Same Types of Tissues?

Let us compare their structure and functions. Do plants and animals have the same structure? Do they both perform similar functions?

There are noticeable differences between the two. Plants are stationary or fixed – they don't move. Since they have to be upright, they have a large quantity of supportive tissue. The supportive tissue generally has dead cells.

Animals on the other hand move around in search of food, mates and shelter. They consume more energy as compared to plants. Most of the tissues they contain are living.

Another difference between animals and plants is in the pattern of growth. The growth in plants is limited to certain regions, while this is not so in animals. There are some tissues in plants that divide throughout their life. These tissues are localised in certain regions. Based on the dividing capacity of the tissues, various plant tissues can be classified as growing or meristematic tissue and permanent tissue. Cell growth in animals is more uniform. So, there is no such demarcation of dividing and non-dividing regions in animals.

The structural organisation of organs and organ systems is far more specialised and localised in complex animals than even in very complex plants. This fundamental difference reflects the different modes of life pursued by these two major groups of organisms, particularly in their different feeding methods. Also, they are differently adapted for a sedentary existence on one hand (plants) and active locomotion on the other (animals), contributing to this difference in organ system design.

It is with reference to these complex animal and plant bodies that we will now talk about the concept of tissues in some detail.

Questions

1. What is a tissue?
2. What is the utility of tissues in multi-cellular organisms?

2.2 Plant Tissues

2.2.1 MERISTEMATIC TISSUE

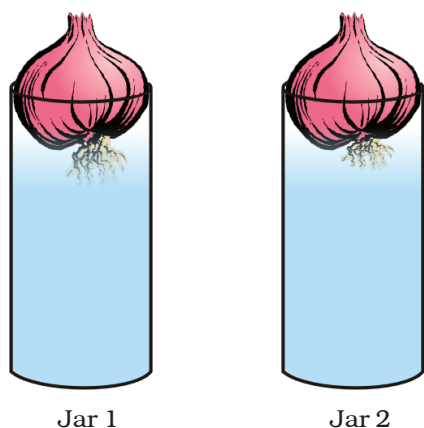


Fig. 2.1: Growth of roots in onion bulbs

Activity 2.1

- Take two glass jars and fill them with water.
- Now, take two onion bulbs and place one on each jar, as shown in Fig. 2.1.
- Observe the growth of roots in both the bulbs for a few days.
- Measure the length of roots on day 1, 2 and 3.
- On day 4, cut the root tips of the onion bulb in jar 2 by about 1 cm. After this, observe the growth of roots in both the jars and measure their lengths each day for five more days and record the observations in tables, like the table below:

Length	Day 1	Day 2	Day 3	Day 4	Day 5
Jar 1					
Jar 2					

- From the above observations, answer the following questions:
 1. Which of the two onions has longer roots? Why?
 2. Do the roots continue growing even after we have removed their tips?
 3. Why would the tips stop growing in jar 2 after we cut them?

The growth of plants occurs only in certain specific regions. This is because the dividing tissue, also known as **meristematic tissue**, is located only at these points. Depending on the region where they are present, meristematic tissues are classified as **apical, lateral and intercalary** (Fig. 2.2). New cells produced by meristem are initially like those of meristem itself, but as they grow and mature, their characteristics slowly change and they become differentiated as components of other tissues.

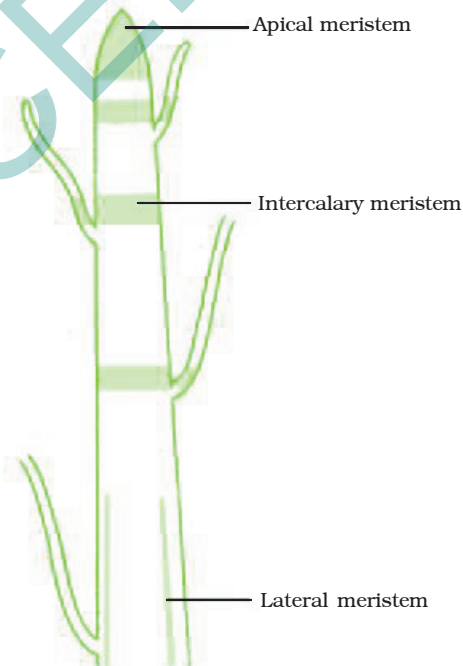


Fig. 2.2: Location of meristematic tissue in plant body

Apical meristem is present at the growing tips of stems and roots and increases the length of the stem and the root. The girth of the stem or root increases due to lateral meristem (cambium). Intercalary meristem seen in some plants is located near the node.

Cells of meristematic tissue are very active, they have dense cytoplasm, thin cellulose walls and prominent nuclei. They lack vacuoles. Can we think why they would lack vacuoles? (You might want to refer to the functions of vacuoles in the chapter on cells.)

2.2.2 PERMANENT TISSUE

What happens to the cells formed by meristematic tissue? They take up a specific role and lose the ability to divide. As a result, they form a permanent tissue. This process of taking up a permanent shape, size, and a function is called differentiation. Differentiation leads to the development of various types of permanent tissues.

3. Can we think of reasons why there would be so many types of cells?
- We can also try to cut sections of plant roots. We can even try cutting sections of root and stem of different plants.

2.2.2 (i) SIMPLE PERMANENT TISSUE

A few layers of cells beneath the epidermis are generally simple permanent tissue. Parenchyma is the most common simple permanent tissue. It consists of relatively unspecialised cells with thin cell walls. They are living cells. They are usually loosely arranged, thus large spaces between cells (intercellular spaces) are found in this tissue (Fig. 2.4 a). This tissue generally stores food. In some situations, it contains chlorophyll

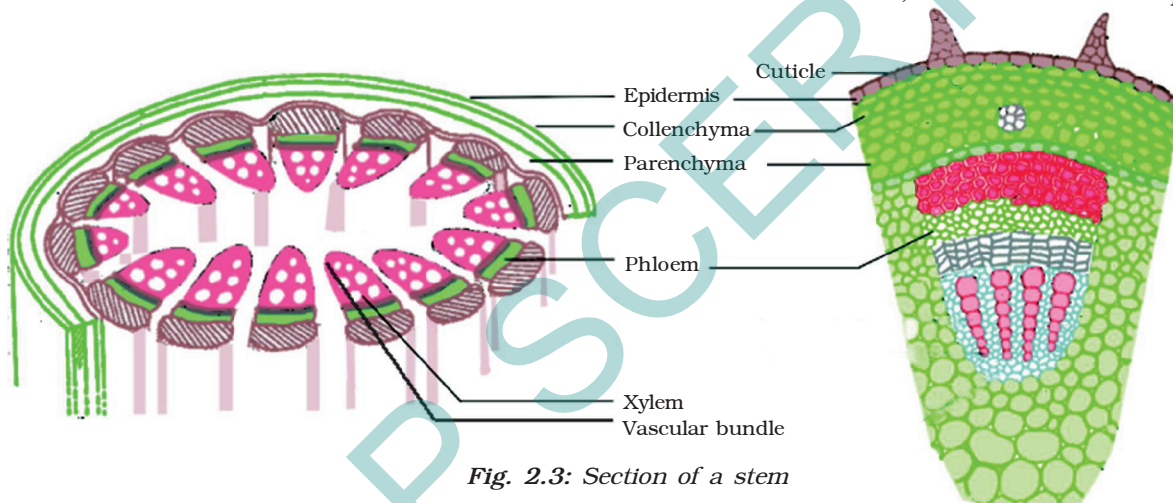


Fig. 2.3: Section of a stem

Activity 2.2

- Take a plant stem and with the help of your teacher cut into very thin slices or sections.
- Now, stain the slices with safranin. Place one neatly cut section on a slide, and put a drop of glycerine.
- Cover with a cover-slip and observe under a microscope. Observe the various types of cells and their arrangement. Compare it with Fig. 6.3.
- Now, answer the following on the basis of your observation:
 1. Are all cells similar in structure?
 2. How many types of cells can be seen?

and performs photosynthesis, and then it is called **chlorenchyma**. In aquatic plants, large air cavities are present in parenchyma to help them float. Such a parenchyma type is called **aerenchyma**.

The flexibility in plants is due to another permanent tissue, **collenchyma**. It allows bending of various parts of a plant like tendrils and stems of climbers without breaking. It also provides mechanical support. We can find this tissue in leaf stalks below the epidermis. The cells of this tissue are living, elongated and irregularly thickened at the corners. There is very little intercellular space (Fig. 2.4 b).

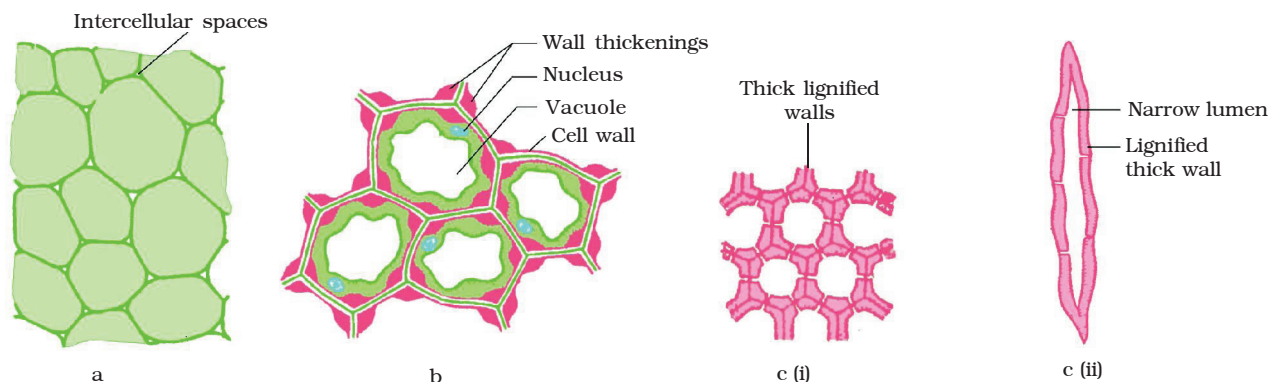


Fig. 2.4: Various types of simple tissues: (a) Parenchyma (b) Collenchyma (c) Sclerenchyma (i) transverse section, (ii) longitudinal section.

Yet another type of permanent tissue is **sclerenchyma**. It is the tissue which makes the plant hard and stiff. We have seen the husk of a coconut. It is made of sclerenchymatous tissue. The cells of this tissue are dead. They are long and narrow as the walls are thickened due to lignin. Often these walls are so thick that there is no internal space inside the cell (Fig. 2.4 c). This tissue is present in stems, around vascular bundles, in the veins of leaves and in the hard covering of seeds and nuts. It provides strength to the plant parts.

Activity 2.3

- Take a freshly plucked leaf of *Rhoeo*.
- Stretch and break it by applying pressure.
- While breaking it, keep it stretched gently so that some peel or skin projects out from the cut.
- Remove this peel and put it in a petri dish filled with water.
- Add a few drops of safranin.
- Wait for a couple of minutes and then transfer it onto a slide. Gently place a cover slip over it.
- Observe under microscope.

What you observe is the outermost layer of cells, called epidermis. The epidermis is usually made of a single layer of cells. In some plants living in very dry habitats, the epidermis may be thicker since protection against water loss is critical. The entire surface of a plant has an outer covering epidermis. It protects all the parts of the plant. Epidermal cells on the aerial

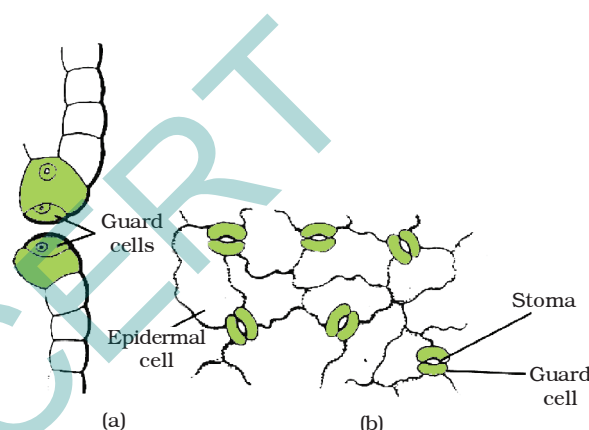


Fig. 2.5: Guard cells and epidermal cells: (a) lateral view, (b) surface view

parts of the plant often secrete a waxy, water-resistant layer on their outer surface. This aids in protection against loss of water, mechanical injury and invasion by parasitic fungi. Since it has a protective role to play, cells of epidermal tissue form a continuous layer without intercellular spaces. Most epidermal cells are relatively flat. Often their outer and side walls are thicker than the inner wall.

We can observe small pores here and there in the epidermis of the leaf. These pores are called **stomata** (Fig. 2.5). Stomata are enclosed by two kidney-shaped cells called guard cells. They are necessary for exchanging gases with the atmosphere. **Transpiration** (loss of water in the form of water vapour) also takes place through stomata.

Recall which gas is required for photosynthesis.
Find out the role of transpiration in plants.

Epidermal cells of the roots, whose function is water absorption, commonly bear long hair-like parts that greatly increase the total absorptive surface area.

In some plants like desert plants, epidermis has a thick waxy coating of cutin (chemical substance with waterproof quality) on its outer surface. Can we think of a reason for this?

Is the outer layer of a branch of a tree different from the outer layer of a young stem?

As plants grow older, the outer protective tissue undergoes certain changes. A strip of secondary meristem located in the cortex forms layers of cells which constitute the cork. Cells of cork are dead and compactly arranged without intercellular spaces (Fig. 2.6). They also have a substance called suberin in their walls that makes them impervious to gases and water.

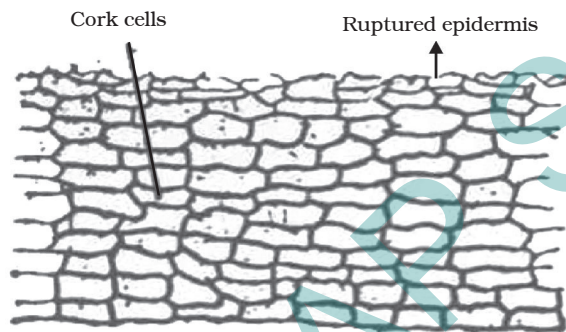


Fig. 2.6: Protective tissue

2.2.2 (ii) COMPLEX PERMANENT TISSUE

The different types of tissues we have discussed until now are all made of one type of cells, which look like each other. Such tissues are called **simple permanent tissue**. Yet another type of permanent tissue is complex tissue. **Complex tissues** are made of more than one type of cells. All these cells coordinate to perform a common function. **Xylem** and **phloem** are examples of such complex tissues. They are both conducting tissues and constitute a vascular bundle. Vascular tissue

is a distinctive feature of the complex plants, one that has made possible their survival in the terrestrial environment. In Fig. 2.3 showing a section of stem, can you see different types of cells in the vascular bundle?

Xylem consists of **tracheids**, **vessels**, **xylem parenchyma** (Fig. 2.7 a,b,c) and **xylem fibres**. Tracheids and vessels have thick walls, and many are dead cells when mature. Tracheids and vessels are tubular structures. This allows them to transport water and minerals vertically. The parenchyma stores food. Xylem fibres are mainly supportive in function.

Phloem is made up of five types of cells: **sieve cells**, **sieve tubes**, **companion cells**, **phloem fibres** and the **phloem parenchyma** [Fig. 2.7 (d)]. Sieve tubes are tubular cells with perforated walls. Phloem transports food from leaves to other parts of the plant. Except phloem fibres, other phloem cells are living cells.

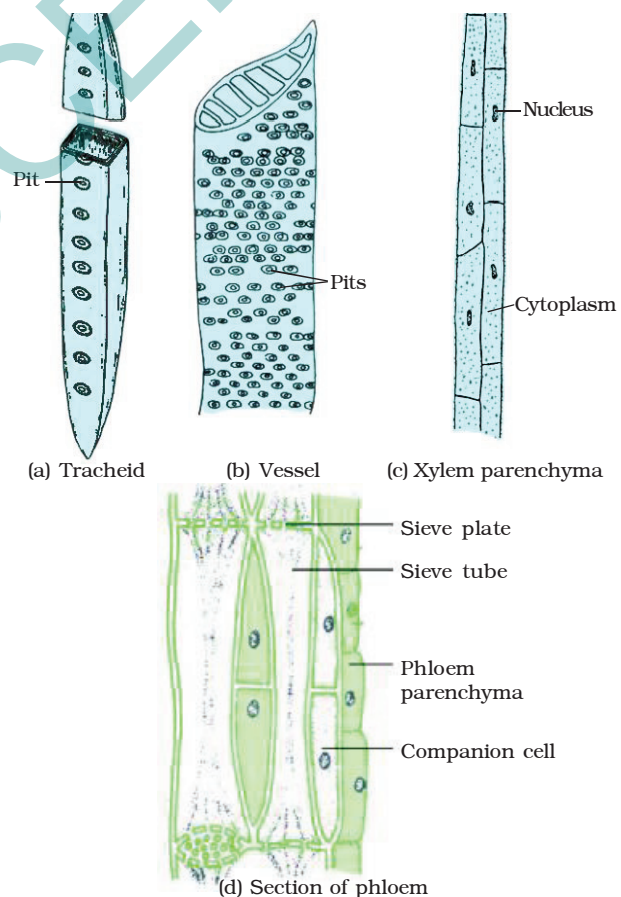


Fig. 2.7: Types of complex tissue

Questions

1. Name types of simple tissues.
2. Where is apical meristem found?
3. Which tissue makes up the husk of coconut?
4. What are the constituents of phloem?

2.3 Animal Tissues

When we breathe we can actually feel the movement of our chest. How do these body parts move? For this we have specialised cells called muscle cells (Fig. 2.8). The contraction and relaxation of these cells result in movement.

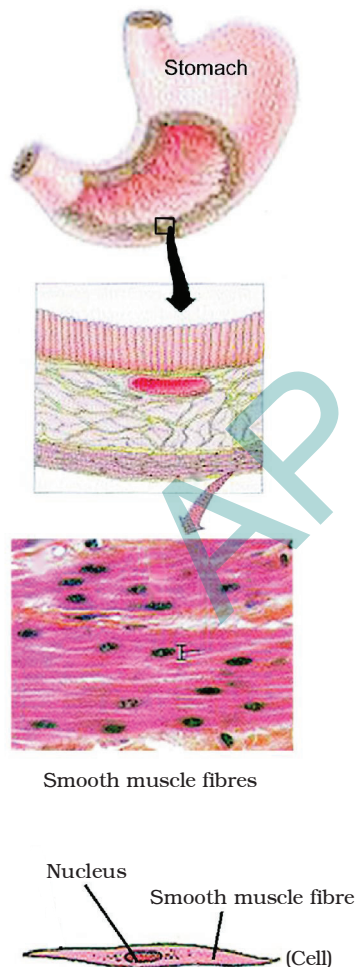


Fig. 2.8: Location of muscle fibres

During breathing we inhale oxygen. Where does this oxygen go? It is absorbed in the lungs and then is transported to all the body cells through blood. Why would cells need oxygen? The functions of mitochondria we studied earlier provide a clue to this question. Blood flows and carries various substances from one part of the body to the other. For example, it carries oxygen and food to all cells. It also collects wastes from all parts of the body and carries them to the liver and kidney for disposal.

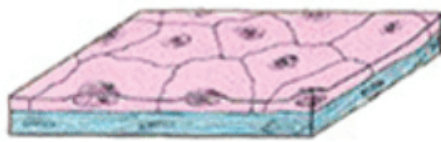
Blood and muscles are both examples of tissues found in our body. On the basis of the functions they perform we can think of different types of animal tissues, such as **epithelial tissue**, **connective tissue**, **muscular tissue** and **nervous tissue**. Blood is a type of connective tissue, and muscle forms muscular tissue.

2.3.1 EPITHELIAL TISSUE

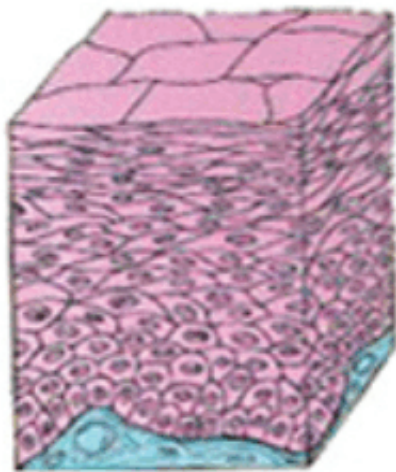
The covering or protective tissues in the animal body are epithelial tissues. Epithelium covers most organs and cavities within the body. It also forms a barrier to keep different body systems separate. The skin, the lining of the mouth, the lining of blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue. Epithelial tissue cells are tightly packed and form a continuous sheet. They have only a small amount of cementing material between them and almost no intercellular spaces. Obviously, anything entering or leaving the body must cross at least one layer of epithelium. As a result, the permeability of the cells of various epithelia play an important role in regulating the exchange of materials between the body and the external environment and also between different parts of the body. Regardless of the type, all epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane.

Different epithelia (Fig. 2.9) show differing structures that correlate with their unique functions. For example, in cells lining blood vessels or lung alveoli, where transportation of substances occurs through a selectively permeable surface, there is a simple flat kind

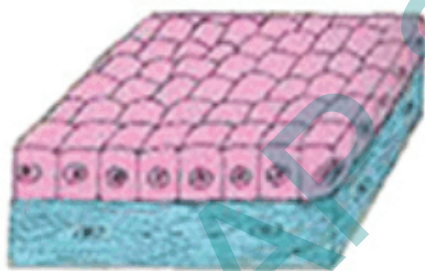
of epithelium. This is called the simple squamous epithelium (squama means scale of



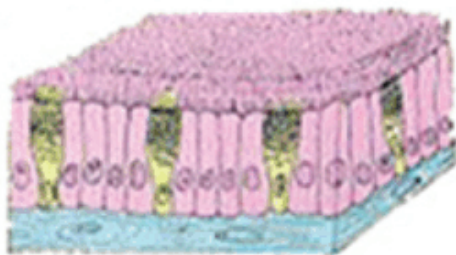
(a) Squamous



(b) Stratified squamous



(c) Cuboidal



(d) Columnar (Ciliated)

Fig. 2.9: Different types of epithelial tissues

skin). Simple squamous epithelial cells are extremely thin and flat and form a delicate lining. The oesophagus and the lining of the mouth are also covered with squamous epithelium. The skin, which protects the body, is also made of squamous epithelium. Skin epithelial cells are arranged in many layers to prevent wear and tear. Since they are arranged in a pattern of layers, the epithelium is called stratified squamous epithelium.

Where absorption and secretion occur, as in the inner lining of the intestine, tall epithelial cells are present. This columnar (meaning 'pillar-like') epithelium facilitates movement across the epithelial barrier. In the respiratory tract, the columnar epithelial tissue also has cilia, which are hair-like projections on the outer surfaces of epithelial cells. These cilia can move, and their movement pushes the mucus forward to clear it. This type of epithelium is thus ciliated columnar epithelium.

Cuboidal epithelium (with cube-shaped cells) forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support. Epithelial cells often acquire additional specialisation as gland cells, which can secrete substances at the epithelial surface. Sometimes a portion of the epithelial tissue folds inward, and a multicellular gland is formed. This is glandular epithelium.

2.3.2 CONNECTIVE TISSUE

Blood is a type of connective tissue. Why would it be called 'connective' tissue? A clue is provided in the introduction of this chapter! Now, let us look at this type of tissue in some more detail. The cells of connective tissue are loosely spaced and embedded in an intercellular matrix (Fig. 2.10). The matrix may be jelly like, fluid, dense or rigid. The nature of matrix differs in concordance with the function of the particular connective tissue.

Activity 2.4

- Take a drop of blood on a slide and observe different cells present in it under a microscope.

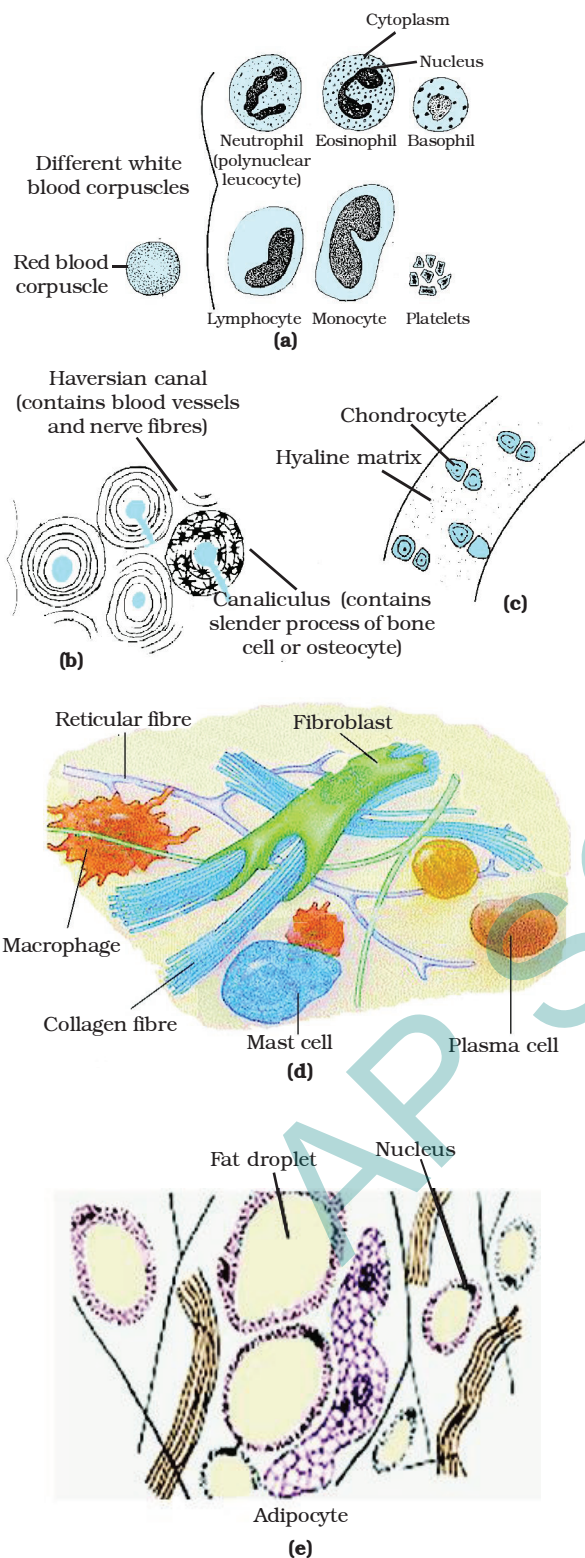


Fig. 2.10: Types of connective tissues: (a) types of blood cells, (b) compact bone, (c) hyaline cartilage, (d) areolar tissue, (e) adipose tissue

Blood has a fluid (liquid) matrix called **plasma**, in which **red blood corpuscles** (RBCs), **white blood corpuscles** (WBCs) and **platelets** are suspended. The plasma contains proteins, salts and hormones. Blood flows and transports gases, digested food, hormones and waste materials to different parts of the body.

Bone is another example of a connective tissue. It forms the framework that supports the body. It also anchors the muscles and supports the main organs of the body. It is a strong and nonflexible tissue (what would be the advantage of these properties for bone functions?). Bone cells are embedded in a hard matrix that is composed of calcium and phosphorus compounds.

Two bones can be connected to each other by another type of connective tissue called the **ligament**. This tissue is very elastic. It has considerable strength. Ligaments contain very little matrix and connect bones with bones. **Tendons** connect muscles to bones and are another type of connective tissue. Tendons are fibrous tissue with great strength but limited flexibility.

Another type of connective tissue, **cartilage**, has widely spaced cells. The solid matrix is composed of proteins and sugars. Cartilage smoothens bone surfaces at joints and is also present in the nose, ear, trachea and larynx. We can fold the cartilage of the ears, but we cannot bend the bones in our arms. Think of how the two tissues are different!

Areolar connective tissue is found between the skin and muscles, around blood vessels and nerves and in the bone marrow. It fills the space inside the organs, supports internal organs and helps in repair of tissues.

Where are fats stored in our body? Fat-storing **adipose tissue** is found below the skin and between internal organs. The cells of this tissue are filled with fat globules. Storage of fats also lets it act as an insulator.

2.3.3 MUSCULAR TISSUE

Muscular tissue consists of elongated cells, also called muscle fibres. This tissue is responsible for movement in our body.

Muscles contain special proteins called contractile proteins, which contract and relax to cause movement.

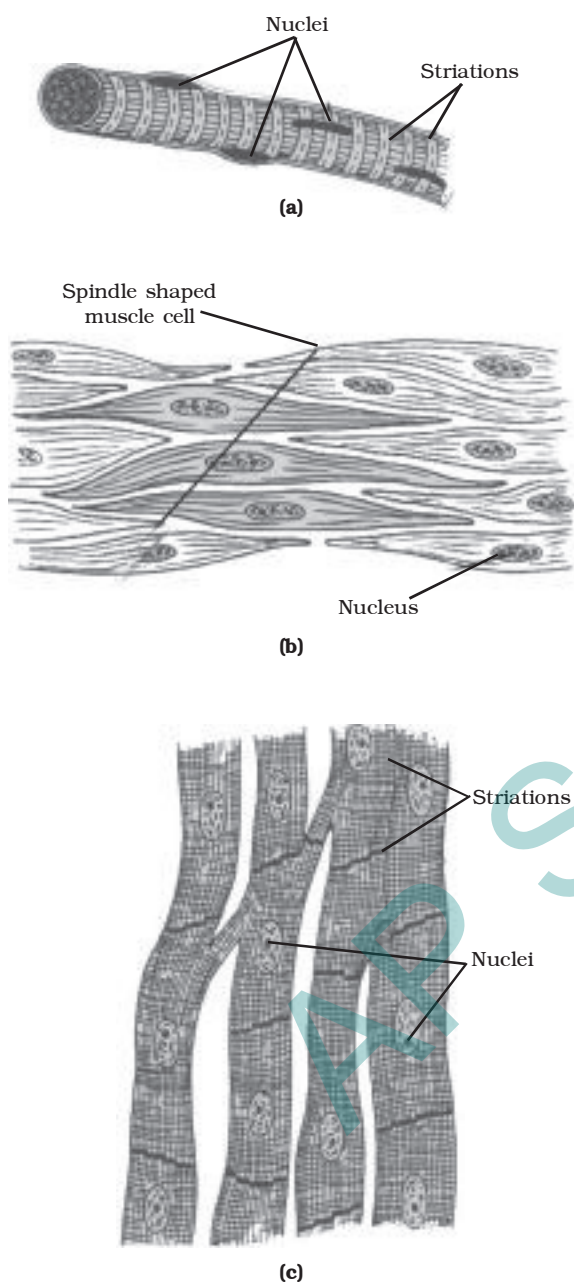


Fig. 2.11: Types of muscles fibres: (a) striated muscle, (b) smooth muscle, (c) cardiac muscle

We can move some muscles by conscious will. Muscles present in our limbs move when we want them to, and stop when we so decide. Such muscles are called voluntary muscles

[Fig. 2.11(a)]. These muscles are also called skeletal muscles as they are mostly attached to bones and help in body movement. Under the microscope, these muscles show alternate light and dark bands or striations when stained appropriately. As a result, they are also called **striated muscles**. The cells of this tissue are long, cylindrical, unbranched and multinucleate (having many nuclei).

The movement of food in the alimentary canal or the contraction and relaxation of blood vessels are involuntary movements. We cannot really start them or stop them simply by wanting to do so! **Smooth muscles** [Fig. 2.11(b)] or involuntary muscles control such movements. They are also found in the iris of the eye, in ureters and in the bronchi of the lungs. The cells are long with pointed ends (spindle-shaped) and uninucleate (having a single nucleus). They are also called **unstriated muscles** – why would they be called that?

The muscles of the heart show rhythmic contraction and relaxation throughout life. These involuntary muscles are called **cardiac muscles** [Fig. 2.11(c)]. Heart muscle cells are cylindrical, branched and uninucleate.

Activity 2.5

Compare the structures of different types of muscular tissues. Note down their shape, number of nuclei and position of nuclei within the cell in the Table 2.1.

Table 2.1:

Features	Striated	Smooth	Cardiac
Shape			
Number of nuclei			
Position of nuclei			

2.3.4 NERVOUS TISSUE

All cells possess the ability to respond to stimuli. However, cells of the nervous tissue are highly specialised for being stimulated and

then transmitting the stimulus very rapidly from one place to another within the body. The brain, spinal cord and nerves are all composed of the nervous tissue. The cells of this tissue are called nerve cells or neurons. A neuron consists of a **cell body** with a nucleus and cytoplasm, from which long thin hair-like parts arise (Fig. 2.12). Usually each neuron has a single long part (process), called the **axon**, and many short, branched

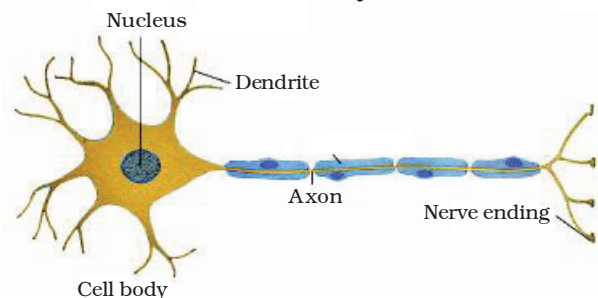


Fig. 2.12: Neuron-unit of nervous tissue



What you have learnt

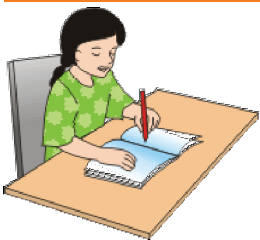
- Tissue is a group of cells similar in structure and function.
- Plant tissues are of two main types – meristematic and permanent.
- Meristematic tissue is the dividing tissue present in the growing regions of the plant.
- Permanent tissues are derived from meristematic tissue once they lose the ability to divide. They are classified as simple and complex tissues.
- Parenchyma, collenchyma and sclerenchyma are three types of simple tissues. Xylem and phloem are types of complex tissues.
- Animal tissues can be epithelial, connective, muscular and nervous tissue.
- Depending on shape and function, epithelial tissue is classified as squamous, cuboidal, columnar, ciliated and glandular.
- The different types of connective tissues in our body include areolar tissue, adipose tissue, bone, tendon, ligament, cartilage and blood.
- Striated, unstriated and cardiac are three types of muscle tissues.
- Nervous tissue is made of neurons that receive and conduct impulses.

parts (processes) called **dendrites**. An individual nerve cell may be up to a metre long. Many nerve fibres bound together by connective tissue make up a nerve.

The signal that passes along the nerve fibre is called a **nerve impulse**. Nerve impulses allow us to move our muscles when we want to. The functional combination of nerve and muscle tissue is fundamental to most animals. This combination enables animals to move rapidly in response to stimuli.

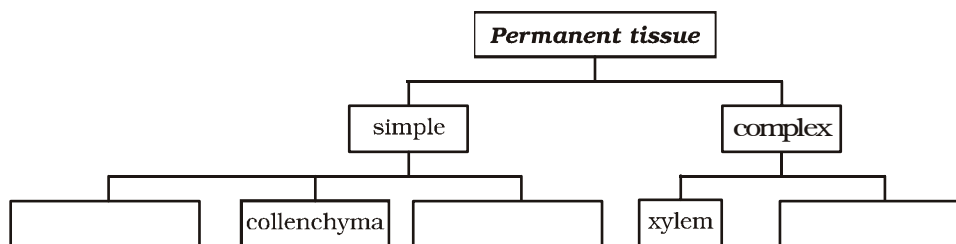
Questions

1. Name the tissue responsible for movement in our body.
2. What does a neuron look like?
3. Give three features of cardiac muscles.
4. What are the functions of areolar tissue?



Exercises

1. Define the term "tissue".
2. How many types of elements together make up the xylem tissue? Name them.
3. How are simple tissues different from complex tissues in plants?
4. Differentiate between parenchyma, collenchyma and sclerenchyma on the basis of their cell wall.
5. What are the functions of the stomata?
6. Diagrammatically show the difference between the three types of muscle fibres.
7. What is the specific function of the cardiac muscle?
8. Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body.
9. Draw a labelled diagram of a neuron.
10. Name the following.
 - (a) Tissue that forms the inner lining of our mouth.
 - (b) Tissue that connects muscle to bone in humans.
 - (c) Tissue that transports food in plants.
 - (d) Tissue that stores fat in our body.
 - (e) Connective tissue with a fluid matrix.
 - (f) Tissue present in the brain.
11. Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle.
12. Name the regions in which parenchyma tissue is present.
13. What is the role of epidermis in plants?
14. How does the cork act as a protective tissue?
15. Complete the following chart:



16. A Student has classified the cells into two different groups as shown below.

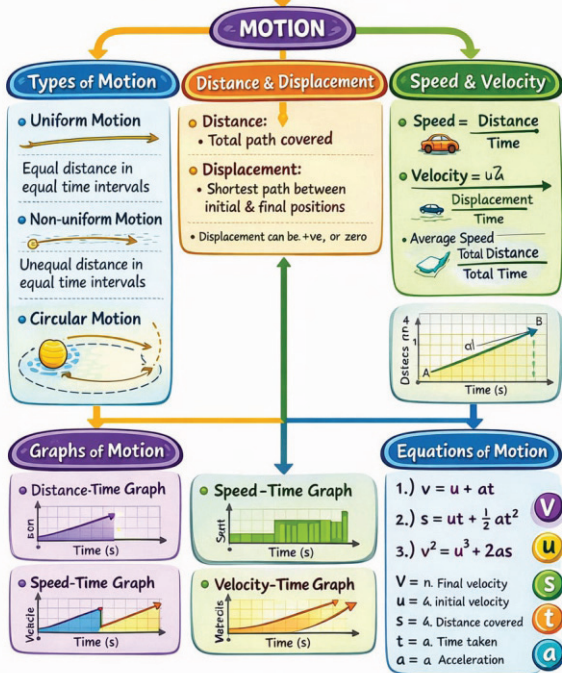
Group - A	Group - B
Xylem parenchyma	Phloem fibres
Sieve cells	Tracheids
Sieve tubes	Vessels

What might be Group - A and Group - B respectively? ()

- A) Simple, Complex
B) Cells in Xylem, cells in phloem
C) Living, non - living
D) Meristematic, Permanent
17. Choose the correct answer based on the given assertion and reason
- Assertion (A) : Differentiation leads to development of various types of permanent tissues.
- Reason (R) : It is the process by which cells develop permanent shape, size and function. ()
- A) A is true but R is false.
B) A is false but R is true.
C) Both A and R are true. R is the correct explanation of A.
D) Both A and R are true. R is not be correct explanation of A.
18. Why do Eskimos living in tundras have a thicker layer of adipose tissue under their skin? ()
- A) To help muscles contract and relax faster in cold weather
B) To store extra oxygen for breathing in cold condition
C) To reduce heat loss and act as an insulator
D) To make their skin harder and stronger



MOTION



MATTER IN OUR SURROUNDINGS

Anything that has mass and occupies space

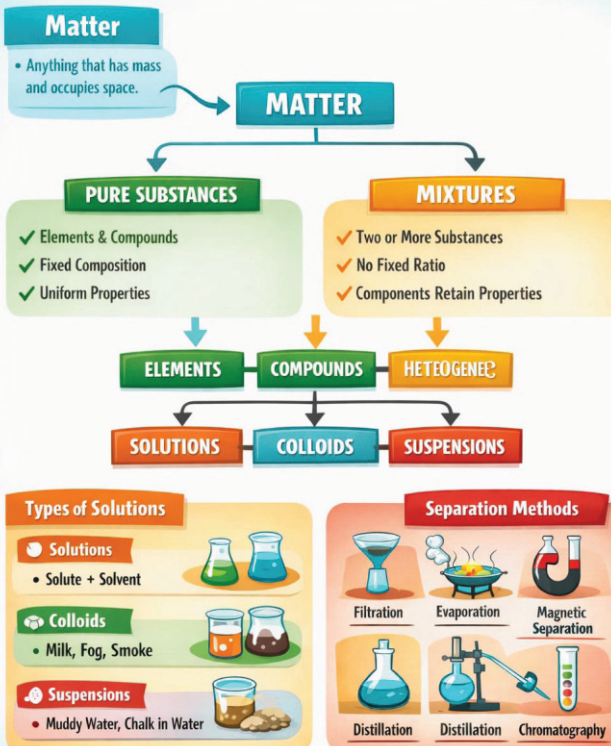


FORCE AND LAWS OF MOTION

Class 9



Is Matter Around Us Pure?





FUNDAMENTAL DUTIES

Fundamental duties: It shall be the duty of every citizen of India-

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence.
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;
- (k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be ward between the age of six and fourteen years;

- Constitution of India,
Part IV A (Article 51 A)

Right of Children to Free and Compulsory Education (RTE) Act, 2009

The RTE Act provides for the right of children to free and Compulsory Education to every child in the age group of 6 – 14 years which came into force from 1st April 2010 in Andhra Pradesh.

Important provisions of RTE Act

- Ensure availability of schools within the reach of the children.
- Improve School infrastructure facilities.
- Enroll children in the class appropriate to his / her age.
- Children have a right to receive special training in order to be at par with other children.
- Providing appropriate facilities for the education of children with special needs on par with other children.
- No child shall be liable to pay any kind of fee or charges or expenses which may prevent him or her from pursuing and completing the elementary education. No test for admitting the children in schools.
- No removal of name and repetition of the child in the same class.
- No child admitted in a school shall be held back in any class or expelled from school till the completion of elementary education.
- No child shall be subjected to physical punishment or mental harassment.
- Admission shall not be denied or delayed on the ground that the transfer and other certificates have not been provided on time.
- Eligible candidates alone shall be appointed as teachers.
- The teaching learning process and evaluation procedures shall promote achievement of appropriate competencies.
- No board examinations shall be conducted to the children till the completion of elementary education.
- Children can continue in the schools even after 14 years until completion of elementary education.
- No discrimination and related practices towards children belonging to backward and marginalized communities.
- The curriculum and evaluation procedures must be in conformity with the values enshrined in the constitution and make the child free of fear and anxiety and help the child to express views freely.