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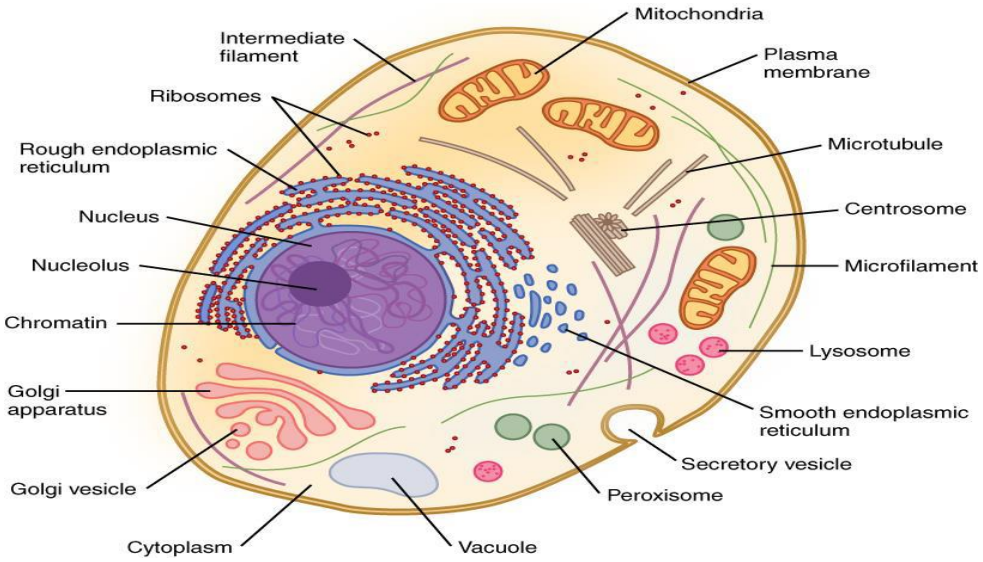
Physiology

Is the study of normal function within living creatures. It is a sub-section of biology, covering a range of topics that include organs, anatomy, cells, biological compounds, and how they all interact to make life possible.

Cell Physiology:

A typical cell, as seen by the light microscope has two major parts, the nucleus and the cytoplasm.
The nucleus is separated from the cytoplasm by a nuclear membrane, and the cytoplasm is separated from the surrounding fluids by a cell membrane, also called the plasma membrane. Or The basic living unit of the body is the cell، each organ is an aggregate of many different cells held together by intercellular supporting structures
Every living thing has cells
The cell divide into three main parts:

1. nucleus
2. cytoplasm
3. plasma membrane



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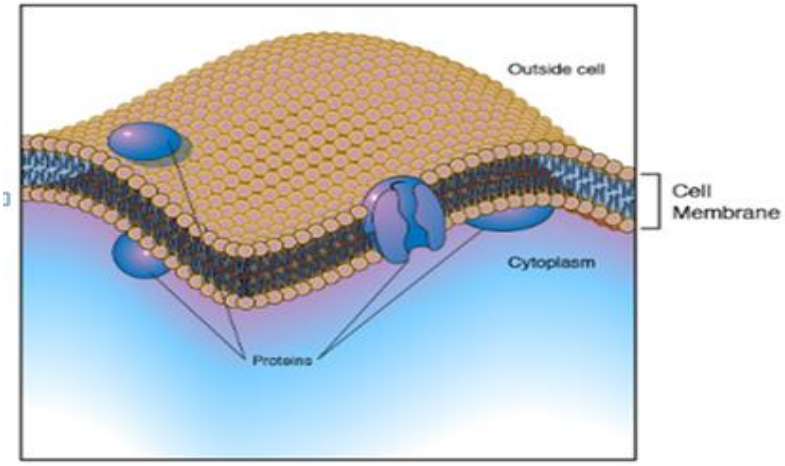
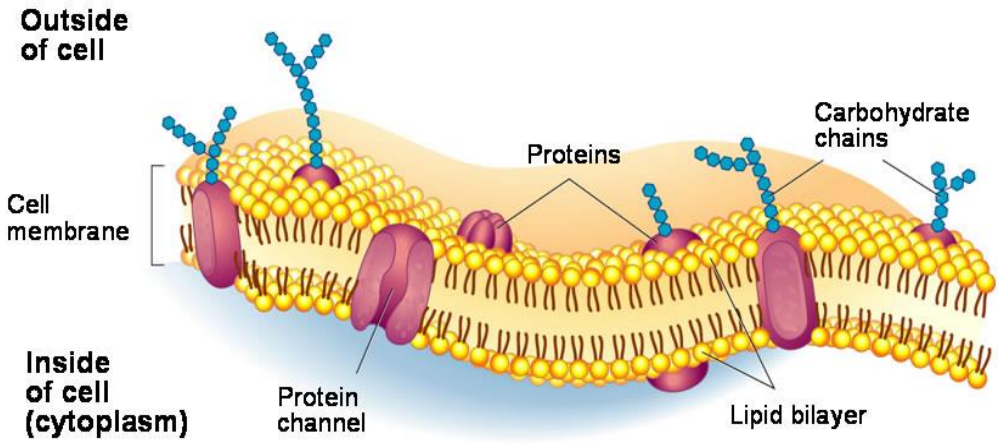
The cell membrane, (also called the plasma membrane), which envelops the cell, is a thin, pliable, elastic structure only 7.5 to 10 nanometers thick. It is composed almost entirely of proteins and lipids. The approximate composition is proteins, 55 %; phospholipids, 25 %; cholesterol, 13 %; other lipids, 4 %; and carbohydrates, 3 %.



Lipid Barrier of the Cell Membrane Impedes Water Penetration The basic lipid bilayer is composed of phospholipid molecules. One end of each phospholipid molecule is soluble in water; that is, it is hydrophilic. The other end is soluble only in fats; that is, it is hydrophobic The phosphate end of the phospholipid is hydrophilic, and the fatty acid portion is hydrophobic.

Structure of the Cell membrane:



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1-lipids (phospholipids and cholesterol)

The lipid layer in the middle of the membrane is impermeable to the usual water-soluble substances, such as ions, glucose, and urea. Conversely, fatsoluble substances, such as oxygen, carbon dioxide, and alcohol, can penetrate this portion of the membrane with ease. The cholesterol molecules in the membrane are also lipid in nature because their steroid nucleus is highly fat soluble. These molecules, in a sense, are dissolved in the bilayer of the membrane.

They mainly help determine the degree of permeability (or impermeability) of the bilayer to water-soluble constituents of body fluids. Cholesterol controls much of the fluidity of the membrane as well.

Cholesterol: another lipid composed of four fused carbon rings, is found alongside phospholipids in the core of the membrane.

2- ***Cell Membrane Proteins***.: are the second major component of plasma membranes. These are membrane proteins, most of which are glycoproteins. Two types of proteins occur: integral proteins that protrude all the way through the membrane, and peripheral proteins that are attached only to one surface of the membrane and do not penetrate all the way through.

Many of the integral proteins provide structural channels (or pores) through which water molecules and water-soluble substances, especially ions, can diffuse between the extracellular and intracellular fluids. Other integral proteins act as carrier proteins for transporting substances that otherwise could not penetrate the lipid bilayer.

Peripheral protein molecules are often attached to the integral proteins. These peripheral proteins function almost entirely as enzymes or as controllers of transport of substances through the cell membrane —pores.

3-Carbohydrate

the third major component of plasma membranes. In general, they are found on the outside surface of cells and are bound either to proteins (forming glycoproteins) or to lipids (forming

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glycolipids). The carbohydrate moieties attached to the outer surface of the cell have several important functions:

(1) Many of them have a negative electrical charge, which gives most cells an overall negative surface charge that repels other negative objects.

(2) The glycocalyx of some cells attaches to the glycocalyx of other cells, thus attaching cells to one another.

(3) Many of the carbohydrates act as receptor substances for binding hormones, such as insulin; when bound, this combination activates attached internal proteins that, in turn, activate a cascade of intracellular enzymes.

(4) Some carbohydrate moieties enter into immune reactions.

Cytoplasm and Its Organelles

The cytoplasm is filled with both minute and large dispersed particles and organelles. The clear fluid portion of the cytoplasm in which the particles are dispersed is called cytosol; this contains mainly dissolved proteins, electrolytes, and glucose.

Dispersed in the cytoplasm are neutral fat globules, glycogen granules, ribosomes, secretory vesicles, and five especially important organelles: the endoplasmic reticulum, the Golgi apparatus, mitochondria, lysosomes, and peroxisomes.

Endoplasmic Reticulum:

network of tubular and flat vesicular structures in the cytoplasm. Thespace inside the tubules and vesicles is filledwith endoplasmic matrix, a watery medium that is different from the fluid in the cytosol outside the endoplasmic reticulum**.**

Ribosomes and the Granular Endoplasmic Reticulum Attached to the outer surfaces of many parts of the endoplasmic reticulum are large numbers of minute granular particles called ribosomes. Where these are present, the reticulum is called the granular endoplasmic reticulum. The ribosomes are composed of mixture of RNA and proteins, and they function to synthesize new protein molecules in the cell.

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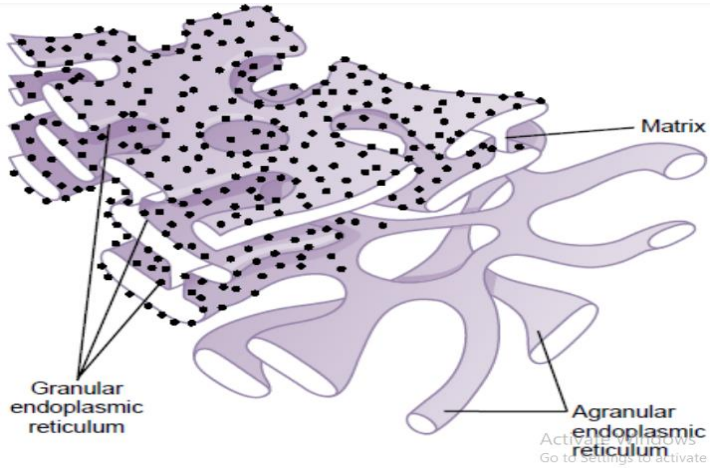


Golgi Apparatus

The Golgi apparatus, is closely related to the endoplasmic reticulum. It has membranes similar to those of the a granular endoplasmic reticulum. This apparatus is prominent in secretory cells, where it is located on the side of the cell from which the secretory substances are extruded. The Golgi apparatus functions in association with the endoplasmic reticulum. In this way, substances entrapped in the endoplasmic reticulum (ER) vesicles are transported from the endoplasmic reticulum to the Golgi apparatus.

Lysosomes:-

are vesicular organelles that form by breaking off from the Golgi apparatus and then dispersing throughout the cytoplasm. The lysosomes provide an intracellular digestive system that allows the cell to digest

(1) damaged cellular structures,

(2) food particles that have been ingested by the cell, and

(3) unwanted matter such as bacteria.

Peroxisomes

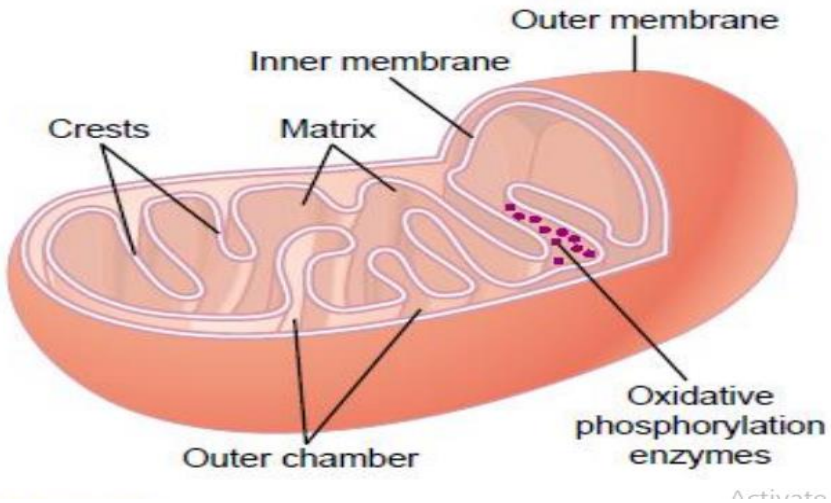
Peroxisomes are similar physically to lysosomes, but they are different in two important ways. First, they are believed to be formed by self-replication (or perhaps by budding off from the smooth endoplasmic reticulum) rather than from the Golgi apparatus. Second, they contain oxidases rather than hydrolases. Several of the oxidases are capable of combining oxygen with hydrogen ions derived from different intracellular chemicals to form hydrogen peroxide (H2O2).

Mitochondria

The mitochondria, are called the —powerhouses of the cell. Without them, cells would be unable to extract enough energy from the nutrients, and essentially all cellular functions would cease. Mitochondria are present in all areas of each cell's cytoplasm, mitochondria are concentrated in the portions of cell that are responsible for the major share of its energy metabolism.

The basic structure of the mitochondrion, is composed mainly of two lipid bilayer– protein membranes: an outer membrane and an inner membrane.

Many infoldings of the inner membrane form shelves onto which oxidative enzymes are attached. In addition, the inner cavity of the mitochondrion is filled with a matrix that contains large quantities of dissolved enzymes that are necessary for extracting energy from nutrients.



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Mitochondria are self-replicative, which means that one mitochondrion can form a second one, a third one, and so on, whenever there is a need in the cell for increased amounts of ATP. Indeed, the mitochondria contain DNA similar to that found in the cell nucleus.

Nucleus

The nucleus is the control center of the cell. Briefly, the nucleus contains large quantities of DNA, which are the genes. The genes determine the characteristics of the cell's proteins, including the structural proteins, as well as the intracellular enzymes that control cytoplasmic and nuclear activities. The genes also control and promote reproduction of the cell itself. The genes first reproduce to give two identical sets of genes; then the cell splits by a special process called mitosis to form two daughter cells, each of which receives one of the two sets of DNA genes.