

CLASS - 8

Date - 4.11.2024

Subject - Biology

Teacher - Nidhi Rana

Chapter - 2 Cell - The Unit of Life.

Good Morning Students,

This lesson is of Class-8 for the subject of Biology

Topic - Cell - [The unit of Life] which is covered in Chapter - 2 'Cell - The unit of life' starting on Page-7 of your text book titled - 'Concise Biology - Selina

Publications and is being submitted to you on 4.11.2024.

All of you may now please open page no. 7 of your text book. and carefully listen to me. I will be asking you a few questions in between the chapter.

So let us begin with - Cell : The unit of life

All living organisms, from a simple bacteria to a multicellular organism like an elephant, are made up of small units or building blocks called the 'Cells'

Cell is the smallest part of the body of an organism which is capable of independent existence and of performing the essential functions of life. To elaborate it, I would say -

At the structural level all living organisms are composed of cells i.e. the tiny living units

Also, each and every cell, whether as a unicellular organism or as a part of multicellular organism, is capable of performing the essential functions of life

Thus we can say - Cell is the structural and functional unit of life.

Cells are tiny living units which cannot be seen with the naked eyes. We need magnifying aids like microscope to observe the cells.

Most organisms start their life from a single cell called zygote which is formed after the fertilization of male and female gamete.

Before going further, let me ask you a few questions children. You may pause the audio

for 3 minutes to write down the answers to the following questions -

Q.No 1 Name the structural and functional unit of Life

Q.No. 2. Name the term given to the single cell from which all organisms start their life.

Now you may pause the audio for 3 minutes

3 Minutes break is over children.

Before continuing with the chapter, let me give you answers to the questions I asked you before break

Ans 1 Cell - is the structural and functional unit of life

Ans 2 All living organisms start their life from a single cell called Zygote.

Now children let us continue the chapter with -

Invention of microscope and discovery of a cell.

The invention of microscope during 17th century was instrumental in the discovery of the cell

Anton Van Leeuwenhoek, a Dutch lens maker and microscopist was the first to observe minute microscopic organisms in rainwater using his simple microscope. His microscopes were called simple

microscopes because they consisted of a single biconvex lens. Some of these microscopes had a considerable magnifying power upto 200 times.

All children may please look at Fig 2.1 on Page 7 showing Leeuwenhoek's simple microscope. In this microscope, eye was kept close to the lens on one side and the object was mounted on the needle like screw point on the opposite side of the lens. With such simple microscope not much magnification could be achieved.

Later Robert Hooke an English scientist developed a microscope by using two lenses to form Compound microscope.

In Hooke's microscope the object to be seen was placed on the stage below and light from an oil flame was thrown on it by means of a concave mirror. All children may please see Fig 2.2A on Page No 8 of your textbook showing the Robert Hooke's microscope. Robert Hooke observed that the cork was composed of box like compartments, forming a honeycomb structure. He named the compartments as cells, thus coined the term "Cell". However the cells which Hooke saw were all dead cells and they only represented the boundaries of the cells i.e. the cell walls. To refresh your knowledge I would like to mention here that cork is derived from the bark of a tree and is a dead tissue.

Now all of you please look at the Fig 2.3 showing a modern compound microscope which is greatly improved design of the original Hooke's microscope. A source of light illuminates the specimen, which the observer views through the two magnifying lenses - Eye piece and objective lens. An ordinary compound microscope may magnify an object up to a maximum of about 2000 times their original size. Later during 1930 to 1946, a much better type of microscope, the electron microscope was developed. Instead of visible light, a beam of electrons is used in this microscope, which are bent by magnets and a magnification of over 2,00,000 times is achieved. Before the advent of electron microscopy a cell was described as having an outer limiting cell membrane, a nucleus and cytoplasm. The structures of most of the cell organelles like the endoplasmic reticulum, mitochondria, chloroplasts etc were known and understood only after using an electron microscope.

Now again let us take a short break.

Answer the following questions during the break.

Q.No-1 Who coined the term 'Cell'?

Q.No-2 Name the kind of microscope that consists of single biconvex lens.

Q.No-3 Name the kind of mirror used for throwing light on the object in Hooke's microscope.

Children you may pause the audio for break now. Break is over children. Firstly listen to the answers of the questions being asked before the break.

Ans1 Term cell was coined by Robert Hooke.

Ans2 Simple microscope has single biconvex lens.

Ans3 Concave mirror was used for throwing light on the object in Hooke's microscope.

Now children let us take up the next topic Cell Theory.

In 1838, German botanist Matthias Schleiden proposed that all plants are made up of cells that perform various life processes. A year later in 1839 a German zoologist Theodor Schwann made similar observations about animals.

Work of these two scientists paved the way for the development of cell theory. In 1858, Rudolf Virchow, a German pathologist, established that all cells arise from pre-existing cells. After this observation made by Virchow cell theory got an additional dimension.

The Cell Theory, thus, states 3 major points:-

1. The cell is the smallest unit of structure of all living things.
2. The cell is the unit of function of all living things.
3. All cells arise from pre-existing cells.

Now let me elaborate these points to you by taking example -

- 1) Firstly Cell is the structural unit To understand it we can say that if we take any part of a living organism - a plant or an animal - under the microscope we will see the cellular structure. Thus it implies that all living organisms are made up of cells.
- 2) Cell is the functional unit of living organisms. i.e. any function in the body of living organism is due to the activity of its cells. For eg - movement in animals is brought about by the contraction and relaxation of muscle cells. Similarly if we talk about plant - then in plant Photosynthesis is the process of manufacturing food by the plants. This process of photosynthesis is carried out by the cells in the leaves of the plant. Similarly you will find that all the activities of an organism are basically the activities occurring in the cells of the organism.

- 3) Cells arise from preexisting cells.

Cells in the body of an organism continuously die and are replaced by new ones. New cells are formed by division of younger pre existing cells. Similarly new organisms are formed from a single cell zygote, which divides repeatedly to form a multicellular organism. To refresh your knowledge I would like to mention here that zygote is a single cell formed after the fertilization of male and female gametes. All organisms start their life from a single cell called zygote.

Now children, cells vary in their number, size and shape in (i) different organisms. and also in (ii) different parts of an organism.

Bigger organism has greater number of cells in its body. Depending upon the number we have -

- (i) Single celled organisms or unicellular organisms i.e. made up of just one single cell Eg. Bacteria
- (ii) Few celled organisms - are made up of relatively fewer number of cells i.e. just a few hundred or a few thousand cells. Eg Volvox, Spirogyra
[These are different types of algae.]

- iii) Multicelled organism or multicellular organisms which are made up of millions and billions of cells. For Eg Human beings.

Now Let us talk about 'Cell size'.

Cells are extremely small and can be seen only when magnified and observed through microscope.

It is for your information children that -

- a) Smallest cells are those of bacteria ranging from 0.3 to 5 micrometer. In human body Red blood cells are about 7 micrometer in size. Children 1 micrometer is one millionth of a meter.
- b) Longest cells are the nerve cells which may extend from your finger tip up to the spinal cord inside the backbone.
- c) Largest cells are the bird's eggs. Ostrich egg is the largest single cell of the living world today. It is important to note here that - Cells generally remain small in size and this is because of two main reasons -
 - 1) Different regions of a cell can communicate with each other rapidly for the cell to function efficiently. Thus an efficient communication system is established within the entire body.
 - 2) Cells have a large surface area/volume ratio for greater diffusion of substances in and out of the cell. Larger surface area to volume of a cell helps in greater diffusion or exchange of -
 - (i) Nutrients into the cell
 - (ii) Excretion of metabolic waste from cell to outside
 - (iii) Respiratory gases i.e. O_2 into the cell and CO_2 out of the cell
 - (iv) Also, any damage to the cell can be easily repaired.

Now children let us take another short break

During this break I will give you a small activity to understand the benefit of larger surface area to volume ratio

Children imagine you have a cube A with each of its sides measuring 2mm. Calculate the surface area of cube A. (Surface Area = side $\times$ side $\times$ no. of surfaces)
 Now suppose you cut this cube into 8 equal smaller cubes by reducing each side to half of its previous length. i.e. 1mm. Let us call these 8 cubes formed as cubes 'B'. (with each side 1mm) Calculate the surface area of Cube B.
 (Surface area of cube B = side $\times$ side $\times$ no of surface)
 Now find out the Total surface area of all the 8 cubes 'B' taken together

(i.e. Surface area of cube B $\times$ 8)

Now children you may pause the audio and find out the total surface area of Cube A and total surface area of all the 8 smaller cubes B formed/cut out of the cube A.

Break is over children Let us see the results of surface areas obtained.

$$\text{Cube A - Total surface area} = 2\text{mm} \times 2\text{mm} \times 6 = 24 \text{ sq. mm.}$$

Total surface area of smaller 8 cubes formed from cube A =

$$= 1\text{mm} \times 1\text{mm} \times 6 \text{ (surfaces)} \times 8 \text{ pieces} = 48 \text{ sqmm}$$

Thus we see that the surface area of smaller cubes taken together is double that of the original larger cube. However the volume in both cases still remains the same.

To conclude smaller the size of a cell, larger will be the surface area to volume ratio and greater will be the diffusion of substances in and out of the cell.

Now children let us talk about the shapes of the cells. Cells vary greatly in shape which is often determined by the function they perform.

Cells may be spherical, oval, disc like, polygonal, rectangular, cuboid, thread like, flat or even irregular. All students may please see Fig 2.5 showing some of the different kinds of cell shapes. To illustrate that the functions determine the shape of the cells, let me give you a few examples.

- (i) Human Red blood cells are circular and biconcave not spherical because they lack nucleus. This biconcave shape helps them to pass through narrow capillaries and increase their surface area so that they can carry/transport more oxygen.
- (ii) White blood cells are amoeboid i.e. amoeba like movement with pseudopodia that helps the white blood cells to come out of the capillary walls easily.
- (iii) Nerve cells are long to conduct impulses/signals to distant parts of the body from brain and viceversa with rapidity.
- (iv) Muscle cells are contractile i.e. they can contract and relax to bring out movements of body parts.
- (v) Guard cells that surround the stomatal pore or stomata in the leaves are bean shaped to open and close the stomata or stomatal pore.

Children now Let us conclude our discussion here. Next time we will take up the structure of a cell.

Now I will give you some home assignment questions. All students have to answer these home assignment questions in the notebooks.

Home assignment questions are as follows -

Q.No1 List various substances which are ensured greater diffusion due to large surface area/volume ratio of the cells.

Q.No2 What is cell theory? Who propounded it and when?

Q.No3 Do you think the cells of an elephant would be larger than the cells of a rat? Discuss.