Cell Biology:

Biology is a scientific study of the living organisms, which grow, reproduce and respond to stimuli of the environmental factors.

Introduction to the Cell

All organisms are composed of structural and functional units of life called "CELLS". The body of some organisms like bacteria, protozoans and some algae is made up of a single cell while the body of fungi, plants and animals are composed of many cells. Human body is built of about one trillion cells. Cells vary in size and structure as they are specialized to perform different functions. But the basic components of the cell are common to all cells.

What Defines a Cell?

Cells are considered the basic units of life .All cells are surrounded by a structure called the Cell Membrane which, much like the walls of a house, serves as a clear boundary between the cell's internal and external environments. The cell membrane is sometimes also referred to as the Plasma Membrane.

Cell membranes are based on a framework of fat-based molecules called Phospholipids, which physically prevent water loving, or hydrophilic, substances from entering or escaping the cell. These membranes are also studded with proteins that serve various functions. Some of these proteins act as gatekeepers, determining what substances can and cannot cross the membrane Others function as markers, identifying the cell as part of the same organism or as foreign.

Yet other membrane proteins serve as communicators, sending and receiving signals from neighboring cells and the environment whether friendly or alarming.

Cytoplasm is the gelatinous liquid that fills the inside of a cell. It is composed of water, salts, and various organic molecules. Some intracellular organelles, such the nucleus and mitochondria, are enclosed by membranes that separate them from the cytoplasm.

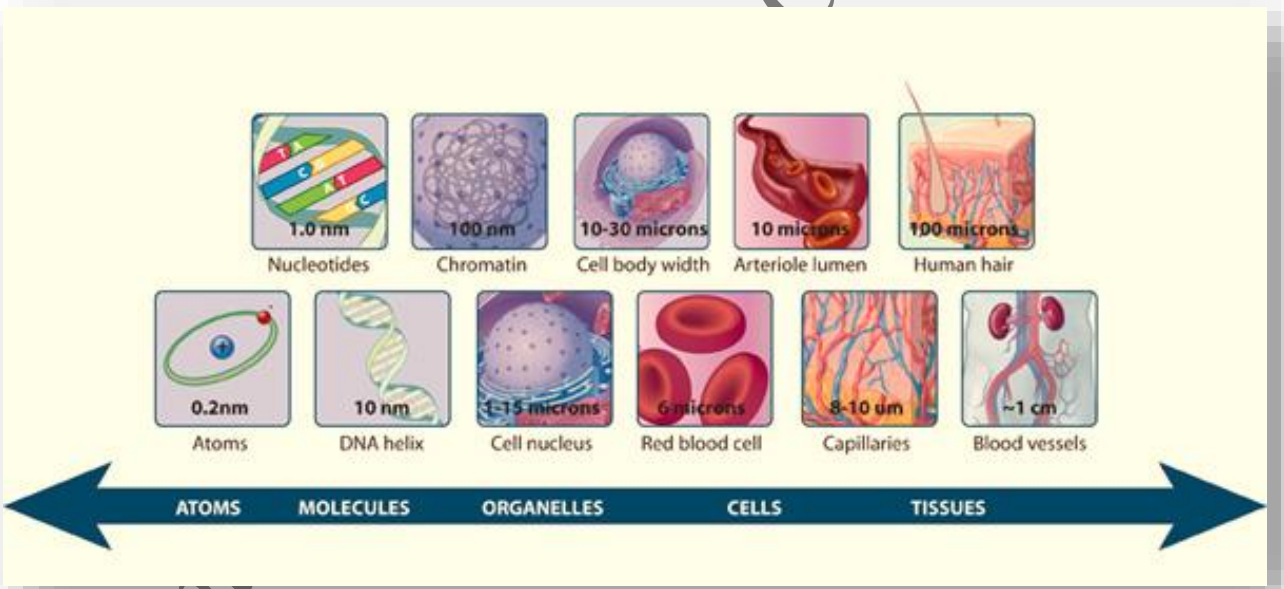
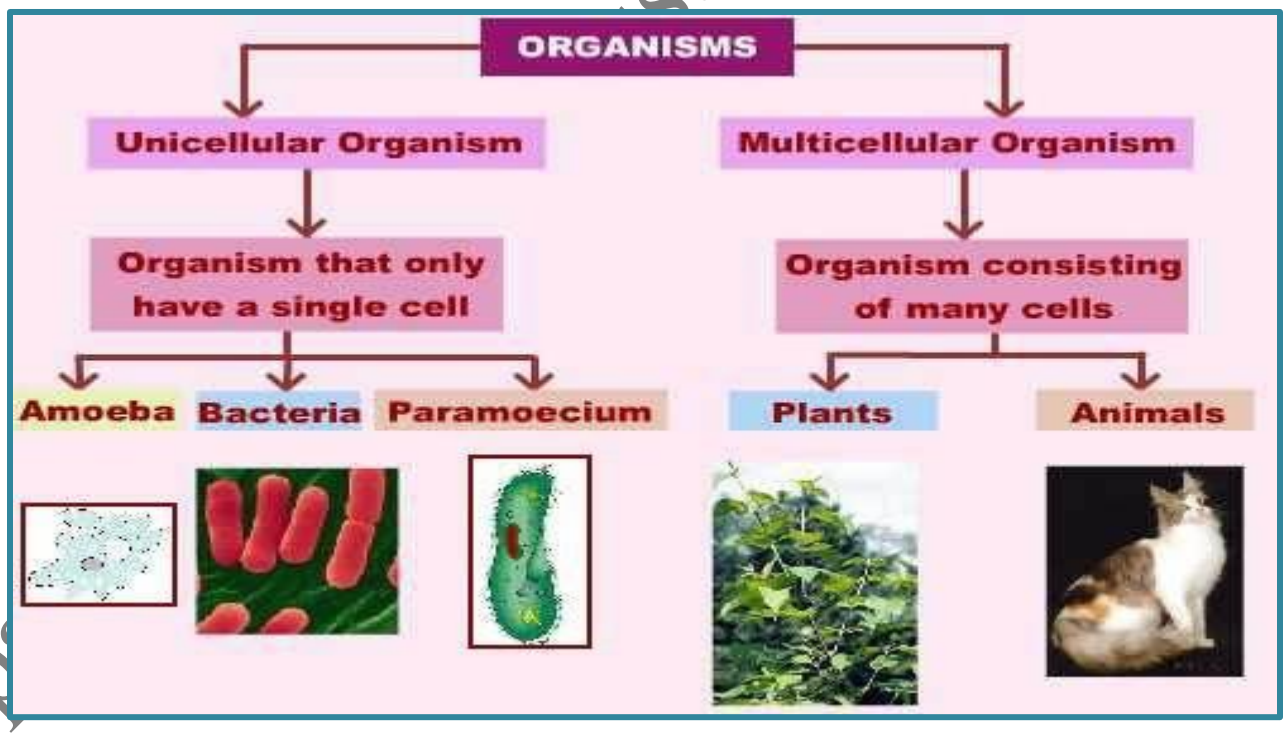


Figure 2: The relative scale of biological molecules and structures Cells can vary between 1 micrometer (µm) and hundreds of micrometers in diameter. Within a cell, a DNA double helix is approximately 10 nanometers (nm) wide, whereas the cellular organelle called a nucleus that encloses this DNA can be approximately 1000 times bigger (about 10 µm). See how cells compare along a relative scale axis with other molecules, tissues, and biological structures (blue arrow at bottom). Note that a micrometer (µm) is

Classification of the organisms according to 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 a single cell such as bacteria)
2. **Multicellular:** (including plants and animals).



THE CELL AND CELL THEORY

Soon after Anton van Leewenhock invented the microscope, Robert Hooke in 1665 observed a piece of cork under the microscope and found it to be made of small compartments which he called "cells" In 1672, Leewenhock observed bacteria, sperm and red blood corpuscles, all of which were cells. In 1831, Robert Brown, an Englishman observed that all cells had a centrally positioned body which he termed the **nucleus**.

The cell theory:

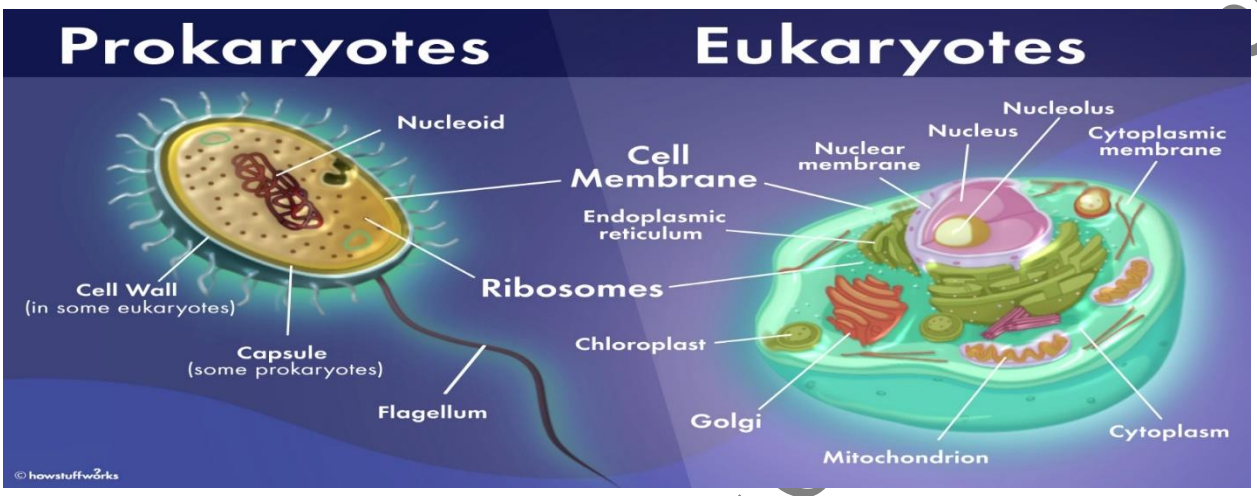
In 1838 M.J. Schleiden and Theodore Schwann formulated the "Cell Theory". The cell theory maintains that:

- All organisms are composed of cells.
- Cell is the structural and functional unit of life, and
- Cells arise from pre-existing cells.

The cells vary considerably, in shape and size. Nerve cells of animals have long extensions. They can be several feet in length. Muscle cells are elongated in shape. Egg of the ostrich is the largest cell (75 mm). Some plant cells have thick walls. There is also wide variation in the number of cells in different organisms.

Two basic types of cells

Cytologists recognize two basic types of cells. Their differences have been tabulated below in table below. Organisms which do not possess a well formed nucleus are Prokaryotes such as the bacteria. All others possess a well-defined nucleus, covered by a nuclear membrane. They are Eukaryotes.



Functions of the cell:

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.

- Structure and Support. You know a house is made of bricks. ...
- Growth. In complex organisms such as humans, the tissues grow by simple multiplication of cells. ...
- Transport. ...
- Energy Production. ...
- Metabolism. ...
- Reproduction.

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.

		Prokaryotes	Eukaryotes
1	**Type of Cell**	Always unicellular	Unicellular and multi-cellular
2	**Cell size**	Ranges in size from 0.2 μm – 2.0 μm in diameter	Size ranges from 10 μm – 100 μm in diameter
3	**Cell wall**	When present, chemically simple in nature	Usually present; chemically complex in nature
4	**Nucleus**	Absent. Instead, they have a nucleoid region in the cell	Present
5	**Ribosomes**	Present. Smaller in size and spherical in shape	Present. Comparatively larger in size and linear in shape
6	**DNA arrangement**	Circular	Linear
7	**Mitochondria**	Absent	Present
8	**Cytoplasm**	Present, but cell organelles absent	Present, cell organelles present
9	**Endoplasmic reticulum**	Absent	Present
10	**Plasmids**	Present	Very rarely found in eukaryotes
11	**Ribosome**	Small ribosomes	Large ribosomes
12	**Lysosome**	Lysosomes and centrosomes are absent	Lysosomes and centrosomes are present
13	**Cell division**	Through binary fission	Through mitosis
14	**Flagella**	The flagella are smaller in size	The flagella are larger in size
15	**Reproduction**	Asexual	Both asexual and sexual
16	**Example**	Bacteria and Archaea	Plant and Animal cell