# Cell structure and function

All living things are composed of cells. Cells are the basic units of life and all tissues and organs are composed of cells. They are so small that they must be viewed with a microscope.

- There are many cells in an individual, which performs several functions throughout the life. The size and the shape of the cell range from millimeter to microns, which are generally based on the type of function that it performs. A cell generally varies in their shapes. A few cells are in spherical, rod, flat, concave, curved, rectangular, oval and etc.
- Cells have many structures inside of them called organelles. These organelles are like the organs in a human and they help the cell stay alive. Each organelle has its own specific function to help the cell survive.

## Eukaryotic Cell Structure

They are the cells with the presence of true nucleus. Organisms, with this cell type are known by the term eukaryotic organisms. Eukaryotic cells (Animal and Plant cells) are more complex than prokaryotic cells. These organisms have membrane bound nucleus with many cell organelles to perform several cellular functions within the system.

### * Animal cell structure:

**1- Cell membrane (plasma membrane):** it is a fluid mosaic of proteins moving in a phospholipid bilayer. The cell membrane functions like a gate, controlling which

molecules can enter and leave the cell. It consists of proteins, lipids and carbohydrates, where lipids beaning as a structure and proteins are connected or immersed in fat and interacts with each other and with the lipids, while retaining it capability to movement within the lipids. The head of phospholipids molecule is charged and so polar; the tails are not charged and so are non-polar. Thus, the two ends of this molecule have different properties in water. The head is hydrophilic and so their position will going to be upper and lower surfaces of the membrane as close as possible to water molecules. The non- polar tails are hydrophobic and so will tend to direction within the membrane and correspond to each other away from water. This causes the phospholipids of the cell membrane to form two layers, known as a phospholipid bilayer. Cells are bathed in an aqueous environment and since the inside of a cell is also aqueous, water molecules surround both sides of the cell membrane. A membrane's function is defined by the proteins embedded in it; there is two types of membrane proteins:

**- Integral protein**

• Penetrate the hydrophobic interior; can stick out of the surface

• Integral proteins that extent the membrane are called transmembrane proteins – Peripheral protein

• Stick to the surface of the membrane.

**Carbohydrates:** it connected with Peripheral proteins and distinct parts of Integral proteins on the upper surface of the membrane, made up what is known Glycocalyx which have important functions in the cell life.

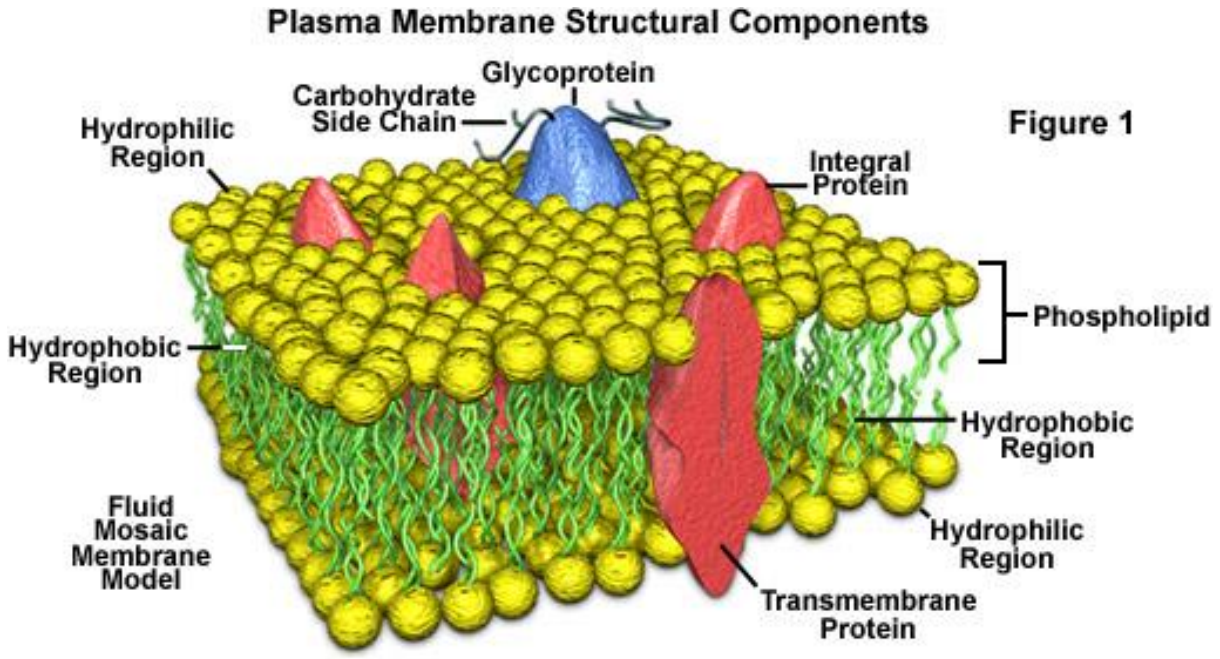
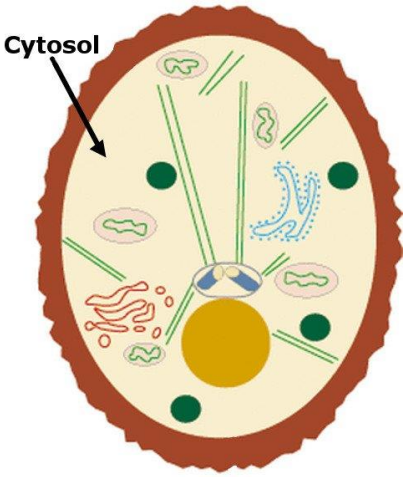



**Figure 1: Cell membrane**

**2 – Cytoplasmic matrix (Cytosol):** is the liquid found inside cells, in the eukaryotic cell the cytosol is within the cell membrane and is part of the cytoplasm, which also comprises the mitochondria and other organelles. The cytosol is a complex mixture of substances dissolved in water. The concentrations of ions such as sodium and potassium are different in the cytosol than in the extracellular fluid; these differences in ion levels are important in processes such as osmoregulation, cell signaling, and the generation of action potentials in excitable cells such as endocrine, nerve and muscle cells. Most of the cytosol is water, which makes up about 70% of the total volume of a typical cell. It also contains much higher amounts of charged macromolecules such as proteins and nucleic acids than the outside of the cell structure.



**3 – Nucleus:** it is a membrane bound structure that contains the cell's hereditary information and controls the cell's growth and reproduction. It is the command center of a eukaryotic cell and is commonly the most prominent organelle in a cell. The cell nucleus is bound by a double membrane called the nuclear envelope. This membrane separates the contents of the nucleus from the cytoplasm. The envelope helps to maintain the shape of the nucleus and assists in regulating the flow of molecules into and out of the nucleus through nuclear pores and the nuclear envelope is connected with the endoplasmic reticulum (ER). The nucleus is the organelle which houses chromosomes. Chromosomes consist of DNA, which contains heredity information and instructions for cell growth, development, and reproduction. Nucleoplasm is the gelatinous substance within the nuclear envelope. Also called karyoplasm, this semi-aqueous material is similar to cytoplasm and is composed mainly of water with dissolved salts, enzymes, and organic molecules suspended within it. The nucleolus and chromosomes are surrounded by nucleoplasm, which functions to cushion and protect the contents of the nucleus. Substances are exchanged between the cytoplasm and nucleoplasm through nuclear pores.

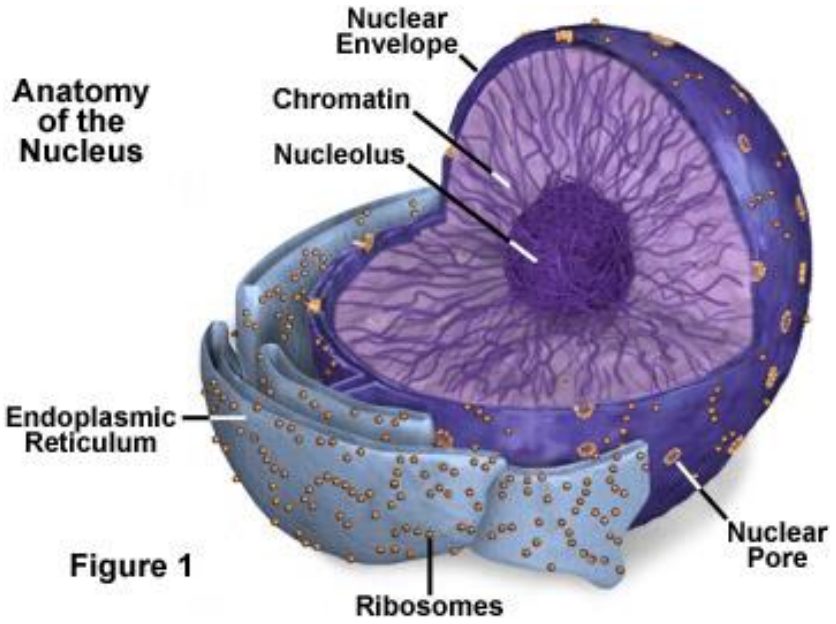
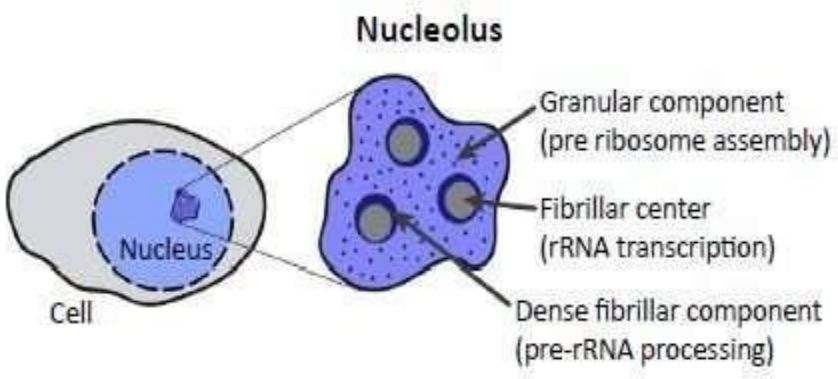



Figure 1

**4 – Nucleolus:** Contained within the nucleus is a dense, membrane-less structure composed of RNA and proteins called the nucleolus. The nucleolus contains nuclear organizers, which are parts of chromosomes with the genes for ribosome synthesis on them. The nucleolus helps to synthesize ribosomes by transcribing and assembling ribosomal RNA subunits. These subunits join together to form a ribosome during protein synthesis.




**5 - Endoplasmic Reticulum (ER):** it is an important organelle in eukaryotic cells. It plays a major role in the production, processing, and transport of proteins and lipids. The ER produces transmembrane proteins and lipids for its membrane and for many other cell components including lysosomes, secretory vesicles, the Golgi apparatus, the cell membrane, and plant cell vacuoles. The endoplasmic reticulum is a network of tubules and flattened sacs. There are two regions of the ER that differ in both structure and function. One region is called rough ER because it has ribosomes attached to the cytoplasmic side of the membrane. The other region is called smooth ER because it lacks attached ribosomes. **The rough endoplasmic reticulum** manufactures membranes and secretory proteins. The ribosomes attached to the rough ER synthesize proteins by the process of translation. In certain leukocytes (white blood cells), the rough ER produces antibodies. In pancreatic cells, the rough ER produces insulin. **The smooth ER** has a wide range

of functions including carbohydrate and lipid synthesis. Smooth ER also serves as a transitional area for vesicles that transport ER products to various destinations. In liver cells the smooth ER produces enzymes that help to detoxify certain compounds. In muscles the smooth ER assists in the contraction of muscle cells, and in brain cells it synthesizes male and female hormones.