



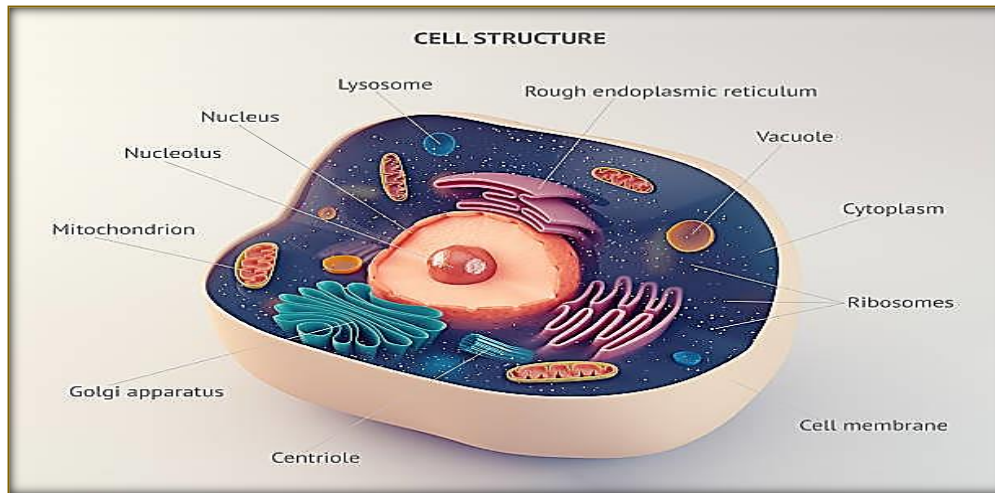
PHYSIOLOGY

Lecture Two cell physiology

M.Sc Nidaa fadhil

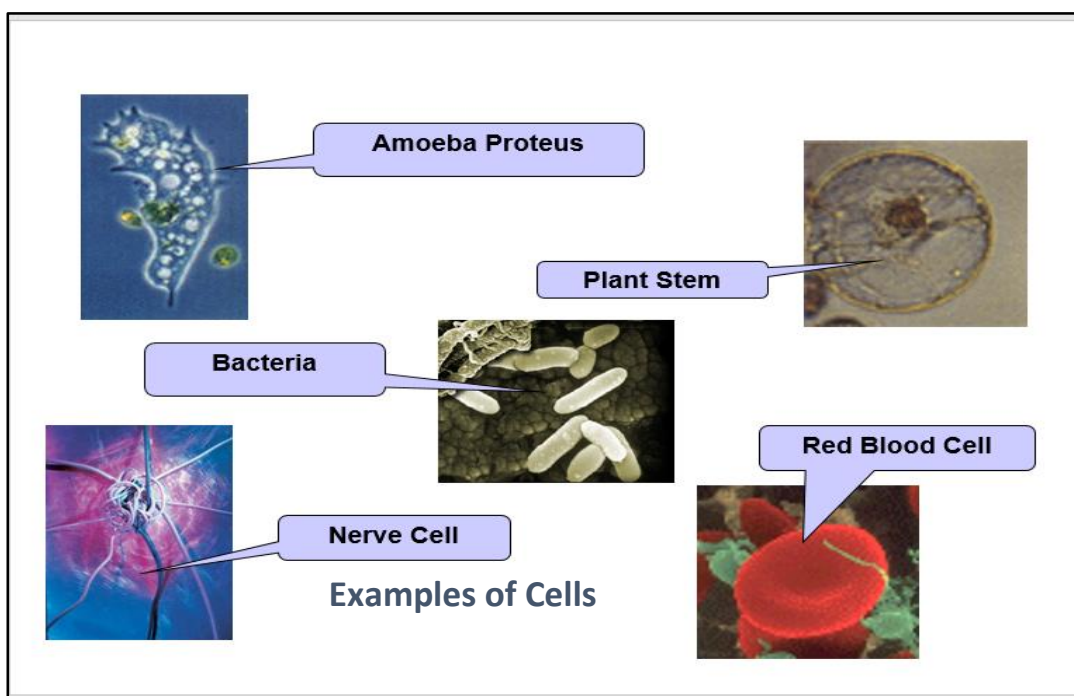
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Cells: is the smallest unit that is capable of performing life functions.



Cell Theory

- ❖ Cells are the fundamental unit of life.
- ❖ All organisms are constructed of and by cells.
- ❖ All cells arise from preexisting cells; Cells contain the information necessary for their own reproduction
- ❖ Cells are the functional units of life; all biochemical processes are carried out by cells.



Cellular Organization

Several different molecules interact to form organelles with our body. Each type of organelle has a specific function.

Cell Membranes

- ❖ Cell Membranes separates internal metabolic events from the external environment and controls the movement of materials into and out of the cell.
- ❖ This membrane is very selective about what it allows to pass through; this characteristic is referred to as "selective permeability."

For example : it allows oxygen and nutrients to enter the cell while keeping toxins and waste products out.

- ❖ The plasma membrane is a double phospholipid membrane, or a lipid bilayer, with the nonpolar hydrophobic tails pointing toward the inside of the membrane and the polar hydrophilic heads forming the inner and outer surfaces of the membrane.

Cytoplasm

- ❖ The gel-like material within the cell membrane is referred to as the cytoplasm. It is a fluid matrix, the cytosol, which consists of 80% to 90% water, salts, organic molecules and many enzymes that catalyze reactions, along with dissolved substances such as proteins and nutrients.
- ❖ It plays a mechanical role by moving around inside the membrane and pushing against the cell membrane helping to maintain the shape and consistency of the cell and again, to provide suspension to the organelles.
- ❖ cytoplasm contains many different organelles which are considered the insoluble constituents of the cytoplasm, such as the mitochondria, lysosomes, peroxysomes, ribosomes, several vacuoles and cytoskeletons, as well as complex cell membrane structures such as the endoplasmic reticulum and the Golgi apparatus that each have specific functions within the cell.

Nucleus

Nucleus is the largest of the cells organelles , Controls the cell.

❖ *Cells can have more than one nucleus or lack a nucleus all together.*

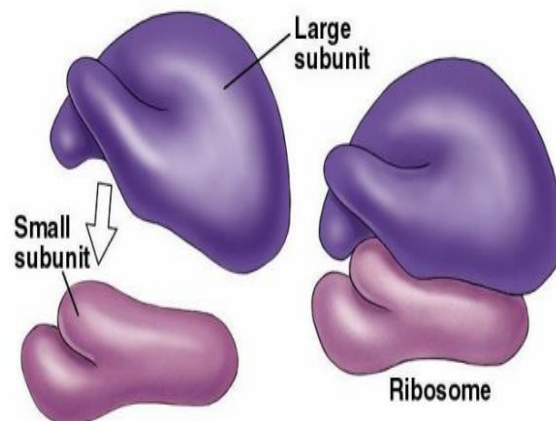
For example

- Skeletal muscle cells contain more than one nucleus .
- red blood cells do not contain a nucleus at all.
- ❖ The nucleus houses the genetic material (contains the DNA), the hereditary information in the cell.
- ❖ The nucleus also serves as the site for the separation of the chromosomes during cell division, When the cell begins to divide.

Ribosomes

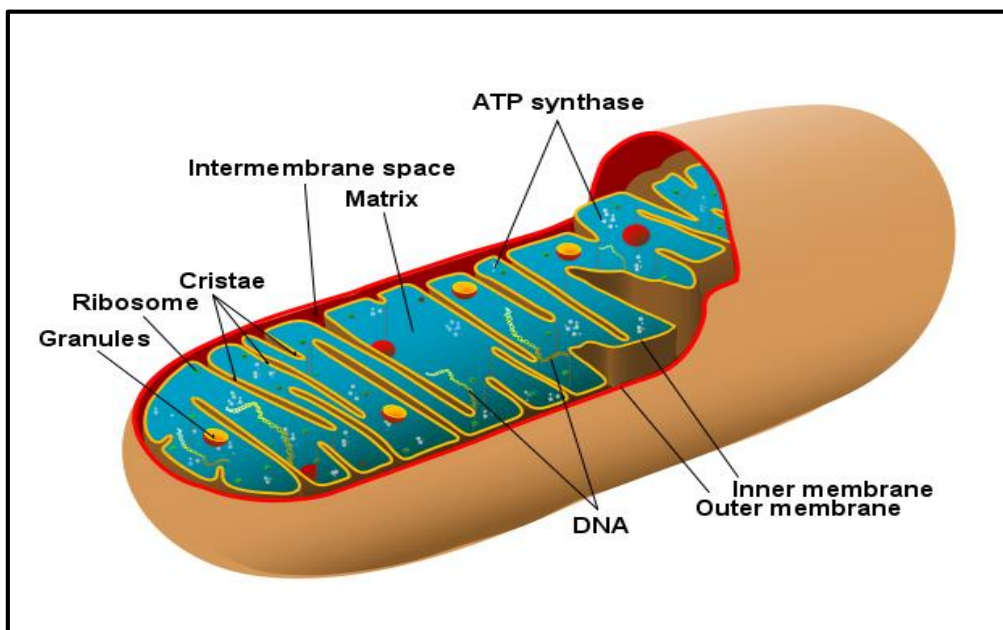
Ribosomes play an active role in the complex process of protein synthesis, where they serve as the structures that facilitate the joining of amino acids. Each ribosome is composed of a large and small subunit which are made up of ribosomal proteins and ribosomal RNAs.

They can either be found in groups called polyribosomes within the cytoplasm or found alone. Occasionally they are attached to the endoplasmic reticulum.



Mitochondria

- ❖ Mitochondria are the organelles that function as the cell "powerhouse" generating ATP, the universal form of energy used by all cells.
- ❖ Mitochondria are tiny sac-like structures found near the nucleus. Little shelves called cristae are formed from folds in the inner membrane.
- ❖ liver and kidney cells have high energy requirements and therefore have more mitochondria.



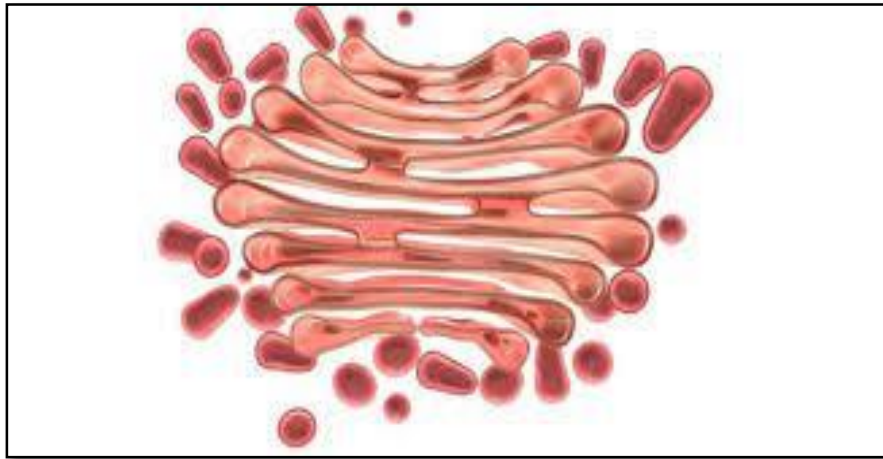
Mitochondria

Lysosomes

Lysosomes are sac-like compartments that contain a number of powerful degradative enzymes. They are built in the Golgi apparatus. They break down harmful cell products and waste materials, cellular debris, and foreign invaders such as bacteria, and then force them out of the cell. Tay-Sachs disease and Pompe's disease are just two of the malfunctions of lysosomes or their digestive proteins.

Golgi Apparatus

- ❖ "Packages" cellular products in sacs called vesicles so that the products can cross the cell membrane and exit the cell.
- ❖ The Golgi apparatus is the central delivery system for the cell. It is a group of flattened sacs arranged much like a stack of bowls.
- ❖ They function to modify and package proteins and lipids into vesicles, small spherically shaped sacs that bud from the ends of a Golgi apparatus.
- ❖ Vesicles often migrate to and merge with the plasma membrane, releasing their contents outside the cell.
- ❖ The Golgi apparatus also transports lipids and creates lysosomes and organelles involved in digestion.



Golgi Apparatus

Vacuoles

Spaces in the cytoplasm that sometimes serve to carry materials to the cell membrane for discharge to the outside of the cell.

Vacuoles are formed during endocytosis when portions of the cell membrane are pinched off.

Endoplasmic Reticulum

Endoplasmic means "within the plasm" and reticulum means "network". A complex three dimensional internal membrane system of flattened sheets, sacs and tubes, that play an important role in making proteins and shuttling cellular products; also involved in metabolisms of fats, and the production of various materials.

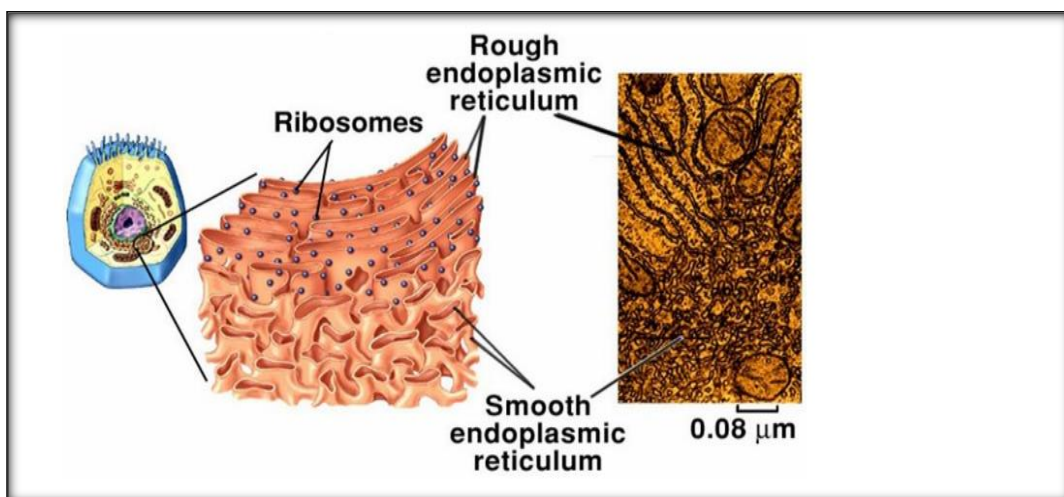
In cross-section, they appear as a series of maze-like channels, often closely associated with the nucleus.

When ribosomes are present, the rough ER attaches polysaccharide groups to the polypeptides as they are assembled by the ribosomes.

Smooth ER, without ribosomes, is responsible for various activities, including the synthesis of lipids and hormones, especially in cells that produce these substances for export from the cell. Rough endoplasmic reticulum has characteristic bumpy appearance due to the multitude of ribosomes coating it.

It is the site where proteins not destined for the cytoplasm are synthesized. Smooth endoplasmic reticulum provides a variety of functions, including lipid synthesis and degradation, and calcium ion storage.

In liver cells, the smooth ER is involved in the breakdown of toxins, drugs, and toxic byproducts from cellular reactions.



Endoplasmic Reticulum