

THE CELL

Cells are the basic unit of life, they are the smallest structures capable of basic life processes, such as taking nutrients, expelling waste, and reproducing. All living things are composed of cells.

Some microscopic organisms, such as bacteria and protozoa, are unicellular, meaning they consist of a single cell. Plants, animals, and fungi are multicellular; that is, they are composed of a great many cells.

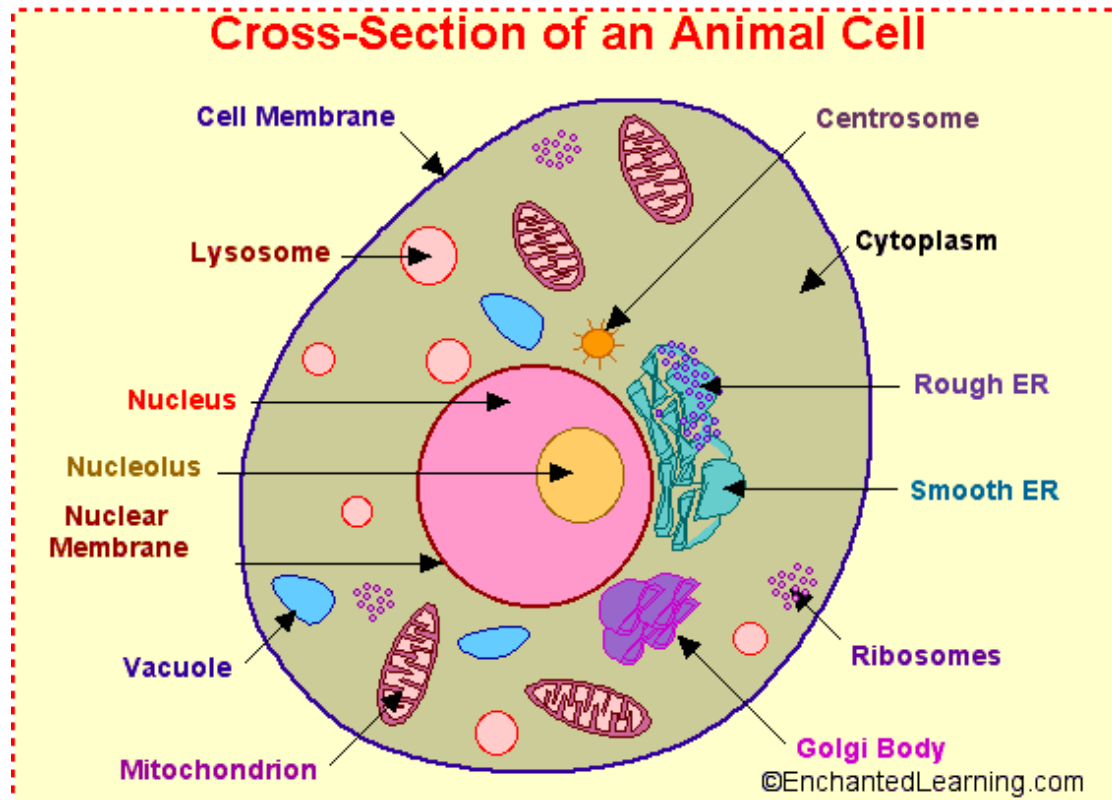
Robert Hooke was the first to use the word cell in 1665, however, in the context of non-living cork. Antonie van Leeuwenhoek was the first person to ever observe a cell under a microscope in 1674.

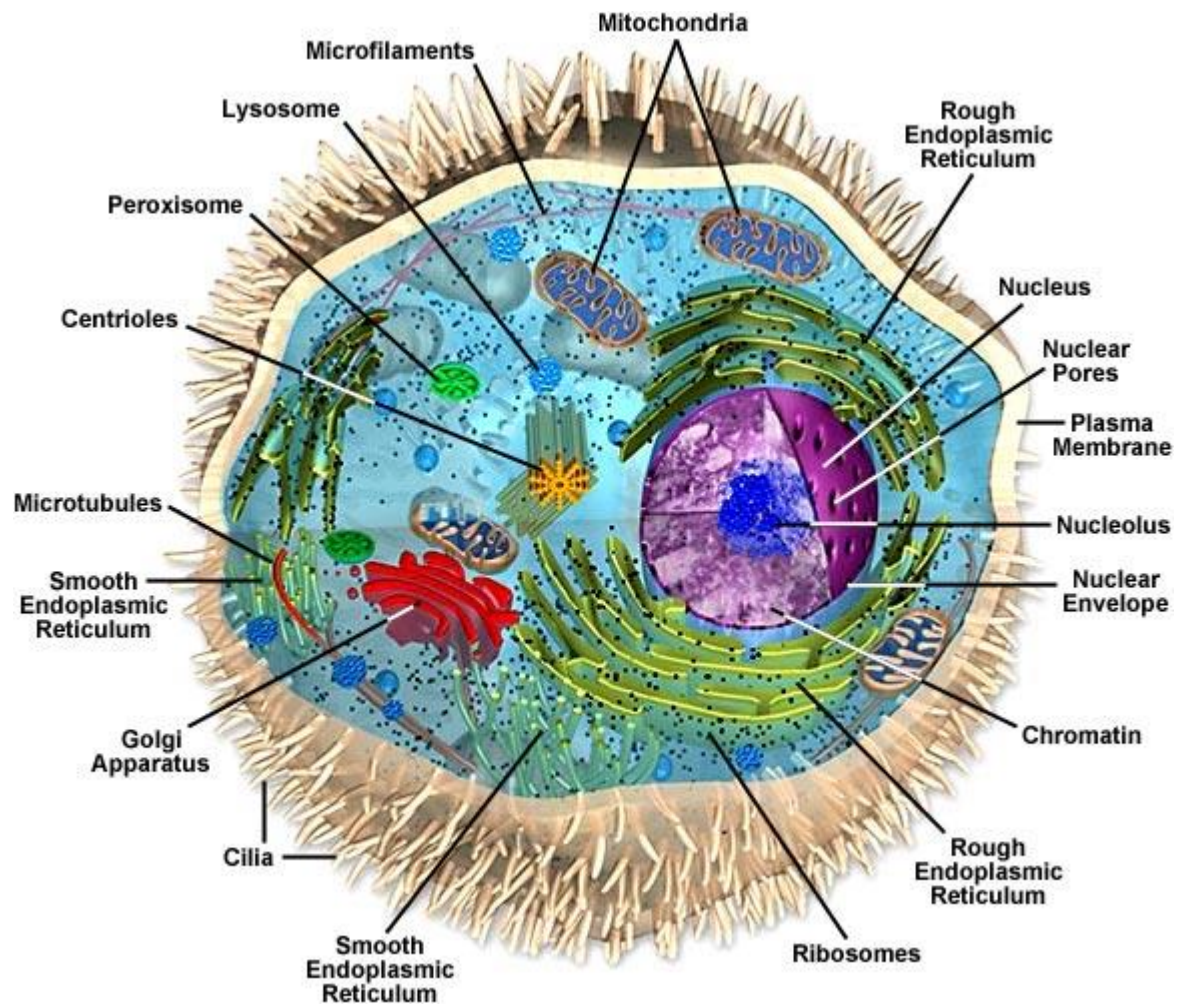
Cells vary considerably in size, shape and internal composition. The smallest cell, a type of bacterium known as a mycoplasma, measures 0.0001 mm in diameter, other cells have lengths with several meters e.g.: nerve cells and some cells can be seen with naked eye e.g.: egg of birds.

Along with their differences in size, cells present in different shape, (spherical shape, rod shape, elongated, flatted.....etc), in multicellular organisms, shape is typically tailored to the cell's job. For example, flat skin cells pack tightly into a layer that protects the underlying tissues from invasion by bacteria.

The cell consists of a mass of protoplasm surrounded by a plasma membrane, the protoplasm is differentiated into two main parts, the inner mostly central part called nucleus and the outer part that surrounds the nucleus called cytoplasm.

There are two types of cells, **prokaryotic cells**, i.e., cells without a nucleus such as bacteria and **eukaryotic cells**, i.e., cells with a distinct nucleus which possess organized chromosomes that store genetic material.





Structure of Cytoplasm:

Cytoplasm is a complex fluid containing a various cellular organelles and inclusions, and surrounded by the plasma membrane.

- Organelles: these are the specialized parts of the cell such as (endoplasmic reticulum, Golgi complex... etc)
- Inclusions: these are non living constitutes of cells such as (secretary granules, glycogen ...etc).

Organelles:

Organelles are specialized subunits within a cell that are usually enclosed by their own lipid membrane. The name organelle illustrates that these subunits have a similar function to the cell as have organs to the human body. Larger organelles such as the cell nucleus are easily visible with a light microscope. Many different types of organelles may be found in a cell depending on the cell's function.

Typical examples of organelles in eukaryotic cells and their characteristic functions are

1- **Nucleus:** serves as cells command center.

2- **Endoplasmic reticulum:** are sites of lipid, protein and carbohydrate synthesis and they are two types :

A/ rough ER: it's granular (appears rough due to the presence of ribosome on the membrane surface).

B/ smooth ER: it's non-granular (the ribosomes are absent)

3- **Golgi apparatus:** they are flatted sacs, play an important role in storage and synthesis of secretary granules also storage and sorting of proteins.

4- **Mitochondria:** the main function of mitochondria is to provide energy for the cell through conversion glucose to ATP. Most cells contain mitochondrion which is a double membrane.

5- **Vacuole:** it is function storage and homeostasis, can contain nutrients, wastes or water.

6- **Lysosomes:** these are membrane bounded organelles which contain a hydrolytic enzyme, it's important in the digestion process inside the cell.

7- **Centrosome:** consists of two centrioles located near the nucleus, it plays a role in cell division.

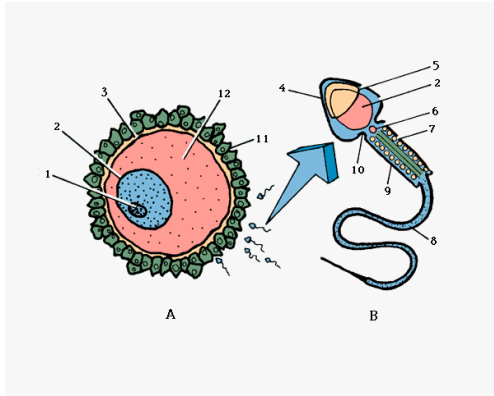
Substructures that perform particular specialized functions but do not possess a distinct cell membrane are typically not considered as organelles.

Typical examples of such structures without membranes are:

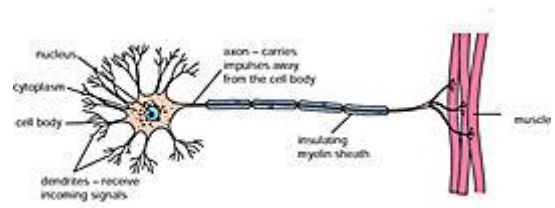
- 1- **Ribosome**: complexes of RNA that express genetic code from nucleic acid into protein by that they play an important role in protein synthesis, it may be located on endoplasmic reticulum, or are free in cytoplasm.
- 2- **Flagellum**: tail-like structures that enable locomotion. Found in some type of bacteria, archaea and eukaryotes.
- 3- **Cytoskeleton**: polymeric network to maintain cell shape.

The Nucleus:

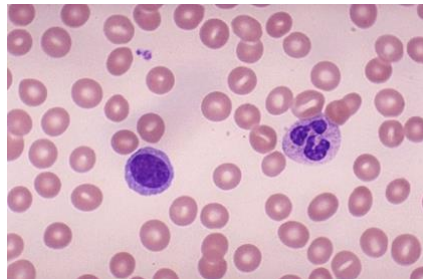
It's the most important part of the cell as it performs the metabolic activity of the cell, stores and maintenance of DNA and transcription of RNA. it is usually spherical in shape or it occur in different shapes such as (kidney, ovoid, flatted and elongated shape).



Ovum and sperm



nerve cell



Blood smear showing RBCs and WBCs