

Al-Mamoon university college

Human Physiology



Medical lab Tech / 2nd class

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Lecture 1

General introduction to physiology

Physiology: is the science of studying the functional activities and its mechanisms in biological body.

Physiology derived from two Greek words

physis = nature

Logos = study

Fields of Physiology:

Physiology can be divided into: viral physiology, bacterial physiology, cellular physiology, plant physiology, human physiology, and many more subdivisions.

Human physiology: is the science of studying the rule of physiological functions in human body.

Cell physiology : general function , cell membrane transport

Cell physiology:

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.

Each type of cell is specially adapted to perform one or a few particular functions.

General functions of the cells:

The main functions of the cells are:

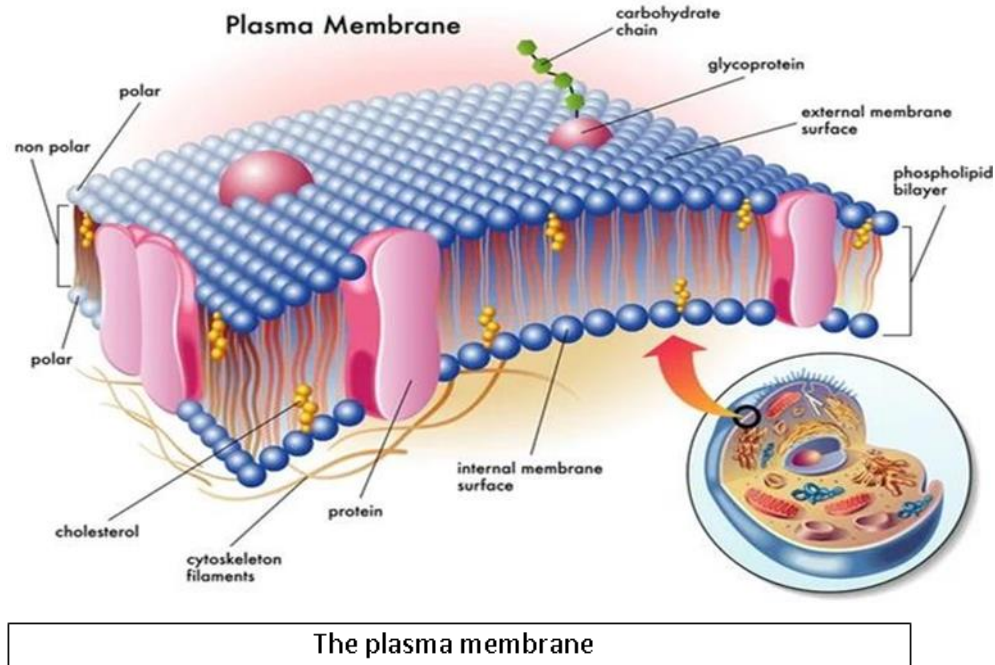
- 1- Absorption.
- 2- Digestion.
- 3- Respiration.
- 4- Biosynthesis.
- 5- Excretion.
- 6- Secretion.
- 7- Movement.
- 8- Homeostasis.
- 9- Reproduction.

The plasma membrane :

- The plasma membrane of the cell is a network of **lipids** and **proteins** that formed a boundary between the cells content and the outside of the cell.
- It's also called **cell membrane**.
- The main function of the cell membrane is to protect the cell from its surrounding environment.
- It's semi-permeable and regulates the materials that enter and exit the cell.
- The cells of all living organisms have a plasma membrane.

Cell membrane structure:

The plasma membrane consists of both **lipids and proteins**. The fundamental structure of the membrane is the **phospholipid bilayer**, which forms a stable barrier between two aqueous compartments. Proteins embedded within the phospholipid bilayer carry out the specific functions of the plasma membrane, including selective transport of molecules and cell-cell recognition.



The functions of plasma membrane :

- 1- The plasma membrane functions as a physical barrier between the external environment and the inner cell organelles.
- 2- The plasma membrane is a selectively permeable membrane, which permits the movement of only certain molecules both in and out of the cell.
- 3- The plasma membrane plays an important role in both endocytosis and exocytosis processes.
- 4- The plasma membrane also functions by facilitating communication and signaling between the cells.
- 5- The plasma membrane plays a vital role in anchoring the cytoskeleton to provide shape to the cell and also maintain the cell potential.

Transport across the cell membrane:

Molecules cross the membrane in 2 ways:

- 1- Passive ways: No energy used. Includes: simple diffusion, channel diffusion, and facilitated diffusion.
- 2- Active ways: Needs energy. Includes: active transport, endocytosis, and exocytosis.

Passive ways:

a) Simple diffusion :

Is the movement of the molecules from an area of higher concentration to an area of lower concentration, until they are distributed equally for example:

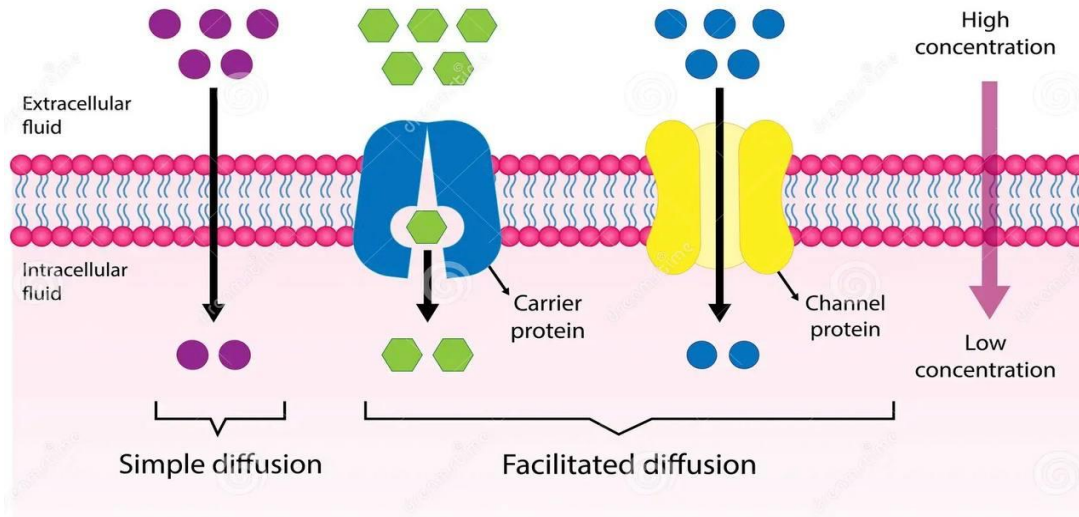
- Gas diffuse through the lipid bilayer, oxygen enter the cell and the carbon dioxide exits it.
- Water also can diffuse through the plasma membrane by the using of cannels called **Aquaporins** .this phenomenon called **Osmosis** (is the movement of water molecules from a solution with a high concentration of water molecules to a solution with a lower concentration of water molecules, through a cell's semi-permeable membrane).

b) Cannel diffusion:

This type of passive transport system also doesn't use energy. Used for movement of Ions (H⁻ or Cl⁻) and required only channel protein.

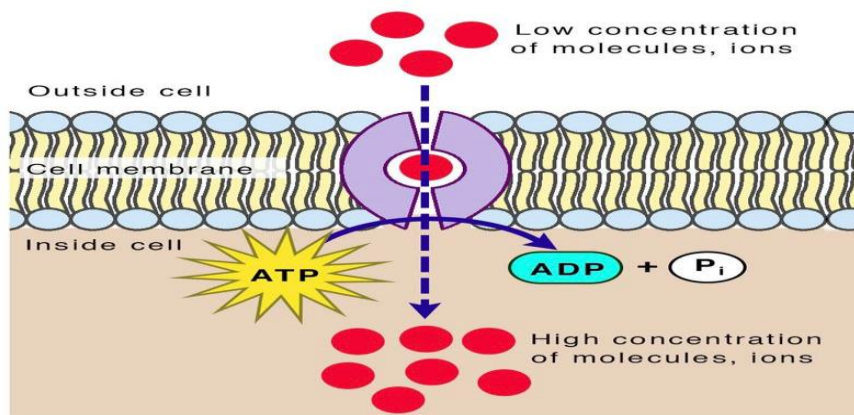
c) **Facilitated diffusion:** is another type of passive transport system doesn't use energy but required a carrier protein assist the movement of glucose or amino acids. Each protein carrier, (sometimes called a transporter), binds only to a particular molecule, such as glucose.

Passive transport



Active ways:

In cellular biology, active transport is the movement of molecules or ions across a cell membrane from the region of lower concentration to the region of higher concentration (**against the concentration gradient**). Active transport requires cellular energy to achieve this movement. (This process is in contrast to passive transport, which allows molecules or ions to move **down their concentration gradient**, from an area of high concentration to an area of low concentration, without energy).



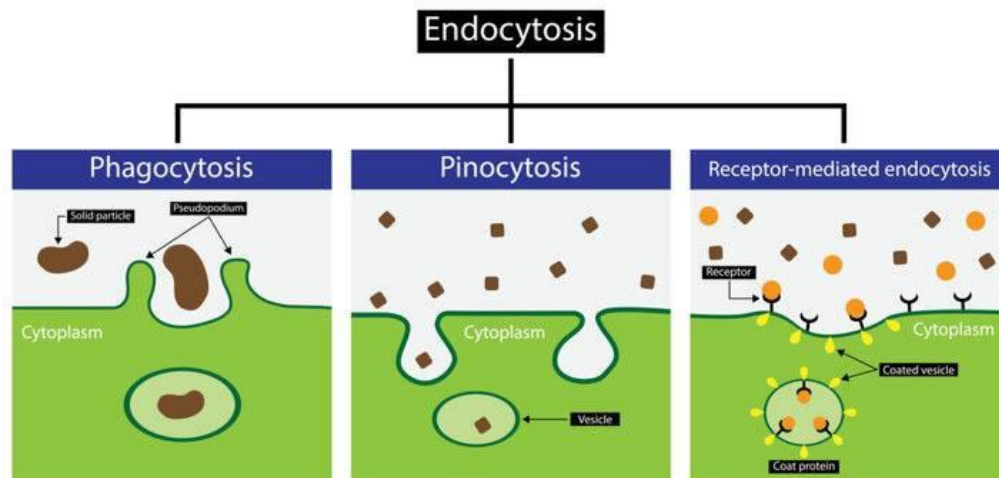
Endocytosis:

Is the uptake process of molecules and transport it across cell membrane into the cell by **vesicle formation**, a portion of the plasma membrane invaginates to envelop the substance, and then the membrane pinches off to form an intracellular vesicle. There are three type of endocytosis:

1- Phagocytosis: means (cell eating) occurs when large solid materials taken inside the cell such as food particles, dead cells, cell debris or anther cell such as bacteria. Best example on phagocytic cell is white blood cells (WBC) can engulf bacteria and worn-out red blood cells by phagocytosis. Digestion occurs when the resulting vacuole (phagocytic vacuole) fuses with a lysosome

2- Pinocytosis: means (cell drinking) occurs when vesicles form around fluid droplets. E.g. cells that line the kidney tubules or intestinal wall use this method of ingesting water substances.

3- Receptor –mediated endocytosis: A special form of endocytosis uses a receptor (a special form of membrane protein on the surface of the cell) to concentrate specific molecules of interest for endocytosis.



Exocytosis:

Is release process of material from the cell. During exocytosis vesicles often formed by Golgi apparatus and carrying a specific molecule fused with plasma membrane and secretion occurs. e.g. release of insulin molecules from beta cells.

