

Introduction and Cell theory:

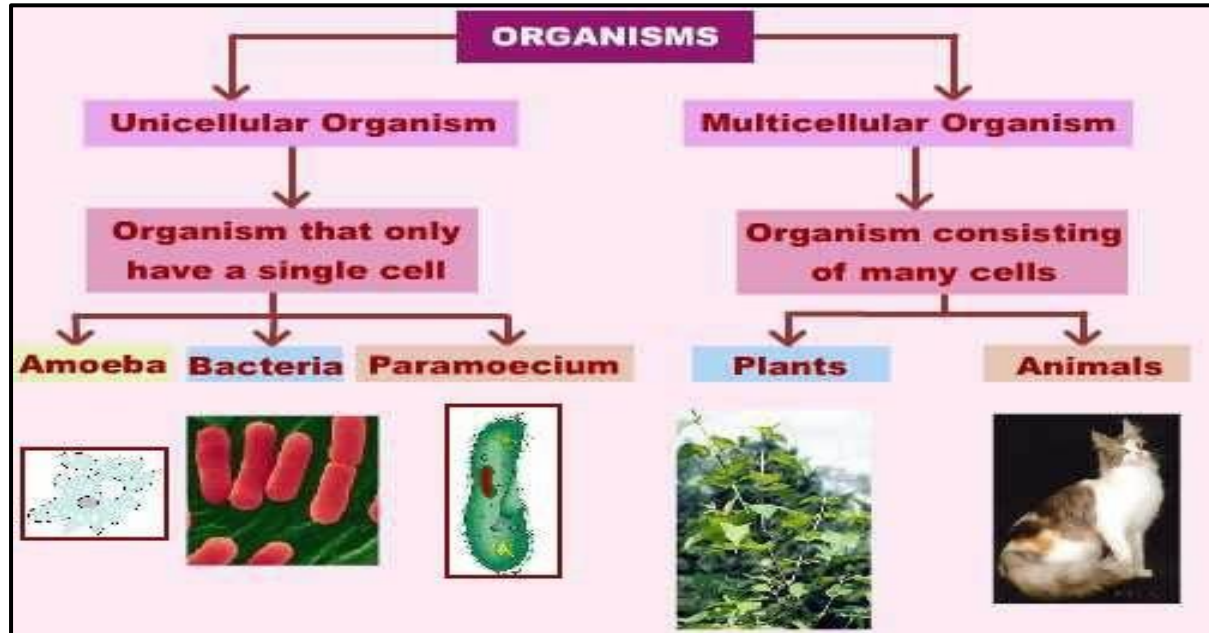
Introduction to the cell:

The cell: the basic membrane bound unit that contains the fundamental molecules of life and of which all living things are composed. **Or:** is the basic structural and functional unit of all forms of life. Which is initially discovered by Robert Hooke in 1665.

Classification of organisms according to the cell number:

A single cell is often a complete organism in itself, such as a bacterium or yeast, or many cells cooperate with other specialized cells and become the building blocks of large organisms, such as humans and other animals, as the following:

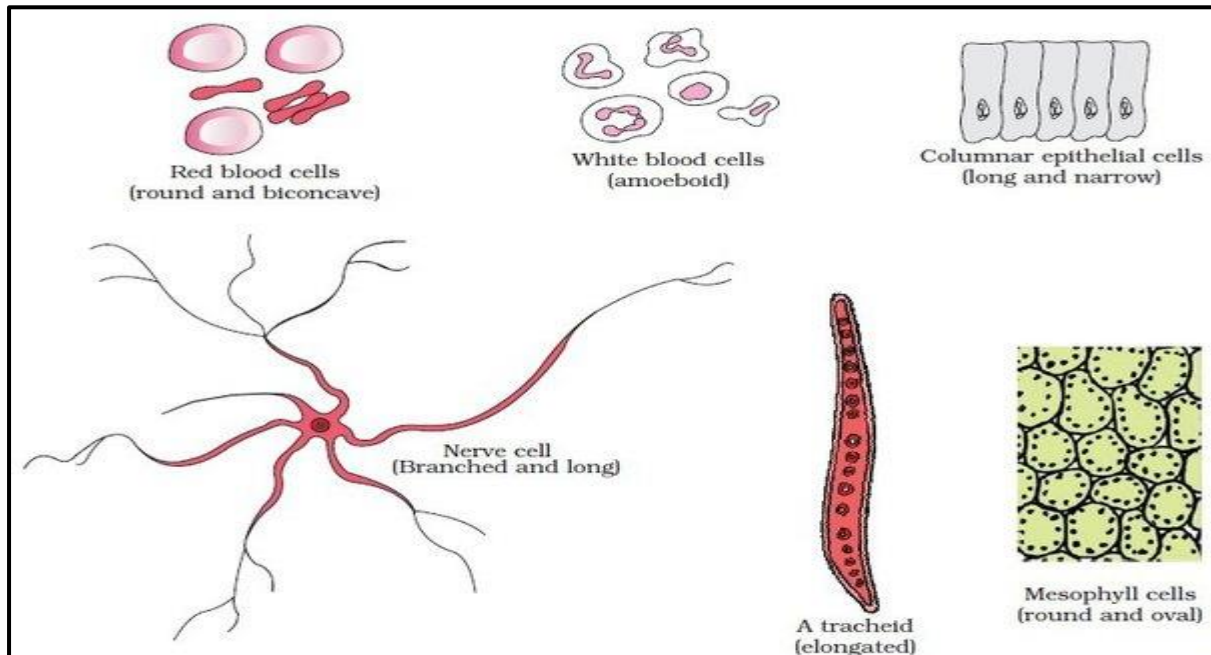
1. **Unicellular:** (consisting of single cell such as bacteria; microorganisms).
2. **Multicellular:** (consisting of many cell such as plants and animals; macroorganisms).



The smallest known cells are a group of tiny bacteria called *Mycoplasma*; some of these single-celled organisms are spheres as small as **0.2 μm in diameter** ($1\mu\text{m}$ = about 0.000039 inch), with a total mass of 10–14 gram—equal to that of 8,000,000,000 hydrogen atoms. Cells of humans typically have a mass 400,000 times larger than the mass of a single *Mycoplasma*, but even human cells are only about **20 μm across**.

Shape of cells:

Usually, the cells are round, elongated or spherical. There are also some cells which are long and pointed on both the ends. Such cells exhibit spindle shape. In some cases, the cells are very long. Some may be branched like the neuron or the nerve cell.



Characteristics of cells:

Following are the various essential characteristics of cells:

1. Cells provide structure and support to the body of an organism.
2. The cell interior is organized into different individual organelles surrounded by a separate membrane.
3. The nucleus (major organelle) holds genetic information necessary for reproduction and cell growth.
4. Every cell has one nucleus and membrane-bound organelles in the cytoplasm.
5. Mitochondria, a double membrane-bound organelle is mainly responsible for the energy transactions vital for the survival of the cell.
6. Lysosomes digest unwanted materials in the cell.
7. Endoplasmic reticulum plays a significant role in the internal organization of the cell by synthesizing selective molecules and processing, directing and sorting them to their appropriate locations.

Functions of cells:

The cells can acquire specified function and carry out various tasks within the cell such as replication, DNA repair, protein synthesis, and motility. Cells are capable of specialization and mobility within the cell.

1. **Basic unit of life:** The cell is the smallest part to which an organism can be reduced that still retains the characteristics of life.
2. **Protection and support:** Cells produce and secrete various protective and immune molecules.
3. **Movement:** All the movements of the body occur because of molecules located within specific cells such as muscle cells.
4. **Communication:** Cells produce and receive chemical and electrical signals.
5. **Cell metabolism and energy release:** The chemical reactions that occur within cells are referred to collectively as cell metabolism.
6. **Inheritance or genetic:** Each cell contains a copy of the genetic information of the individual. Specialized cells are responsible for transmitting that genetic information to the next generation.

Structure of biological molecules of cells:

Biomolecules: are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms.

They range from small molecules such as primary and secondary metabolites and hormones to large macromolecules like proteins, nucleic acids, carbohydrates, lipids etc; as mentioned following table:

No.	Component (Biomolecules)	Percent (%) to cell weight
1.	Water	70
2.	Inorganic ions (sodium, potassium, magnesium, etc.)	1
3.	Miscellaneous small metabolites	3

No.	Component (Biomolecules)	Percent (%) to cell weight
4.	Proteins	18
5.	RNA	1.1
6.	DNA	0.25
7.	Phospholipids and other lipids	5
8.	Polysaccharides	2

Theory of cell:

The cell theory is a scientific theory first formulated in the mid-nineteenth century, that organisms are made up of cells, that they are the basic structural and organizational unit of all organisms, and that all cells come from pre-existing cells.

The theory was once universally accepted, but now some biologists consider non-cellular entities such as **viruses** living organisms, and thus disagree with the first tenet. As of 2021: "expert opinion remains divided roughly a third each between yes, no and don't know". As there is no universally accepted definition of life, discussion still continues.

History of cell theory:

Credit for developing cell theory is usually given to two scientists: **Theodor Schwann** and **Matthias Jakob Schleiden**. While **Rudolf Virchow** contributed to the theory, he is not as credited for his attributions toward it. In 1839, **Schleiden** suggested that every structural part of a plant was made up of cells or the result of cells. He also suggested that cells were made by a crystallization process either within other cells or from the outside.

From these conclusions, the cell theory was postulated; as following:

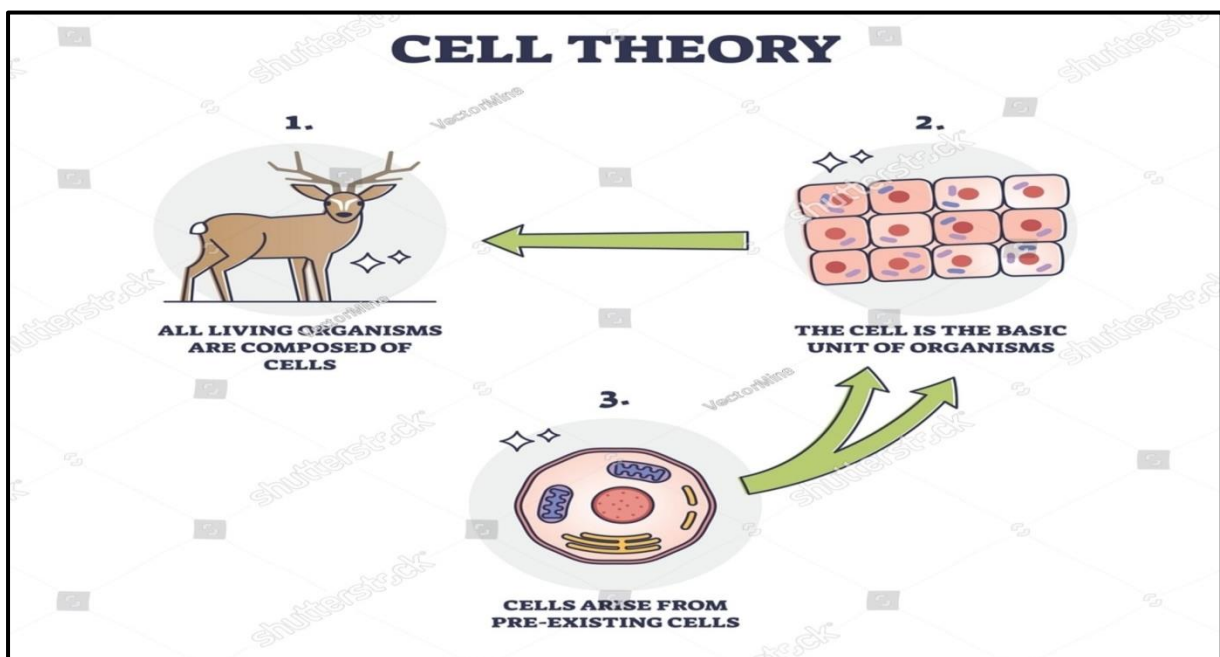
1. All living organisms are composed of one or more cells.
2. The cell is the most basic unit of life.
3. All cells arise only from pre-existing cells.

Generally accepted portions of modern cell theory; as follows:

1. The cell is the fundamental unit of structure and function in living things.
2. All organisms are made up of one or more cells.
3. Cells arise from other cells through cellular division.

Expanded versions of modern cell theory; as follows:

1. Cells carry genetic material passed to daughter cells during cellular division.
2. All cells are essentially the same in chemical composition.
3. Energy flow (metabolism and biochemistry) occurs within cells.



Modern interpretations of cell theory; as follows:

1. All known living things are made up of one or more cells.
2. All living cells arise from pre-existing cells by division.
3. The cell is the fundamental unit of structure and function in all living organisms.
4. The activity of an organism depends on the total activity of independent cells.
5. Energy flow (metabolism and biochemistry) occurs within cells.
6. Cells contain DNA which is found specifically in the chromosome and RNA found in the cell nucleus and cytoplasm.
7. All cells are basically the same in chemical composition in organisms of similar species.