

## CHAP 5: FUNDAMENTAL UNIT OF LIFE

In this chapter we explore, what is a cell. Why is cell called the fundamental unit of life? We also find out who discovered the cell for the first time and also the cell theory. Most importantly we study what are the organs of the cell.

<b>What is a cell?</b>	The <b>cell</b> is the structural and functional unit of all known living organisms. It is the smallest unit of an organism that is classified as living, and is often called the building block of life.	<b>Plasma Membrane or Cell Membrane</b> <ul style="list-style-type: none"><li>• The <b>cell membrane</b> is the biological membrane separating the interior of a cell from the outside environment. It is a semipermeable layer found in all cells. It contains primarily proteins and lipids.</li><li>• 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.</li><li>• Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called diffusion.</li><li>• Water can move across the cell membrane by a process called osmosis.</li></ul>
<ul style="list-style-type: none"><li>• The largest known cell is an unfertilized ostrich egg cell.</li><li>• The word <i>cell</i> comes from the Latin <i>cellula</i>, meaning, a small room.</li><li>• The name 'cell' was chosen by Robert Hooke in a book he published in 1665.</li><li>• All organisms are made up of cells. There are single cell /unicellular organisms like Amoeba, Chlamydomonas, Paramecium and bacteria. There are also multi cellular (multi means many ) organisms fungi, plants and animals.</li><li>• The shape and size of the cells are related to the specific function they perform. This is due to the division of labour (each kind of cell does a particular kind of work).</li></ul>		<b>Diffusion</b> Diffusion is the flow of energy or matter from a higher concentration to a lower concentration, resulting in an even distribution.
<b>What is cell theory?</b>	The cell theory, first developed in 1839 by Matthias Jakob Schleiden and Theodor Schwann, states that all organisms are composed of one or more cells. All cells come from preexisting cells. Vital functions of an organism occur within cells, and all cells contain the hereditary information necessary for regulating cell functions and for transmitting information to the next generation of cells.	<b>Osmosis</b> The movement of water molecules through such a selectively permeable membrane is called osmosis. Thus, osmosis is the passage of water from a region of high water concentration through a semi-permeable membrane to a region of low water concentration.
<b>What is the fundamental structure of cell?</b>	The cell has plasma membrane, nucleus and cytoplasm.	<b>Endocytosis:</b> The process by which an Amoeba acquires its food.
<b>What is a cell organelle?</b>	In cell biology, an <b>organelle</b> is a specialized subunit within a cell that has a specific function, and is usually separately enclosed within its own membrane. They are endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, plastids and vacuoles.	<b>Cell Wall</b> <ul style="list-style-type: none"><li>• 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.</li><li>• The plant cell wall is mainly composed of cellulose. Cellulose is a complex substance and provides structural strength to plants.</li><li>• Due to presence of cell wall, plant cells can withstand much greater changes in the surrounding medium than animal cells.</li></ul>
<b>What are prokaryotes?</b>	The <b>prokaryotes</b> are a group of organisms that lack a cell nucleus (= karyon), or any other membrane-bound organelles.	<b>Nucleus</b> <ul style="list-style-type: none"><li>• The <b>nucleus</b> also sometimes referred to as the "control center", is a membrane-enclosed organelle found in eukaryotic cells.</li><li>• It contains most of the cell's genetic material, organized as DNA molecules to form chromosomes. The genes within these chromosomes are the cell's nuclear genome.</li><li>• The function of the nucleus is to maintain the integrity of these genes and to control the activities of the cell by regulating gene expression--the nucleus is therefore the control center of the cell.</li><li>• The nucleus plays a central role in cellular reproduction, the process by which a single cell divides and forms two new cells.</li></ul>
<b>What are eukaryotes?</b>	A <b>eukaryote</b> is an organism whose cells contain complex structures enclosed within membranes. Almost all large organisms are eukaryotes, including animals, plants and fungi. The presence of a nucleus gives eukaryotes their name, which comes from the Greek [eu (eu, "good", "noble" & "true") and (karyon, "nut" & "kernel")]. Most eukaryotic cells contain other membrane-bound organelles such as mitochondria, chloroplasts and the Golgi apparatus.	

## Cytoplasm

- The **cytoplasm** is the part of a cell that is enclosed within the plasma membrane.
- In eukaryotic cells, the cytoplasm contains organelles, such as mitochondria, which are filled with liquid that is kept separate from the rest of the cytoplasm by biological membranes.
- The contents of the cell nucleus are not part of the cytoplasm and are instead called the nucleoplasm.
- The cytoplasm is the site where most cellular activities occur.

## Endoplasmic reticulum

- The **endoplasmic reticulum (ER)** is a eukaryotic organelle that forms an interconnected network of tubules and sheets within cells.
- 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.
- The ER functions both as a passageway for intracellular transport and as a manufacturing surface.

## Biogenesis.

- The lipids and proteins manufactured by SER help in building the cell membrane. The process is known as membrane biogenesis.

## Golgi Apparatus,

- The **Golgi apparatus** is an organelle found in most eukaryotic cells.
- It consists of a system of membrane-bound vesicles arranged approximately parallel to each other in stacks called cisterns.
- 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.

## Lysosomes

- **Lysosomes** are organelles containing digestive enzymes . They are found in animal cells, while in plant cells the same roles are performed by the vacuole.
- Lysosomes are a kind of waste disposal system of the cell.

## Lysosomes

- Lysosomes help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles.
- During the disturbance in cellular metabolism, lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are also known as the 'suicide bags' of a cell.
- Lysosomes are membrane-bound sacs filled with digestive enzymes. These enzymes are made by RER.

## Mitochondria

- A **mitochondrion** (plural **mitochondria**) is a membrane-enclosed organelle found in most eukaryotic cells. Mitochondria are sometimes described as "cellular power plants" because they generate most of the cell's supply of adenosine triphosphate (ATP), used as a source of chemical energy.
- ATP is known as the energy currency of the cell.
- Mitochondria have two membrane coverings instead of just one. The outer membrane is very porous while the inner membrane is deeply folded. These folds create a large surface area for ATP-generating chemical reactions.
- Mitochondria have their own DNA and ribosomes. Therefore, mitochondria are able to make some of their own proteins.

## Plastids

- Plastids are present only in plant cells. There
- are two types of plastids – chromoplasts (coloured plastids) and leucoplasts (white or colourless plastids).
- Plastids containing the pigment chlorophyll are known as chloroplasts. Chloroplasts are important for photosynthesis in plants.
- Leucoplasts are primarily organelles in which materials such as starch, oils and protein granules are stored.
- Like the mitochondria, plastids also have their own DNA and ribosomes.

## Vacuole

- A **vacuole** is a membrane organelle which is present in all plant and fungal cells and some animal .
- Vacuoles are small sized in animal cells while plant cells have very large vacuoles.
- Vacuole store amino acids, sugars, various organic acids and some proteins.
- In some unicellular organisms, specialised vacuoles also play important roles in expelling excess water and some wastes from the cell.
- Most mature plant cells have a large central vacuole that helps to maintain the turgidity of the cell and stores important substances including wastes.