Revision Notes for Class 9 Science

Chapter 5 - The Fundamental Unit Of Life

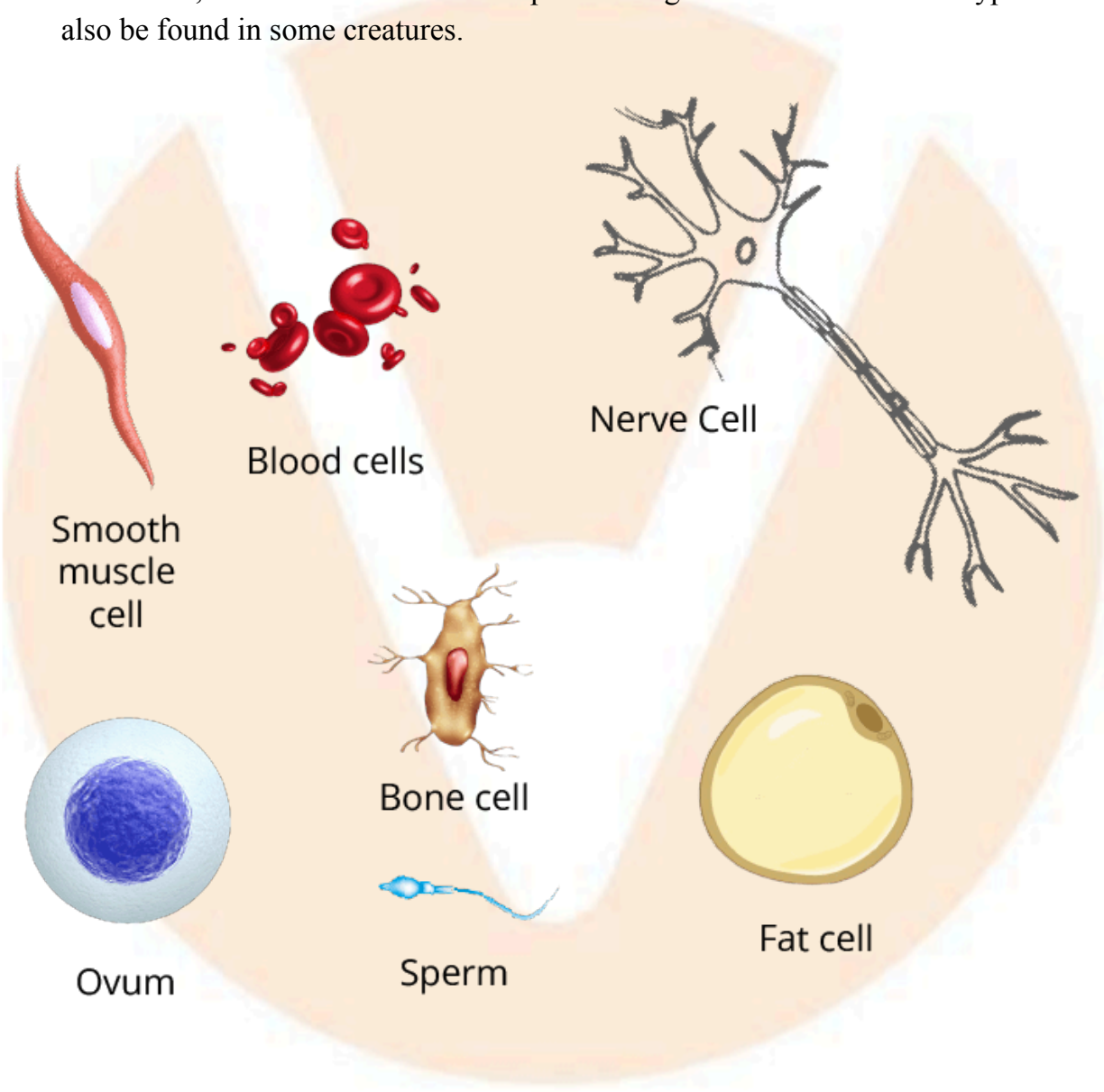
What are the Components of Living Organisms?

Cells are the building blocks of all living beings. Complex organisms' primary structural and functional unit is the cell.

History of Cell:

- Cells were discovered for the first time in 1665 by Robert Hooke using a crude microscope.
- With a better microscope, Leeuwenhoek observed free-living cells in pond water for the first time in 1674.
- The nucleus of the cell was found by Robert Brown in 1831
- Purkinje created the name "protoplasm" for the cell's fluid portion in 1839
- The cell theory, presented by Schleiden in 1838 and Schwann in 1839, states that all plants and animals are made up of cells.
- In 1855, Rudolf Virchow advanced the cell hypothesis by claiming that all cells originate from pre-existing cells.
- The discovery of the microscopic universe was made possible by the invention of magnifying lenses. Unicellular creatures have a single cell that performs all tasks such as nourishment, respiration, excretion, and reproduction. Amoeba, Chlamydomonas, Paramecium, and Bacteria, for example, have solitary cells that make up the entire organism.
- Multicellular organisms are organisms with a large number of cells that perform many roles. Multicellular organisms might exhibit themselves as a single cell or as a group of cells.

- Fungi, plants, and mammals, for example, have many cells that form tissues. A single cell gave rise to every multicellular organism.
- As a result, all cells are derived from pre-existing cells. Cells of various types can also be found in some creatures.

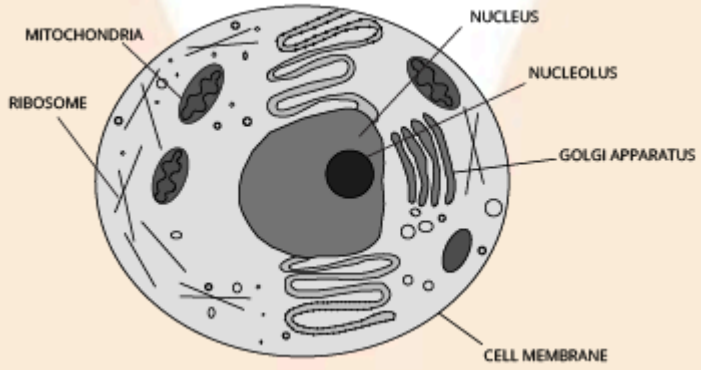


Cell Types

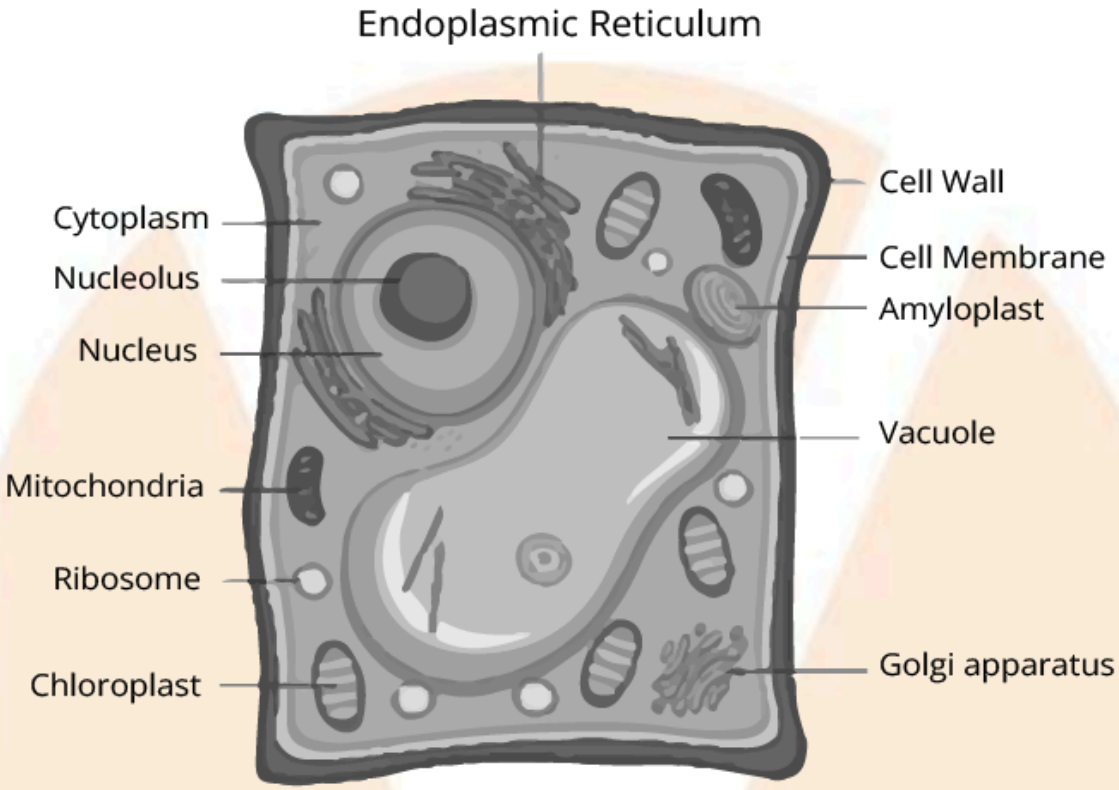
- The shape and size of a cell are determined by the function it performs. Some cells alter their appearance. Amoeba, for example. In other situations, the cell shape may be more or less fixed and unique to a specific cell type. Eg: nerve cells.
- Every live cell has the ability to carry out certain basic operations that are common to all living things. In multicellular organisms like humans, there is a division of labour. This means that various regions of the human body serve diverse purposes.
- Within a single cell, the division of work is also visible. In reality, each of these cells has unique components known as cell organelles. Each type of cell organelle has a distinct purpose. These organelles allow a cell to live and accomplish all of its activities. The basic unit of the cell is made up of these organelles.

What are the Components of a Cell? What is a Cell's Structural Organisation?

Every cell has three distinct features: a plasma membrane, a nucleus, and a cytoplasm. Due to these characteristics, all activity within the cell and exchanges between the cell and its environment are feasible.



Components of a Cell



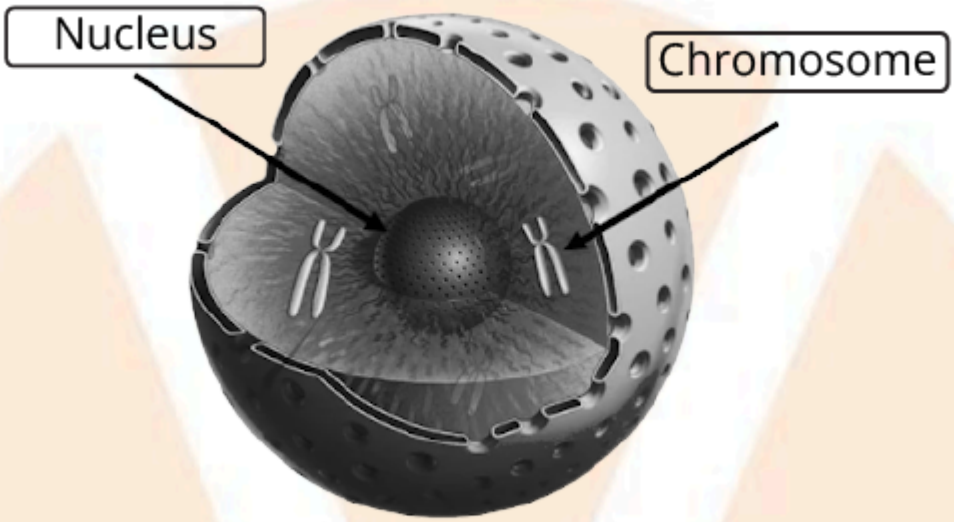
Plant Cell

- The plasma membrane, also known as the cell membrane, is the cell's outermost layer, which separates the cell's contents from its surroundings. It is made up of organic molecules called lipids and proteins and is flexible. The cell membrane's flexibility also allows the cell to take in food and other materials from its surroundings. Endocytosis is the term for such a process. Amoeba, for example.
- It allows some substances to pass into and out of the cell. It also inhibits some other materials from moving. As a result, it's known as a selectively permeable membrane.
- Diffusion, osmosis, and other processes can move chemicals through this semi-permeable barrier.
- The difference between diffusion and osmosis is as below:

OSMOSIS	DIFFUSION
It entails the transfer of solvent molecules.	It entails solute molecule mobility.
Molecules travel from a lower solute concentration to a greater solute concentration.	Molecules travel from a greater solute concentration to a lower solute concentration.
It only happens when a semi-permeable membrane is crossed.	It does not necessitate the use of a semi-permeable membrane.
Example: When a potato slice is kept in a high sucrose solution, it shrinks.	When a drop of ink is dropped into a glass of water, it spreads.

- If we place an animal or plant cell in a hypotonic solution, it would most certainly swell. If the cell is kept in an isotonic solution, it will maintain its size. The cell will shrink if the solution is hypertonic.
- **Osmosis** is a process through which unicellular freshwater organisms and most plants obtain water.
- **Cell wall:** The cell wall is only found in plant cells. Cell walls are made of cellulose and are porous. It keeps the contents of the cell distinct from the rest of the world. It gives the cell its form and protects it.
- Plants, fungi, and bacteria have cell walls that allow them to survive very dilute external media without bursting.
- **Plasmolysis** is the process by which cells in a hypertonic solution lose water.
- **Nucleus:** The nucleus is protected by a double-layered membrane known as the nuclear membrane. The nuclear membrane has pores that allow material to pass from the inside to the outside. Chromosomes, which are made up of Deoxyribonucleic

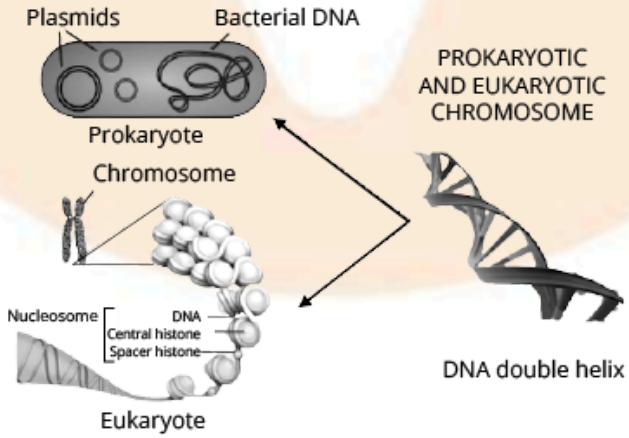
acid (DNA) and proteins, are found in the nucleus. The nucleus is in charge of the cell's entire activity.



Nucleus and Chromosome

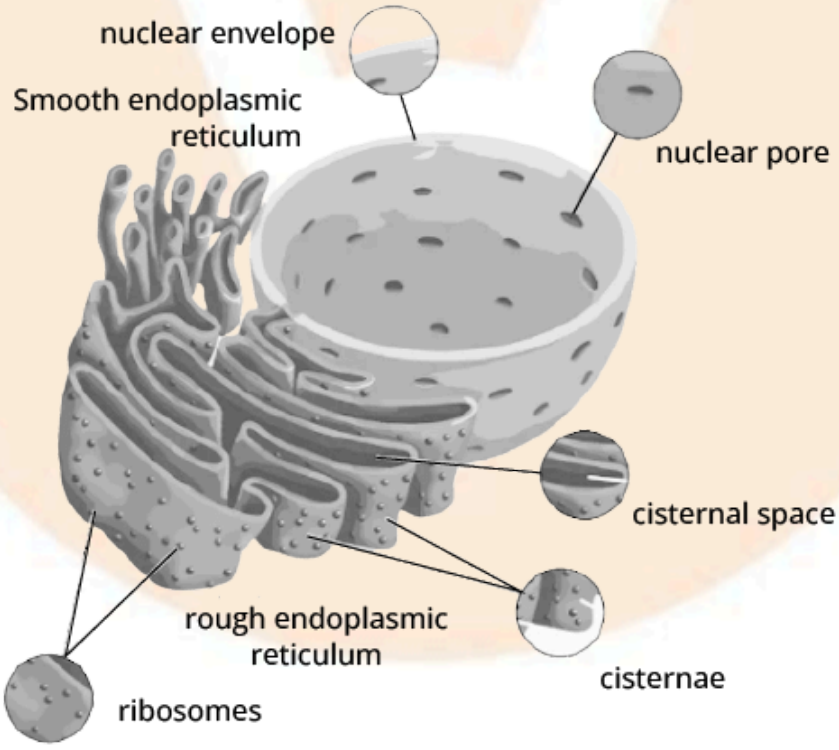
- The nucleus is important in cell division and development because it contains genetic information in the form of DNA. Genes are the functional portions of DNA. Protein synthesis and character transmission from one generation to the next are crucial functions of the nucleus. It is important for cellular reproduction. In some organisms, the nuclear membrane is missing, leaving only nucleic acids (nucleoids) in the nuclear area. Prokaryotes are such creatures. Bacteria, for example. Eukaryotes are organisms that have a nuclear membrane in their cells.

Prokaryotic Cells	Eukaryotic Cells
Very minute in size	Fairly large in size
The nuclear region (nucleoid) is not surrounded by a nuclear membrane	Nuclear material surrounded by a Nuclear membrane
Single chromosomes present	More than one chromosome present
Nucleolus absent	Nucleolus present
Membrane-bound cell organelles are absent	Membrane-bound cell organelles are present
Cell division by fission or budding (no mitosis)	Cell division by mitosis or meiosis



Prokaryotic and Eukaryotic Chromosome

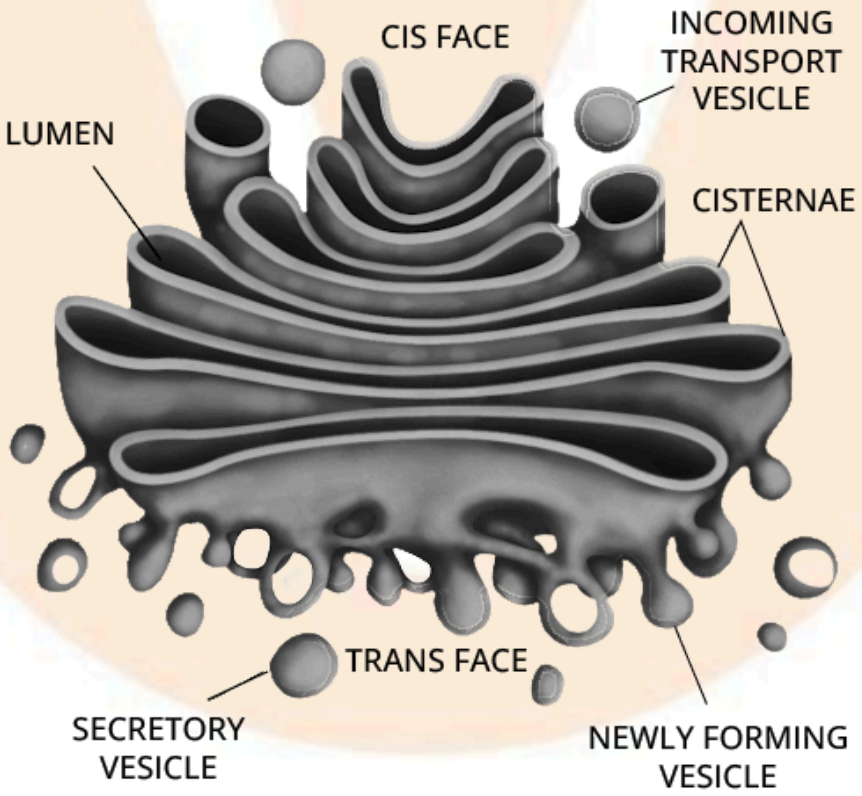
- **Cytoplasm:** The fluid content inside the plasma membrane is referred to as cytoplasm. It's a vicious jelly-like substance that covers the entire cell save the nucleus. It also contains a variety of specialised cell organelles, each of which serves a specific purpose for the cell.
- The endoplasmic reticulum, Ribosomes, Golgi apparatus, Mitochondria, Plastids, Lysosomes, and Vacuoles are examples of cell organelles. They're vital since they perform some of the most important jobs in cells.
- **Endoplasmic reticulum (ER):** The ER, or endoplasmic reticulum, is a vast network of membrane-bound tubes and sheets. It acts as a conduit for the movement of materials, particularly proteins, between distinct cytoplasmic organs or between the cytoplasm and the nucleus. It also serves as a cytoplasmic scaffolding that provides a surface for certain of the cell's metabolic operations. Rough endoplasmic reticulum and smooth endoplasmic reticulum are the two forms of ER.



Endoplasmic Reticulum

a. **RER:** These are rough on the outside and are linked to ribosomes. Protein synthesis is carried out by these cells.
b. **SER:** These are smooth on the outside and have nothing to do with ribosomes. It aids in the production of fat molecules, also known as lipids. It also aids in the detoxification of a variety of toxins and medications.

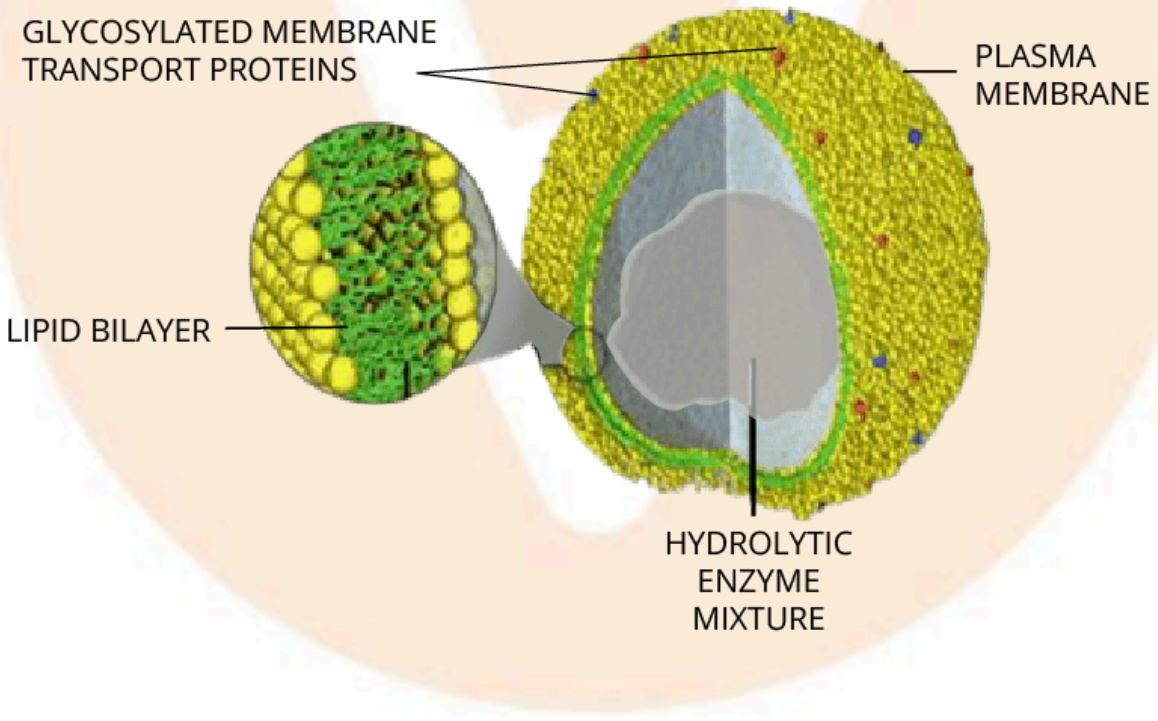
- **Membrane biogenesis:** EF produces proteins and lipids that aid in the formation of the cell membrane. Membrane biogenesis is the name given to this process.
- The Golgi Apparatus is named after Camillo Golgi, a scientist who was the first to describe it. A stack of membrane-bound cisternae makes up the Golgi.



Golgi Apparatus

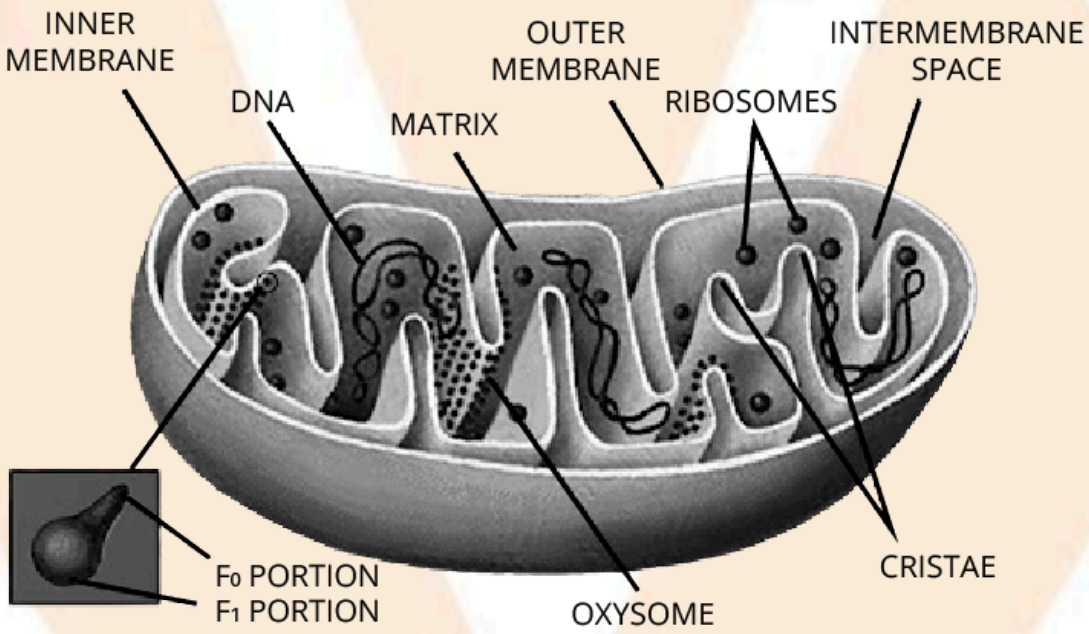
- These membranes are frequently connected to the membranes of the ER, and so form part of a complex cellular membrane system. Its responsibilities include storing, modifying, and packing items in vesicles. It has a role in the development of lysosomes as well.
- **Lysosomes:** Lysosomes are enzyme-filled membranous sacs. RER produces these enzymes. They are a type of cell waste disposal device. They aid in the cleaning of the cell by digesting foreign substances as well as worn-out cell organelles.

Hydrolytic enzymes in lysosomes are capable of digesting cellular macromolecules. When a cell is damaged, the lysosome may burst, allowing the cell's enzymes to digest it. As a result, lysosomes are referred to as ‘suicidal bags'.



Lysosomes

- Mitochondria are cellular organelles that are known as the "powerhouses of the cells." A double membrane separates these from the rest of the body. The exterior membrane is smooth, and the inner membrane is folded into cristae folds. The cristae expands the cellular respiration area. Mitochondria produce ATP molecules, which are used to release energy. ATP is referred to as the cell's "energy currency." Mitochondria have their own DNA DNA ribosomes and are capable of producing some proteins.



Mitochondria

- Plastids are a type of bacterium found solely in plant cells. There are two varieties of these: chromoplasts (coloured plastids) and leucoplasts (white plastids) (white or colourless plastids). Chloroplasts are plastids that contain the pigment chlorophyll. These are necessary for plant photosynthesis. Chromoplasts are organelles that contribute vibrant colours to plant structures such as buds, flowers, and leaves.

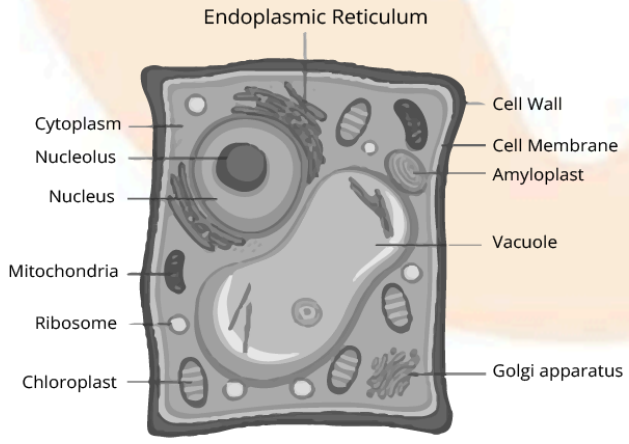
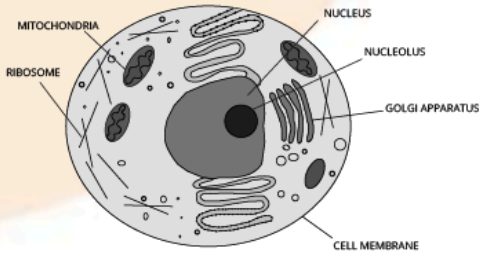
Organelles that store starch, oils, and protein granules are known as leucoplasts. Plastids are made up of several membrane layers that are encased in the stroma. Plastids have DNA and ribosomes of their own.

Vacuoles:

Plant and animal cells both have vacuoles, which are membrane-bound compartments. These are solid or liquid-filled storage sacs. In animal cells, they are small, whereas in plant cells, they are larger. Plant cells have sap-filled vacuoles that give the cell turgidity and stiffness. Water, waste materials, and compounds including amino acids, carbohydrates, and proteins are all stored in these organelles. Specialised vacuoles serve a vital function in the expulsion of excess water and certain wastes from the cell in some unicellular organisms.

Difference Between Plant Cells and Animal Cells:

The difference between plant and animal cells is enlisted below:

PLANT CELLS	ANIMAL CELLS
	

Plant cells possess a cell wall.	Animal cells do not possess a cell wall.
Chloroplasts are present in plant cells.	Animal cells do not possess chloroplasts.
Plant cells possess large vacuoles.	Animal cells have many small vacuoles.
Higher plants do not possess centrioles.	Animal cells do contain centrioles.

Cell Division

Cell division is the process by which new cells are formed in organisms for growth, replacing old, dead, and injured cells, and for reproduction. There are two main types of cell division: mitosis and meiosis.

- Mitosis is the type of cell division responsible for growth and tissue repair. In mitosis, a mother cell divides into two identical daughter cells, each having the same number of chromosomes as the mother cell.
- Meiosis occurs in the reproductive organs to form gametes, which are necessary for sexual reproduction. Meiosis results in four new cells, each with half the number of chromosomes compared to the mother cell. This reduction is important to maintain the chromosome number in offspring after fertilisation.

The reduction in chromosome number during meiosis ensures that when gametes combine, the offspring have the correct number of chromosomes.