2. Nucleus:

Nuclei are roughly spherical in shape in animal cells; they are typically located in the central region of the cell. The nucleus is separated from the rest of the cell by double phospholipid layer, which together make up the nuclear envelope.

The outer membrane of the nuclear envelope is continuous with Endoplasmic reticulum (ER), Shallow depressions scattered over the surface of nuclear envelope, are called nuclear pores. These pores are 5-80 nanometers a part, form at locations where the two membrane layers of the nuclear envelope pinch together rather than being empty, nuclear pores are filled with proteins that act as molecular channels permitting certain molecules to pass into and out of the nucleus.

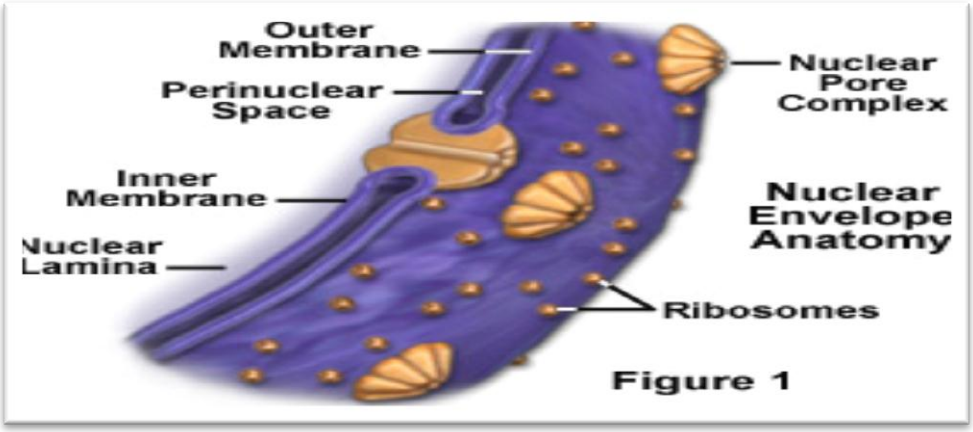
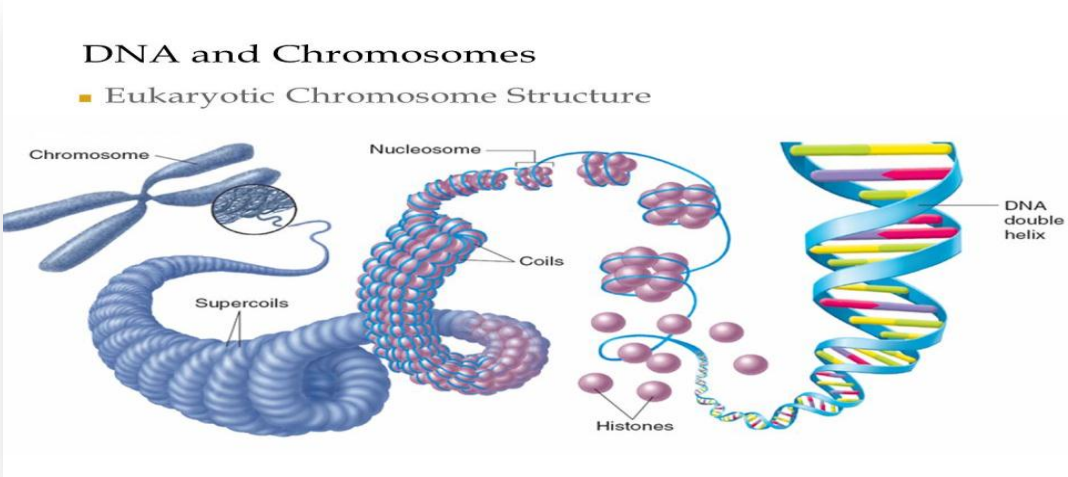


Figure 1

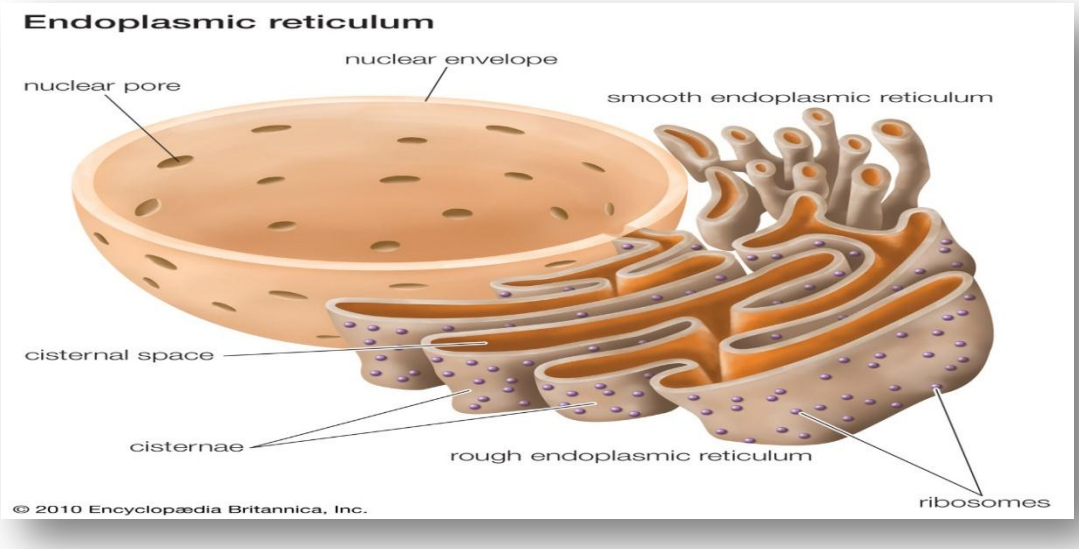
The nucleus is the center of the genetic information that directs all of the activities of the living eukaryotic cell. The DNA of animals is divided into several chromosomes is associated with packaging protein form chromosomes.

The areas where ribosomes are being assembled are easily visible within the nucleus as one or more dark staining regions, called nucleoli. Nuclei can be seen under the light microscope even when the chromosomes are extended.



3. Endoplasmic Reticulum

The endoplasmic reticulum (ER) is a complex, membrane-bound labyrinth of flattened sheets, sacs, and tubules that branches and spreads throughout the cytoplasm. The ER is continuous from the nuclear envelope to the plasma membrane and is a series of channels that helps various materials to circulate throughout the cytoplasm. It also is a storage unit for enzymes and other proteins and a point of attachment for ribosomes. ER with attached ribosomes is Rough ER, and ER without attached ribosomes is Smooth ER



A. Rough endoplasmic reticulum

(Rough endoplasmic reticulum) it spreads throughout the cell making it one of the largest organelles. The outer surface of rough endoplasmic reticulum consists of millions of ribosomes (membrane-bound ribosomes) which are involved in protein assembly through a process known as translation. Some of the main functions of the rough endoplasmic reticulum include:

1. Protein folding :

Protein folding refers to the process through which polypeptide chains are folded into specific three-dimensional (3D), biologically active proteins, through protein folding, a new regions appear on the protein molecule called active sites (lock and key). These proteins are sent to the Golgi apparatus before being transported to the appropriate destination e.g. the cell membrane.

2. Protein quality control :

Protein quality control occurs in the lumen of the endoplasmic reticulum. This is an important process that ensures only correctly folded proteins are produced and delivered to the appropriate destination. If incorrectly formed proteins are identified, they are either retained in the lumen or broken down to amino acids that can be re-used.

3. Protein transport :

The endoplasmic reticulum also plays an important role in the transport of most proteins to the Golgi apparatus where they are further sorted.

B. Smooth Endoplasmic Reticulum

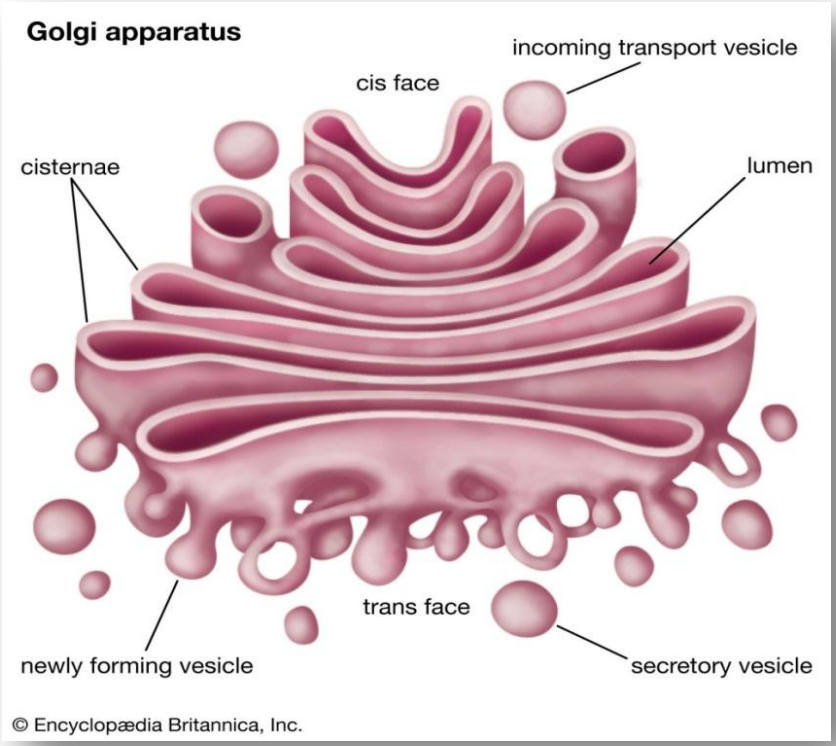
Unlike the rough endoplasmic reticulum, the smooth endoplasmic reticulum, as the name suggests, does not have surface ribosomes. It's also more tubular with an interconnecting network of sub-compartments. It's primarily involved in the assembly and packaging of lipids that are either used within the cell or exported outside the cell

Other functions associated with the smooth endoplasmic reticulum:
• **Metabolism - e.g. breakdown of glycogen to glucose in the liver.**
• **Production of steroid hormones in the adrenal cortex.**
• **Detoxification of various organic chemicals .**

5. Golgi Apparatus:

The Golgi apparatus is also a membrane-bound organelle that consists of membranous sacs and vesicles. Like the endoplasmic reticulum, the Golgi apparatus consists of membrane in folds commonly known as cisternae. When describing this organelle in relation to the endoplasmic reticulum, two faces are often discussed.

1. The **Cis** face, is the region of the Golgi apparatus facing towards the endoplasmic reticulum., it serves to receive material from the ER.
2. The **Trans** face, also known as the shipping face, is posterior to the Cis face and points towards the plasma membrane of the cell.



Folded proteins and lipids from the endoplasmic reticulum are transported to the Cis face of the Golgi apparatus through transport vesicles. In the Golgi, these products are modified, packed, and tagged.

Tagged products (protein or lipid in nature) are then sent into new vesicles (e.g. secretory vesicles) that bud off from the trans face of the Golgi apparatus to be transported to the appropriate destination.

6. Lysosomes:

Producers of digestive enzymes for the cell, lysosomes, another class ofmembrane-bounded organelles, provide an example of metabolic compartmentalization achieved by activity of the Golgi complex. The contain in a concentrated mix the digestive enzymes of the Cell, which catalyze the rapid breakdown of proteins, nucleic acids, lipids and carbohydrates. Throughout the live, lysosomal enzymes break down

old organelles, recycling their components molecules and making room for newly formed organelles.

7. Mitochondrion:

Mitochondrion, membrane-bound organelle found in the cytoplasm of almost all eukaryotic cells (cells with clearly defined nuclei), the primary function of which is to generate large quantities of energy in the form of adenosine triphosphate (ATP). Mitochondria are typically round to oval in shape and range in size from 0.5 to 10 μm.

In addition to producing energy, mitochondria store calcium for cell signaling activities, generate heat, and mediate cell growth and death. The number of mitochondria per cell varies widely—for example, in humans, erythrocytes (red blood cells) do not contain any mitochondria, whereas liver cells and muscle cells may contain hundreds or even thousands.

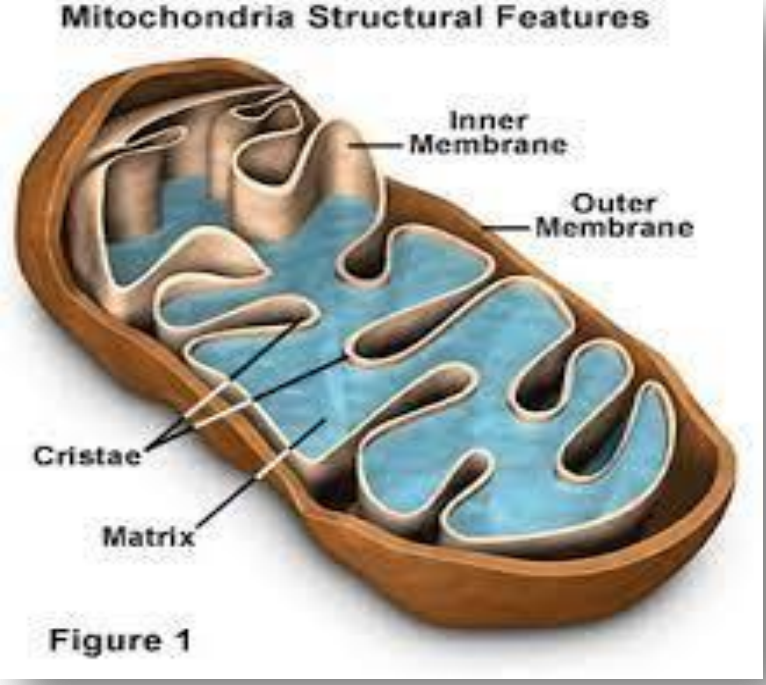


Figure 1

Mitochondria are unlike other cellular organelles in that they have two distinct membranes and a unique genome and reproduce by binary

fission; these features indicate that mitochondria share an evolutionary past with prokaryotes (single-celled organisms). Most of the proteins and other molecules that make up mitochondria originate in the cell nucleus. In many organisms, the mitochondrial genome is inherited maternally. because the mother's egg cell donates the majority of cytoplasm to the embryo, and mitochondria inherited from the father's sperm are usually destroyed.

8- Flagella and Cilia:

They are appendage extending from cells body Motility for the cell animal, cilia and flagella are remarkably similar in molecular composition and structure, consisting of a circle of nine microtubule pairs surrounding two central pairs; this arrangement is referred to as the 9 of 2 structures. Flagella (singular = flagellum) are long, thread-like structures that extend from the plasma membrane, less numbers, present at end or two ends of cell, help in locomotion, Wave-like undulating, sinusoidal, slow movement compared to cilia. Cilia are short hair like structure and more number, occurs throughout the cell surface, rotational, like a motor, very fast moving, and helps in locomotion, feeding circulation, aeration

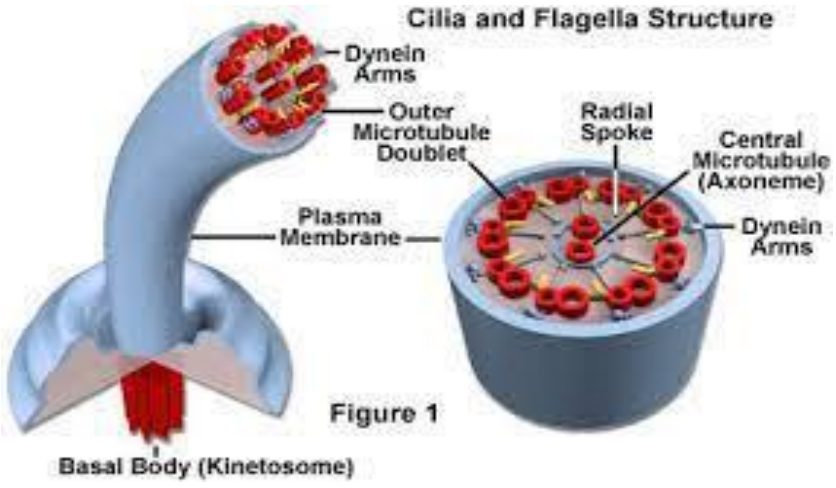
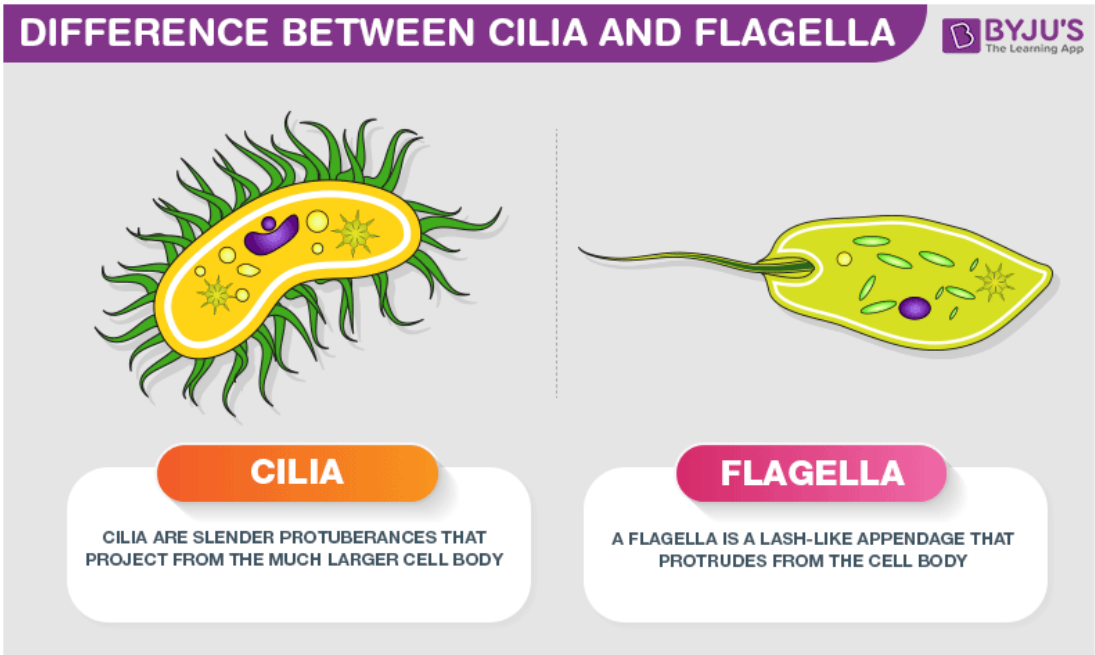


Figure 1



8- Centrioles:

Are barrel-shaped organelles found in the cells of animals, They occur in pairs, usually located in the cytoplasm near the nuclear membrane. Centrioles play a role in organizing microtubules of which are long, hollow cylinders composed of the protein tubulin. They help determine the locations of the nucleus and other organelles within the cell. Microtubules influence cell shape move the chromosomes in cells