

The Cell :-

The **cell** is the basic structural and functional unit of all known living organisms. It is the smallest unit of life and is often called the building block of life. Organisms can be classified as unicellular (consisting of a single cell; including bacteria) or multicellular (including plants and animals). Humans contain about 10 trillion (10^{13}) cells. Most plant and animal cells are between 1 and 100 μm and therefore are visible only under the microscope.

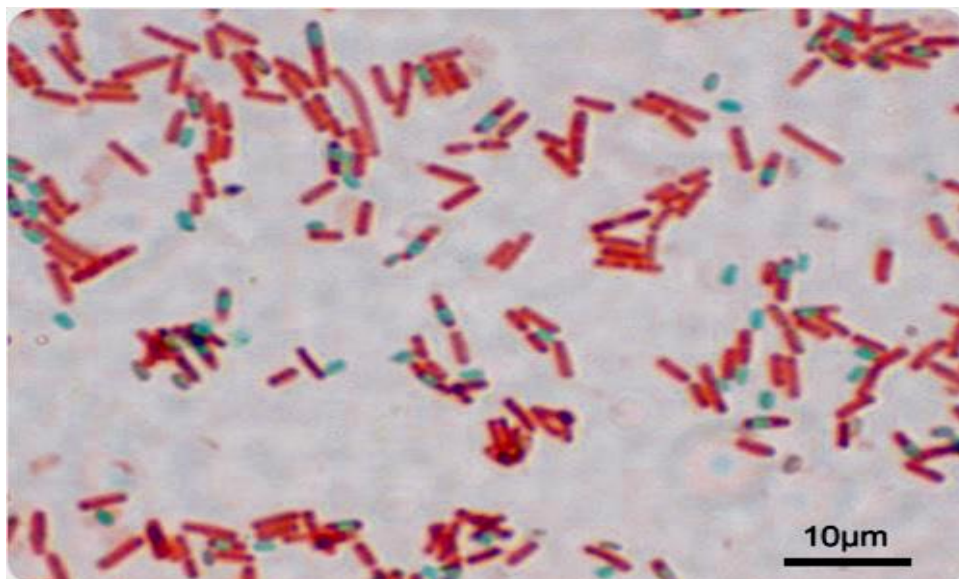
Types of cells:

There are two types of cells: eukaryotic and prokaryotic. Prokaryotic cells are usually independent, while eukaryotic cells are often found in multicellular organisms.

Prokaryotic cells

The prokaryote cell is simpler, and therefore smaller, than a eukaryote cell, lacking a nucleus and most of the other organelles of eukaryotes. There are two kinds of prokaryotes: bacteria and archaea; these share a similar structure.

The nuclear material of a prokaryotic cell consists of a single chromosome that is in direct contact with the cytoplasm. Here, the undefined nuclear region in the cytoplasm is called the nucleoid.



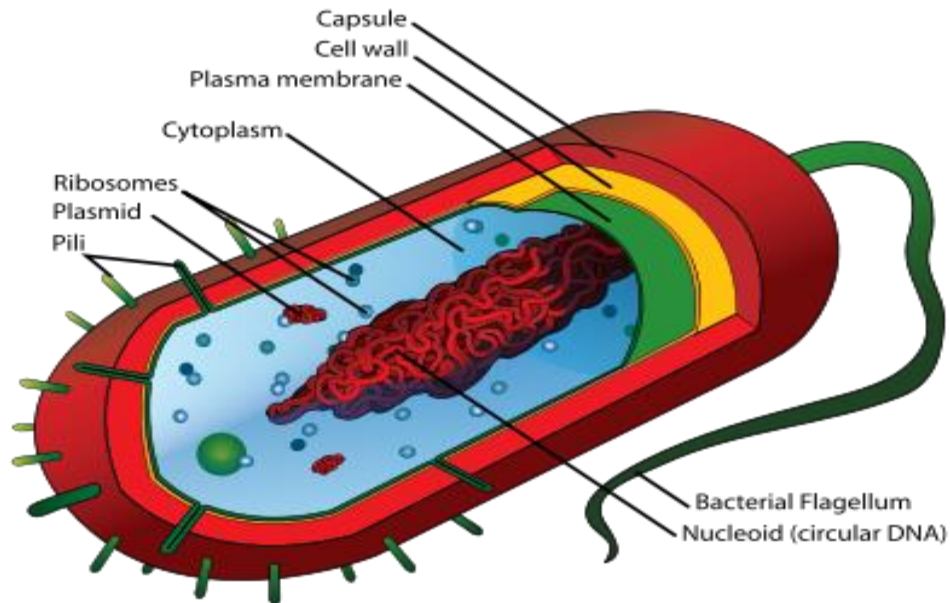


Diagram of a typical prokaryotic cell

A prokaryotic cell has three architectural regions:

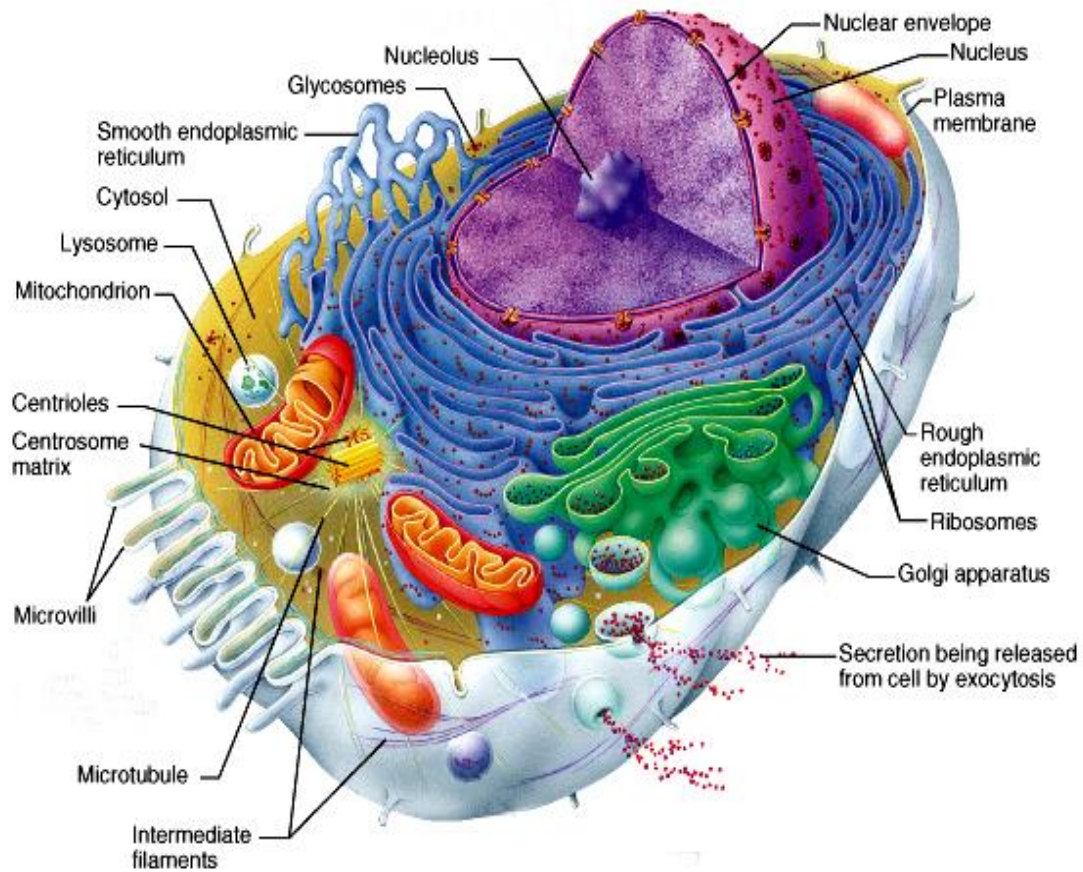
- On the outside, flagella and pili project from the cell's surface. These are structures (not present in all prokaryotes) made of proteins that facilitate movement and communication between cells;
- Enclosing the cell is the cell envelope – generally consisting of a cell wall covering a plasma membrane though some bacteria also have a further covering layer called a capsule. The envelope gives rigidity to the cell and separates the interior of the cell from its environment, serving as a protective filter, it also prevents the cell from expanding and finally bursting (cytolysis) from osmotic pressure against a hypotonic environment. Though most prokaryotes have a cell wall, there are exceptions such as *Mycoplasma* and *Thermoplasma*. Some eukaryote cells (plant cells and fungal cells) also have a cell wall;

- Inside the cell is the cytoplasmic region that contains the cell genome (DNA) and ribosomes and various sorts of inclusions. Though there is no *nucleus*, the DNA is condensed in a *nucleoid*. Prokaryotes can carry extrachromosomal DNA elements called *plasmids*, which are usually circular.

Eukaryotic cells

Plants, animals, fungi, slime moulds, protozoa, and algae are all eukaryotic. These cells are about 15 times wider than a typical prokaryote and can be as much as 1000 times greater in volume. The major difference between prokaryotes and eukaryotes is that eukaryotic cells contain membrane-bound compartments in which specific metabolic activities take place. Most important among these is a cell nucleus that houses the DNA. This nucleus gives the eukaryote its name, which means "true nucleus". Other differences include:

- The plasma membrane resembles that of prokaryotes in function, with minor differences in the setup. Cell walls may or may not be present.
- The eukaryotic DNA is organized in one or more linear molecules, called chromosomes, which are associated with histone proteins. All chromosomal DNA is stored in the *cell nucleus*, separated from the cytoplasm by a membrane. Some eukaryotic organelles such as mitochondria also contain some DNA.
- Many eukaryotic cells are ciliated with *primary cilia*. Primary cilia play important roles in chemosensation, mechanosensation, and thermosensation. Cilia may thus be "viewed as sensory cellular antennae that coordinate a large number of cellular signaling pathways, sometimes coupling the signaling to ciliary motility or alternatively to cell division and differentiation.
- Eukaryotes can move using *motile cilia* or *flagella*. The flagella are more complex than those of prokaryotes.



Structure of a typical animal cell

Table 1: Comparison of features of prokaryotic and eukaryotic cells

	Prokaryotes	Eukaryotes
Typical organisms	bacteria	plants, animals
Typical size	~ 1–10 μm	~ 10–100 μm
Type of nucleus	nucleoid region; no real nucleus	real nucleus with double membrane
DNA	circular (usually)	linear molecules (chromosomes)

		with histone proteins
RNA- /protein- synthesis	coupled cytoplasm	in RNA-synthesis inside the nucleus protein synthesis in cytoplasm
Ribosomes	50S+30S	60S+40S
Cytoplasmatic structure	Very few structures	highly structured by endomembranes and a cytoskeleton
Mitochondria	None	one to several thousand (though some lack mitochondria)
Chloroplasts	None	in algae and plants
Organization	usually single cells	single cells, colonies, higher multicellular organisms with specialized cells
Cell division	Binary fission (simple division)	Mitosis (fission or budding) Meiosis