

Introduction to Human Physiology

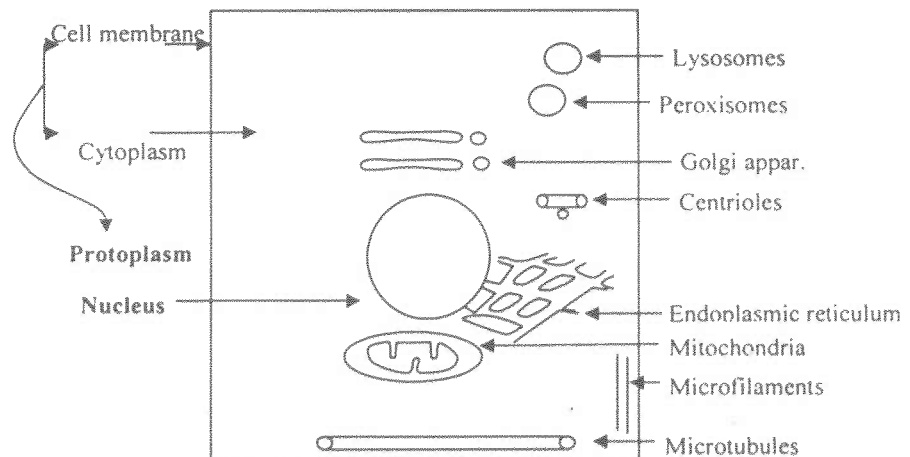
- ❖ Human physiology is concerned with the study of normal functions of different parts of human body or is concerned with the specific characteristics and mechanisms of human body that make it a living being.
- ❖ **Body composition:** In the average adult male, the body is composed of :-
 1. Water: 60%
 2. Proteins and related substances: 20%
 3. Fat: 15%
 4. Minerals: 5%.
 5. Carbohydrates have little structural function in the cell except as part of glycoprotein molecule but their major role is in nutrition of the cell
- ❖ **Organization of the body:**
 - The body is formed of group of systems as nervous system, endocrine system, cardiovascular system, respiratory system, digestive system, urogenital system and musculoskeletal system.
 - Each system is formed of group of organs.
 - Each organ is formed of group of tissues.
 - Each tissue is formed of group of cells.

Thus, the basic living unit of the body is the cell. The human body contains about 100 trillion cells.

Body → System → Organs → Tissues → Cells.

Cell Physiology

The cell is composed of:



- 1- Cell membrane:- Discussed later.
- 2- Protoplasm which is composed of:- Discussed in histology.
 - a- Cytoplasm that contains cell organelles

1-Endoplasmic reticulum	2-Golgi apparatus
3-Mitochondria	4-Lysosomes
5-Peroxisomes	6-Centerioles
7-Microtubules	8-Microfilaments.
 - b- Nucleus

Cell Membrane

- It is fluid rather than solid matrix. This fluidity makes it more flexible.
- It is semipermeable i.e. allows some substances to pass and prevents others.
- **Structure:-** Composed of lipids (42%), proteins (55%) and carbohydrates (3%):

1- Lipids (lipid bilayer, 42%)

- Continuous over entire surface.
- It provides a barrier that prevents the movement of water soluble substances.
- **Composition:-** Made up of phospholipids (the major lipid in cell membrane) and cholesterol.

A. Phospholipids:

- The major lipid in cell membrane.
- It is 2 molecules in thickness. Each molecule has:
 1. Head:
 - Contains the phosphate radical of phospholipids.
 - Relatively water-soluble (hydrophilic), thus it is exposed to water present inside or outside the cell, i.e., ICF and ECF.
 2. Tail:
 - Contains the free fatty acid radical (FFA).
 - Relatively water insoluble (hydrophobic). Thus, it is present in the water poor interior of the membrane.

B. Cholesterol

- It is dissolved in the phospholipid bilayer.
- Function:
 1. Determine the permeability of the lipid layer to water soluble substances.
 2. Determine the fluidity of the membrane.

2- Proteins (55%):

They do not form a continuous layer as lipids but they exist as globular masses floating in the lipid bilayer that may be:

a. **Integral proteins**

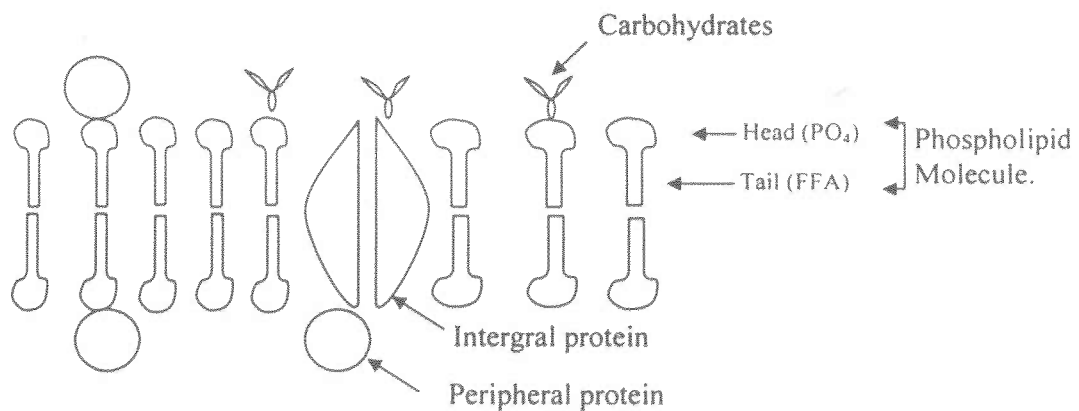
- Extend through the whole thickness of the membrane.
- Functions:- they act as
 - 1- Ion channels for passage of ions.
 - 2- Carriers for transport of substances as glucose and amino acids.
 - 3- Receptors for action of substances as hormones.
 - 4- Enzymes.

b. **Peripheral proteins**

- They are attached to cell membrane either from outside or more commonly from inside and not extended through the whole thickness of the membrane. They are often attached to one of the integral proteins.
- They act mainly as enzymes.

1. **Carbohydrates (Cell glycocalyx, 3%)**

- Present on the outer surface of cell membrane and in most cells form a loose coat on the entire surface of the cell called glycolcalex.
- They may be combined with proteins (glycoproteins) or lipids (glycolipids).
- Functions:
 - a. Many of them are negatively charged thus give most cells an overall negative surface charge.
 - b. Attach cells to each other.
 - c. Act as receptors.
 - d. Some enter into immune response.



Intercellular communications

Cells communicate with each other by sending signals or chemical messenger to each other. There are 2 types of communication.

1- Direct (electrical) communication

- In which the messenger (mainly depolarization) moves from cell to cell via gap junctions directly without entering to ECF.
- Gap junctions are channels running across the intercellular space connecting one cell to another. They permit the rapid propagation of action potential from cell to cell.
- Present in cardiac and smooth ms.

2- Indirect (chemical) communication

- The most common type of communications, in which the cell secrete chemical messenger to ECF to affect other cells by binding to receptor protein on cell membrane, cytoplasm or nucleus. There are 4 types:-

a. **Neural (synaptic) communication**

In which chemical messenger (called neurotransmitter) is released from presynaptic neuron passes the synaptic cleft and binds to a receptor on postsynaptic neurone.

b. **Endocrine communication**

In which the chemical messenger (called hormone) is secreted to blood and affect far cells.

c. **Paracrine communication**

In which the chemical messenger (mostly metabolic products as histamine and prostaglandins) is secreted to interstitial fluid and affects nearby cells.

d. **Autocrine communication**

In which the chemical messenger binds to receptor (affects) on the same cell that secrete it.

