Physiology (code)-year 2

Lecture 1(Functional organization of the (human body)

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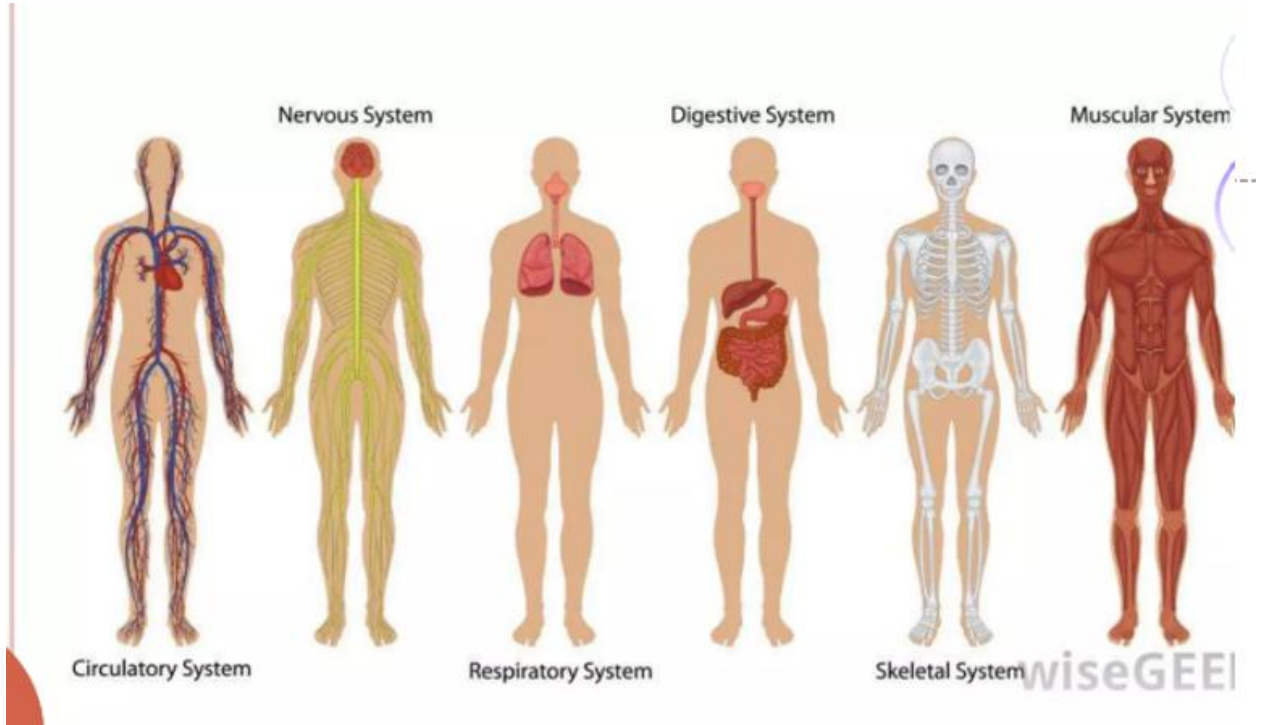
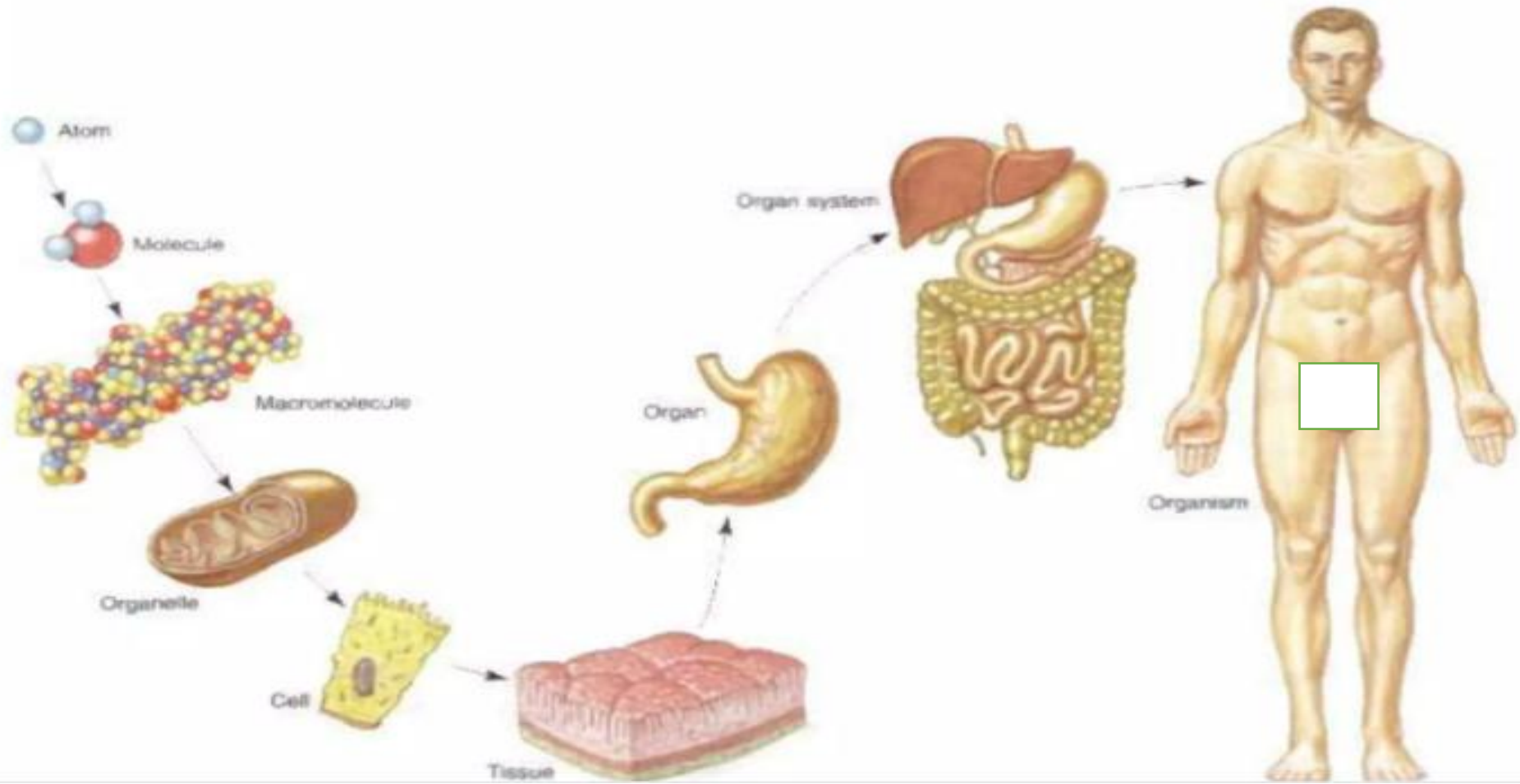
- Objectives
- Understand the level of organization of the human body
- Function organization of the human body
- Cell physiology
- Cell components
- Cell Junction



LEVELS OF ORGANISATION



DEFINITIONS

Cells are the basic structural and functional units that form our organism.

A **tissue** is a group of cells of the same type and origin, which perform the same function.

An **organ** is formed by different tissues that perform a particular function.

A **system** is a group of organs that participate in one or more specific functions.

An **organism** is formed by the ensemble of systems that function in a coordinated way.

Physiology

***Physiology* :** is the science that seeks to explain the physical and chemical mechanisms that are responsible for the origin, development, and progression of life.

The vast field of physiology can be divided into viral physiology, bacterial physiology, cellular physiology, plant physiology, human physiology, and many more subdivisions.

Human physiology

- The science of human physiology attempts to explain the specific characteristics and mechanisms of the human body that make it a living being.
- Human physiology links the basic sciences with medicine and integrates multiple functions of the cells, tissues, and organs into the functions of the living human being.
- This integration requires communication and coordination by a vast array of control systems that operate at every level—from the genes that program synthesis of molecules to the complex nervous and hormonal systems that coordinate functions of cells, tissues, and organs throughout the body.

Cells are the living unit of the body

- Cells: the basic structural and functional unit

Tissues: (e.g. muscles, epithelial, nervous)

Organs: (e.g. kidney, heart, liver, pancreas)

Organ systems: (e.g. cardiovascular, urinary)

Cells Physiology

• The basic living unit of the body is the cell; Each tissue and organ is an aggregate of many different cells held together by intercellular supporting structures.

• For example, the red blood cells, numbering about 25 trillion in each human being, transport oxygen from the lungs to the tissues.

• Although the red blood cells are the most abundant of any single type of cell in the body, about 75 trillion additional cells of other types perform functions different from those of the red blood cell.

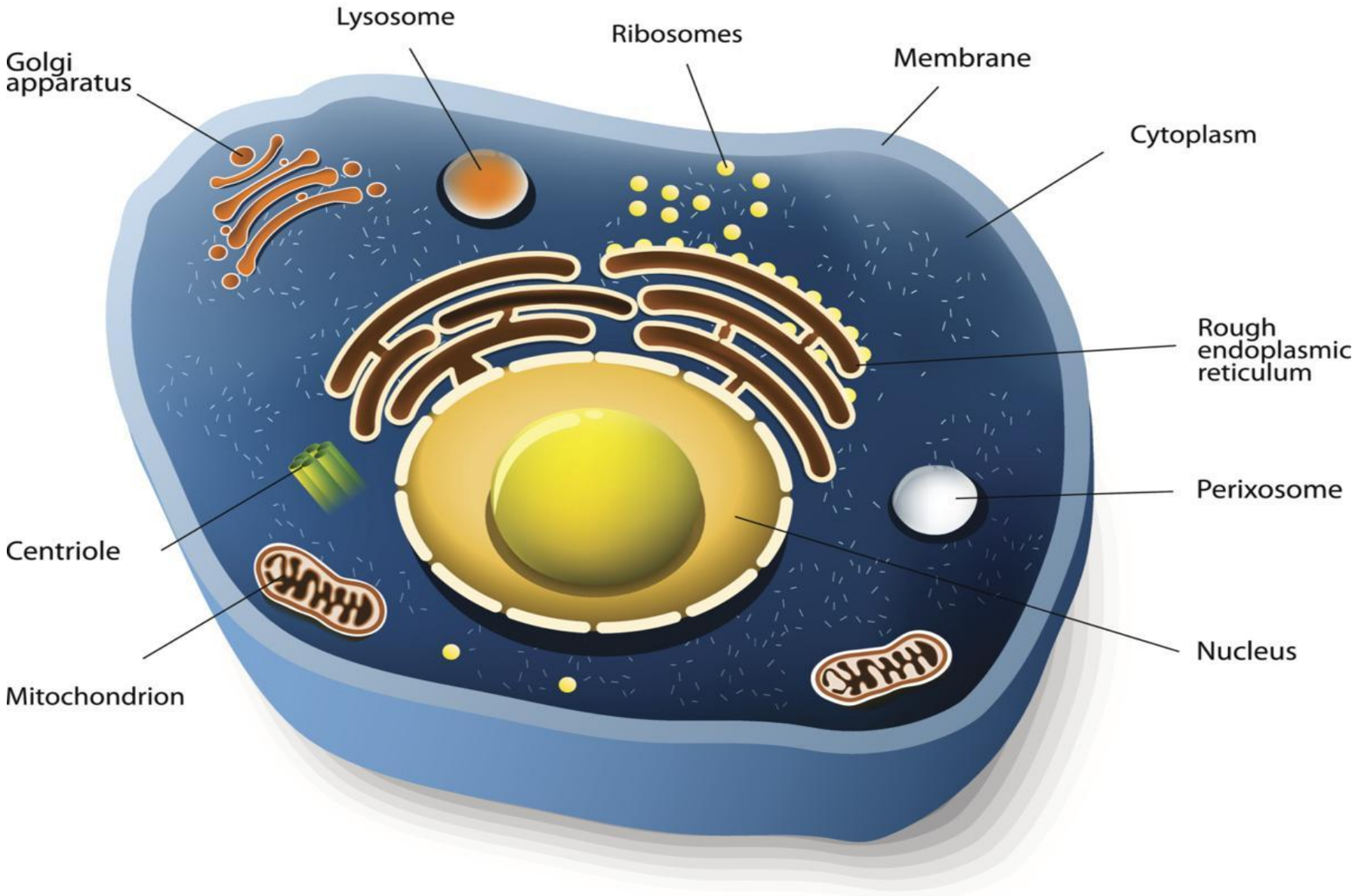
• The entire body, then, contains about 100 trillion cells.

- Almost all cells also have the ability to reproduce additional cells of their own kind. Fortunately, when cells of a particular type are destroyed from one cause or another, the remaining cells of this type usually generate new cells until the supply is replenished.

The many cells of the body often differ markedly from one another but all have certain basic characteristics that are alike. For example, oxygen reacts with carbohydrate, fat, and protein to release the energy required for all cells to function.

Furthermore, the general chemical mechanisms for changing nutrients into energy are basically the same in all cells, and all cells deliver products of their chemical reactions into the surrounding fluids.

ANIMAL CELL

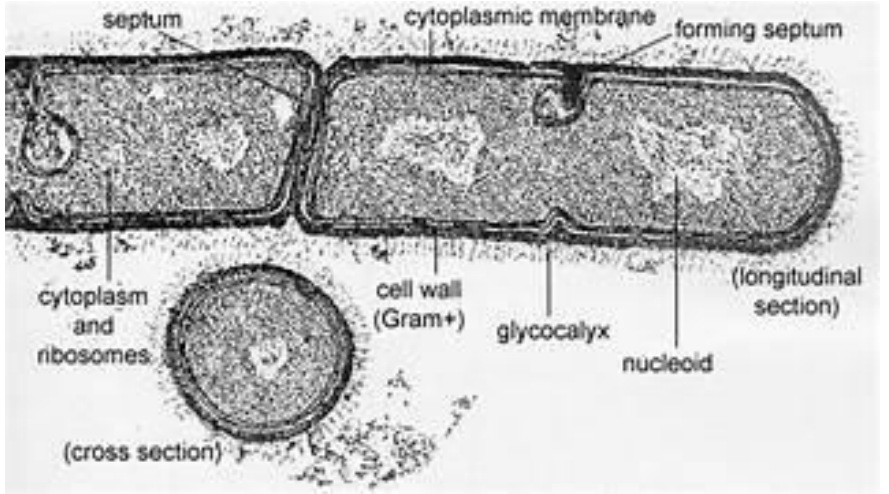

Lysosome
Ribosomes
Golgi apparatus
Membrane
Cytoplasm
Rough endoplasmic reticulum
Perixosome
Centriole
Nucleus
Mitochondrion

The cell membrane

Also called the *plasma membrane* or *plasmalemma* is a biological membrane separating the interior of a cell from the outside environment .

It appears in thin sections with the electron microscope as a triple-layered structure about 7.5–10 nanometers thick .

The cell membrane is flexible and allows a unicellular organism to move .



FUNCTIONS OF PLASMA MEMBRANE

1) Membrane keeps a cell intact and as protective barrier.
2) Regulate transport in & out of cell (selectively permeable) such as small lipid-soluble molecules, e.g. oxygen and carbon dioxide can pass easily , and water can freely cross the membrane .
3) Ions and large molecules cannot cross without assistance .
4) Allow cell recognition.
5) Provide anchoring sites for filaments of cytoskeleton.
6) Provide a binding site for enzymes .
7) Interlocking surfaces bind cells together (junctions) .
8) Contains the cytoplasm (fluid in cell).

CHEMICAL COMPOSITION OF THE CELL MEMBRANE

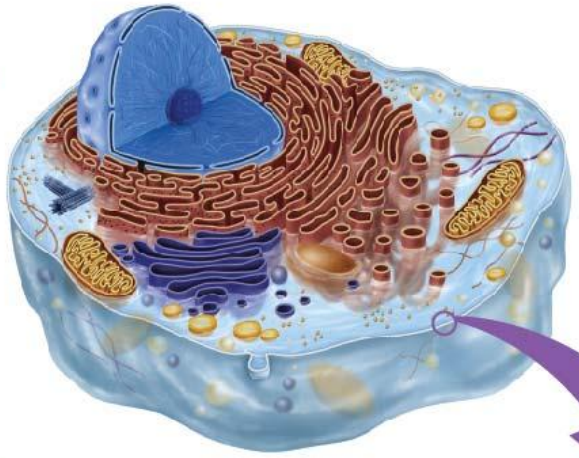
Cell membranes are composed primarily of lipids and proteins.

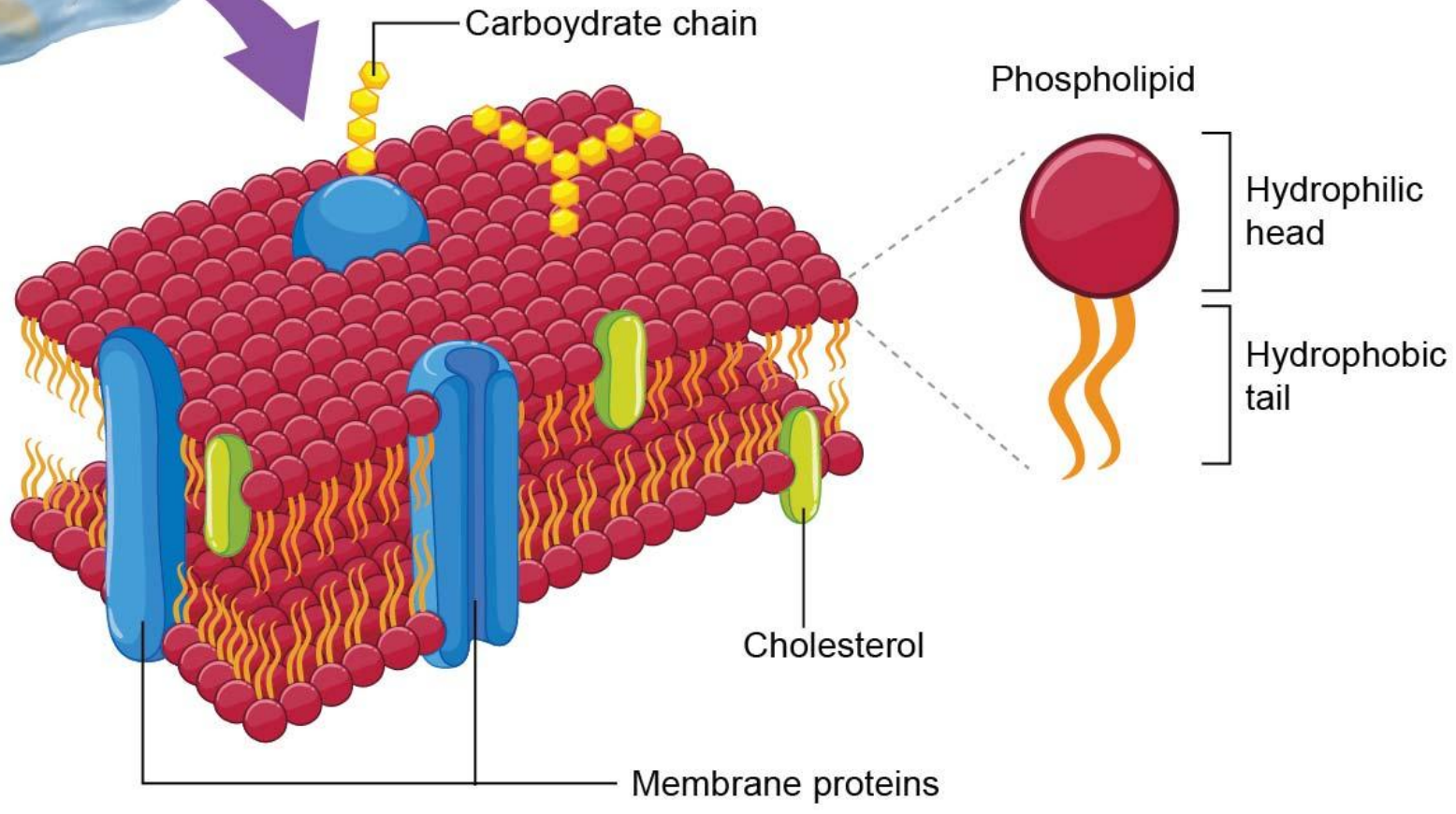
The **lipid** component consists of phospholipids, cholesterol, and glycolipids and is responsible for the high permeability of cell membranes to lipid-soluble substances such as carbon dioxide, oxygen, fatty acids, and steroid hormones.

The lipid component of cell membranes is also responsible for the low permeability of cell membranes to water soluble substances such as ions, glucose, and amino acids.

Phospholipids molecule has a polar head and nonpolar tails , The polar head is charged and hydrophilic (loves water) facing outward .The nonpolar tails are hydrophobic (hates water) facing inward .

Cell membrane





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Proteins-plasma membrane contains about 50% protein. Amount and type is variable.

Proteins of plasma membranes are of two types:

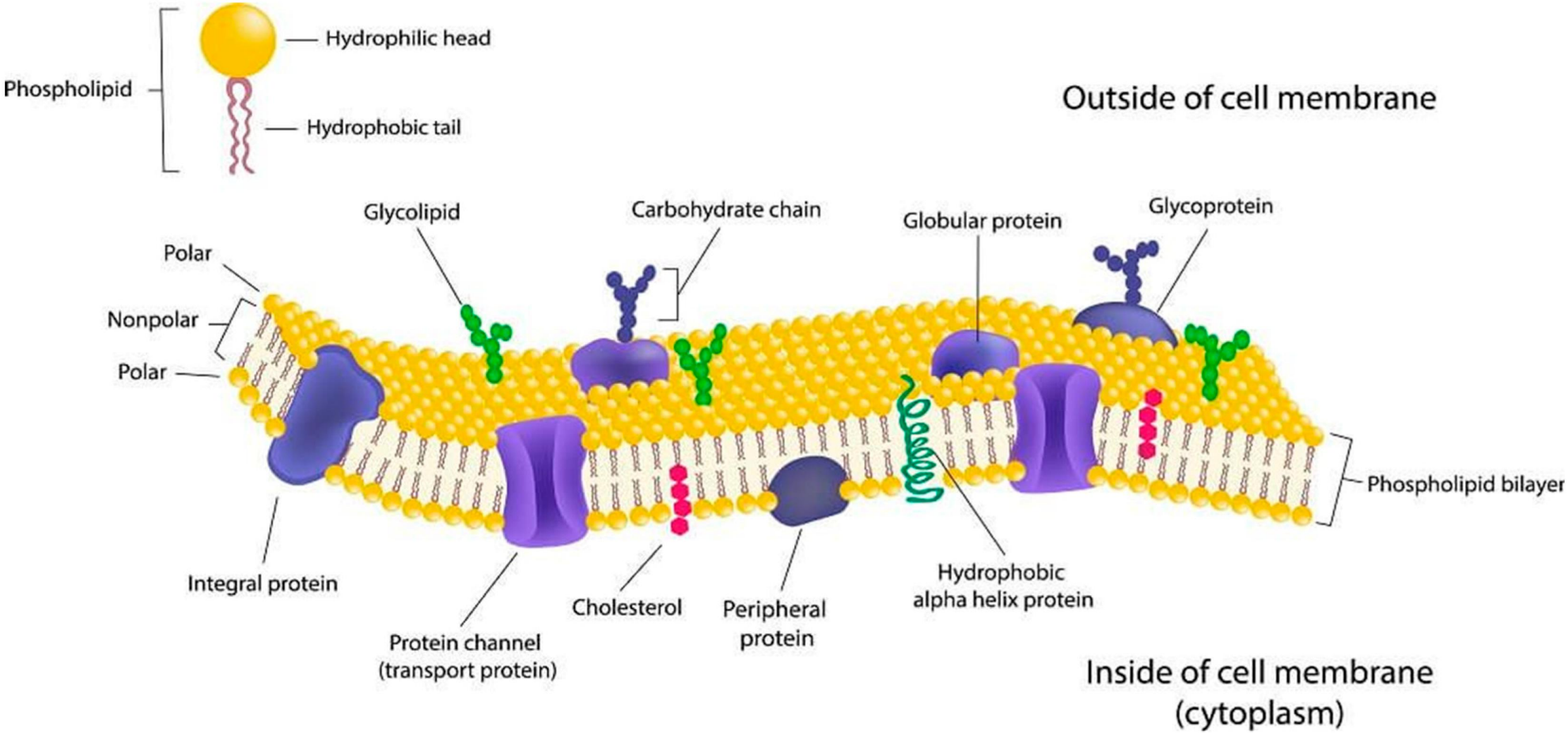
Integral protein As its name suggests, an integral protein is a protein that is embedded in the membrane, an integral protein that extends an opening through the membrane for ions to enter or exit the cell is known as a channel protein .

Peripheral protein are typically found on the inner or outer surface of the lipid bilayer but can also be attached to the internal or external surface of an integral protein.

- Plasma membranes contains structural proteins, transport proteins and enzymes. Some of them acts as receptors.
- Enzymes present in the plasma membrane are acid phosphatase, ATP ase, RNA ase, maltase, lactase, phospholipase etc) .

- **Carbohydrates-** they are present only in the plasma membrane and are present exterior (glycoproteins) or polar end of phospholipids at the external surface of plasma membrane .

Structure of the cell membrane



Cell components

Cells contain organelles . Cell Components that performs specific functions for the cell.

Cellular Organelles

1. The Plasma membrane

2.The Nucleus :Brain of Cell ,

Bordered by a porous membrane - nuclear envelope.

Contains thin fibers of DNA and protein called Chromatin.

Rod Shaped Chromosomes

Contains a small round nucleolus

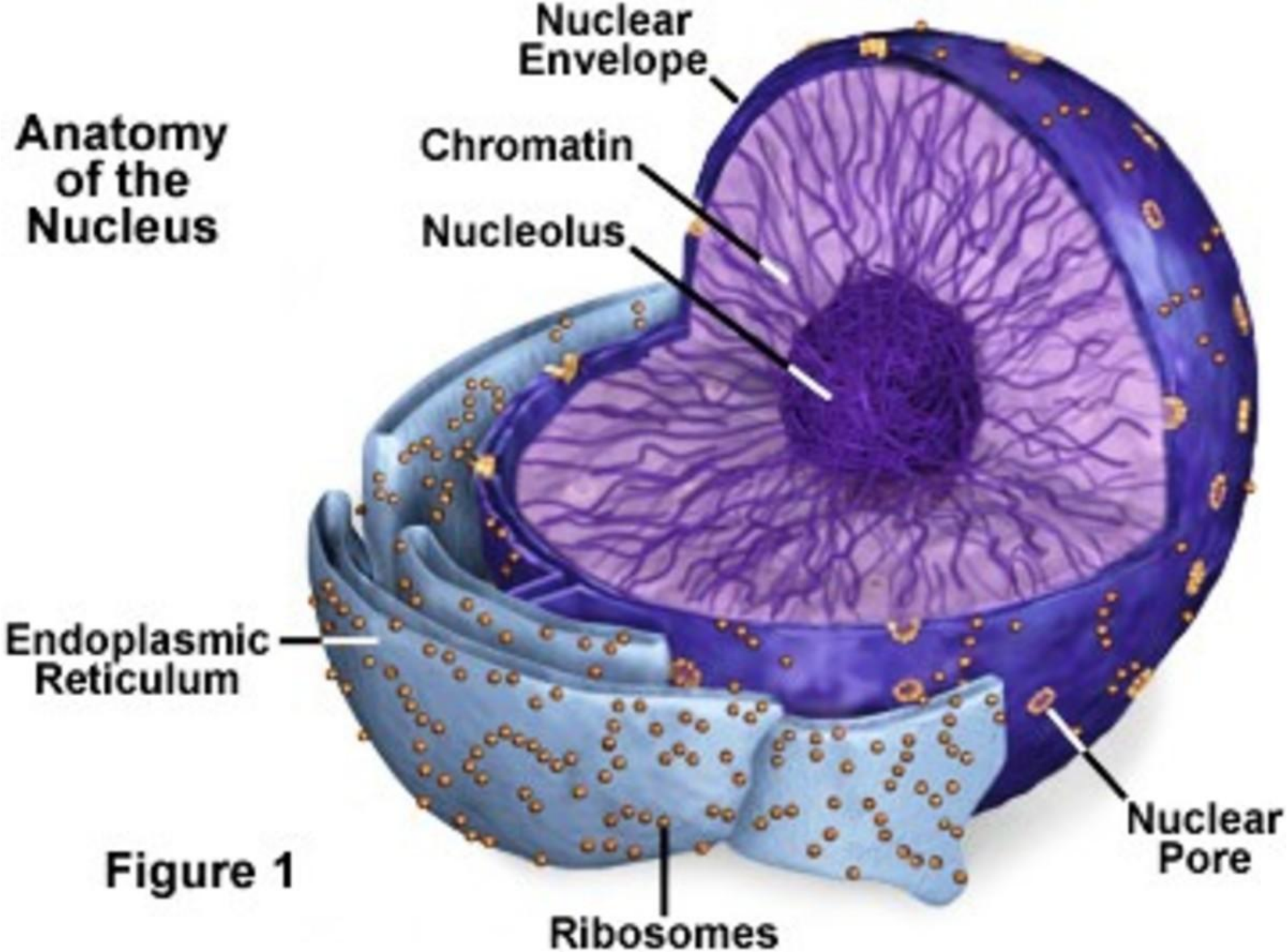

Anatomy of the Nucleus
Nuclear Envelope
Chromatin
Nucleolus
Endoplasmic Reticulum
Nuclear Pore
Ribosomes

Figure 1

3. Ribosomes:

Site of protein synthesis in the cell.

4. Endoplasmic Reticulum:

complex network of transport channels. Two types:

a) Smooth- ribosome free and functions in poison detoxification.

b) Rough - contains ribosomes and releases newly made protein from the cell.

5. Golgi Apparatus : A series of flattened sacs that modifies, packages, stores, and transports materials out of the cell.

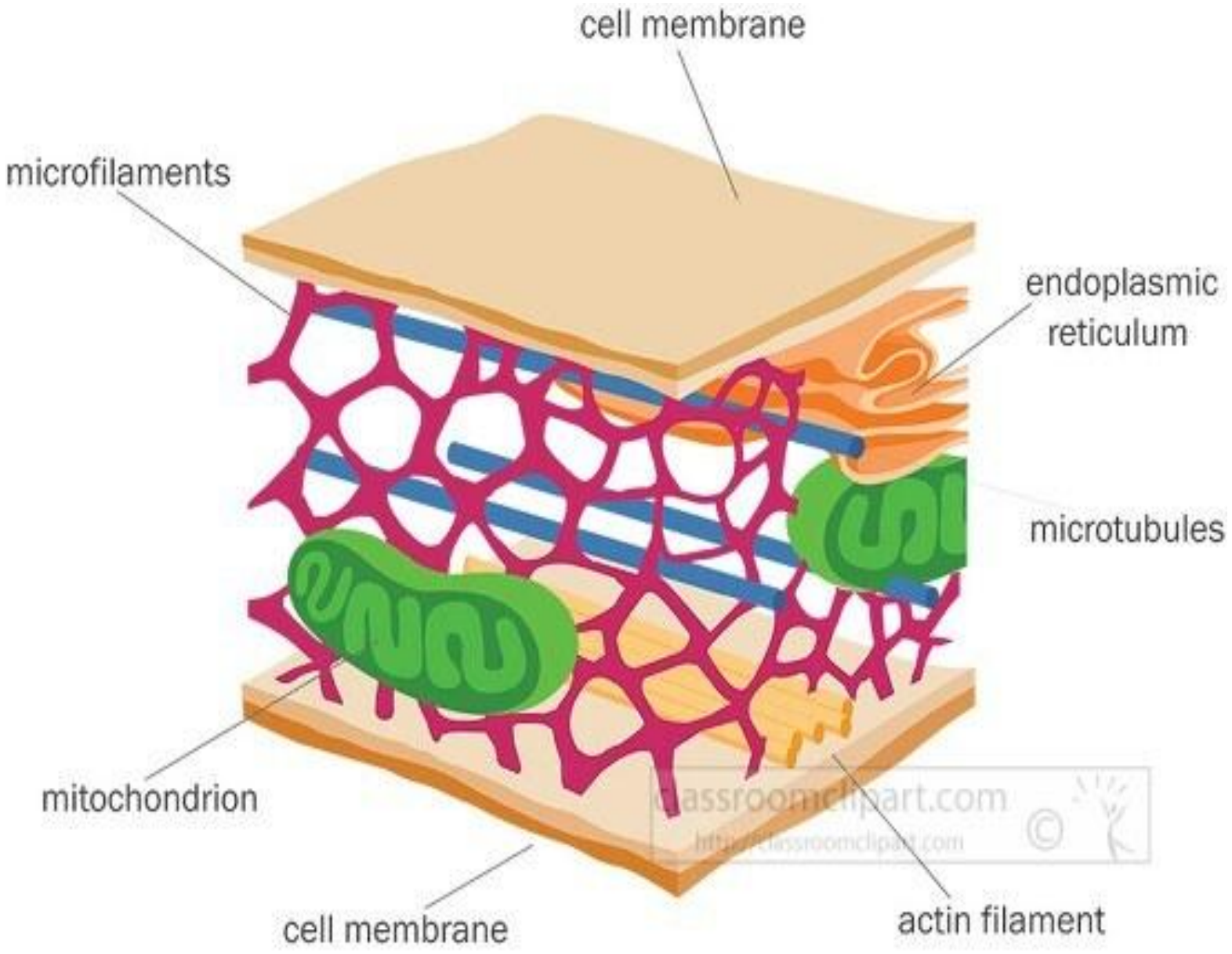
6. Lysosomes :containing a variety of enzymes . Help digest food particles inside or out side the cell.

7. Centrioles : Play a role in cellular reproduction.

8. Cytoskeleton : Framework of the cell , Contains small microfilaments and larger microtubules. They support the cell, giving it its shape and help with the movement of its organelles.

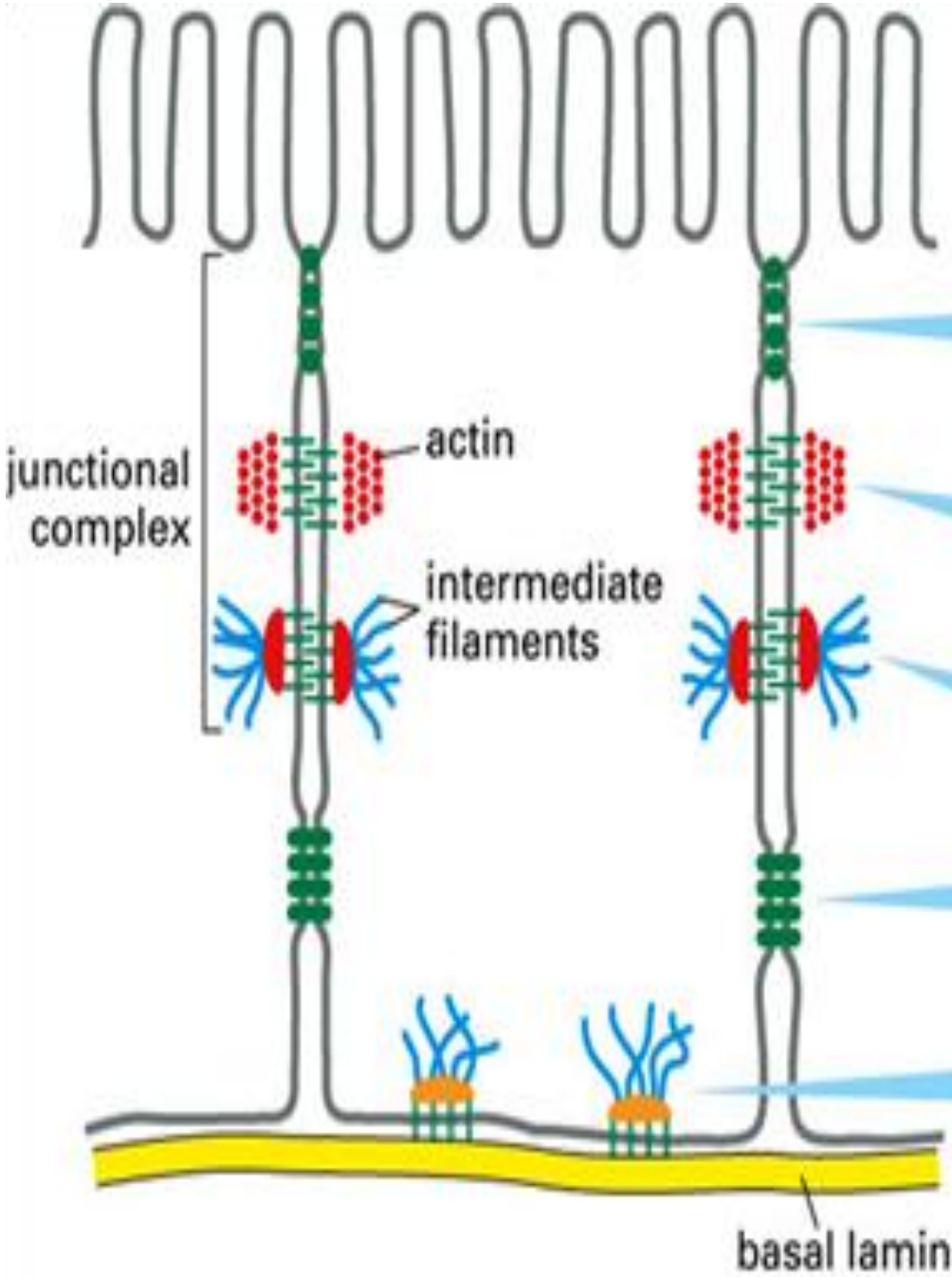
9. Mitochondrion : Double Membranous , Produces high energy compound ATP.

The Cytoskeleton



CELL JUNCTIONS

- Cell junction is the connection between neighboring cells or the contact between the cell and the extracellular matrix.
- Connection between two cells is called ***Intercellular junction*** like **tight junction**, **gap junction**, **adherence junction** and **desmosome**. Contact between the cell and extracellular matrix are ***hemidesmosome***.



name	function
tight junction	seals neighboring cells together in an epithelial sheet to prevent leakage of molecules between them
adherens junction	joins an actin bundle in one cell to a similar bundle in a neighboring cell
desmosome	joins the intermediate filaments in one cell to those in a neighbor
gap junction	allows the passage of small water-soluble ions and molecules
hemidesmosome	anchors intermediate filaments in a cell to the basal lamina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YOU