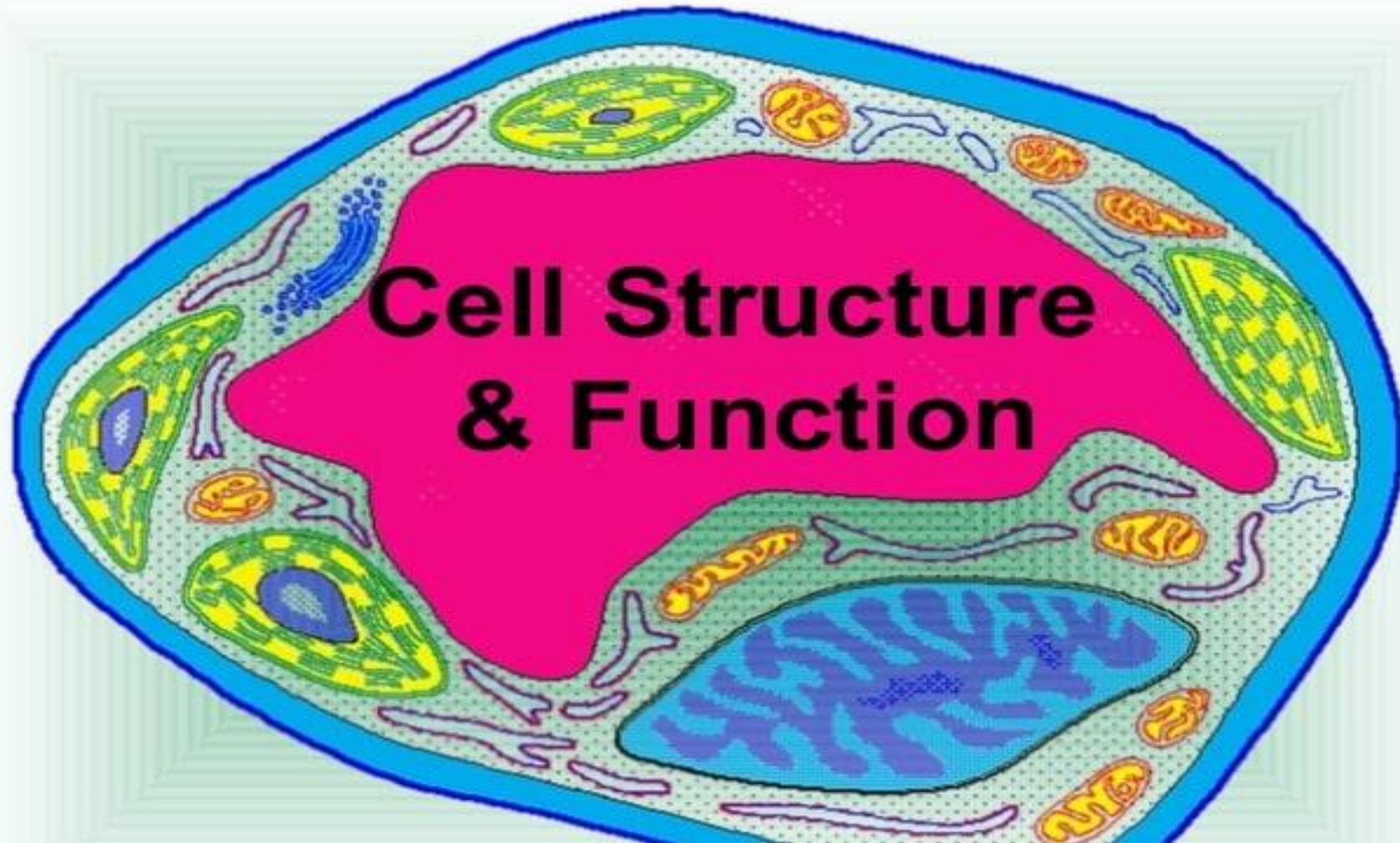




By lecturer:
Ms. Sarmad Sirag
M.sc Biochemistry and Molecular Biology

What is the cell?

- **The cell** is the basic structural and functional unit of all living systems.
- Thus, biochemistry can also be described as **the science concerned with the chemical constituents of living cells and with the reactions and processes, they undergo.**

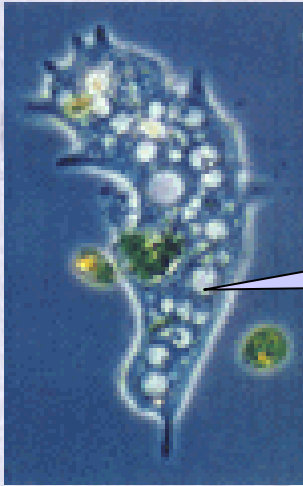
Cells produce **tissues**-----

Tissues produce **organs**-----

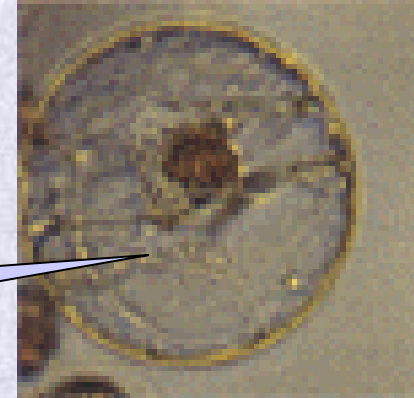
Organs produce **organ systems**----

Organ systems produce **organisms**

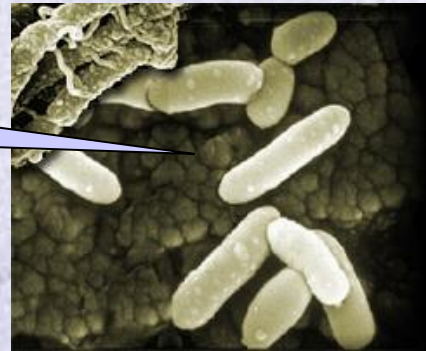
Examples of Cells



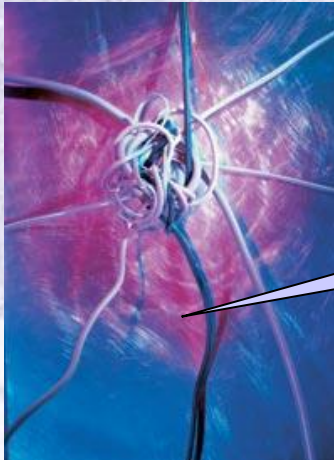
Amoeba Proteus



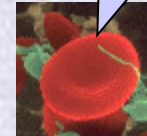
Plant Stem



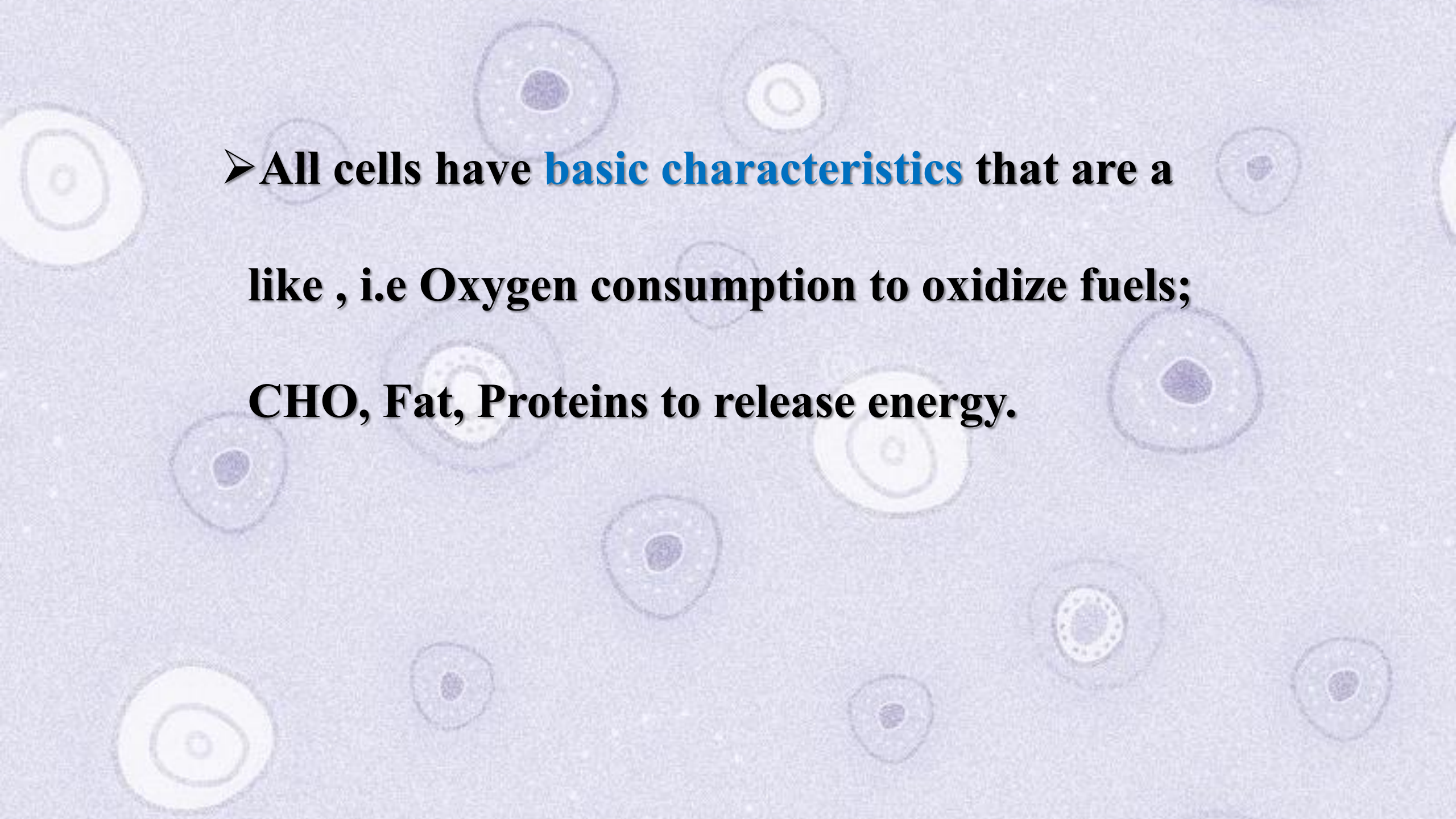
Bacteria



Nerve Cell



Red Blood Cell

The background of the slide features a repeating pattern of stylized cells. Each cell is depicted with a light blue outer boundary, a darker blue inner boundary, and a central dark blue nucleus. The cells are scattered across the slide, creating a biological or medical theme.

➤ All cells have **basic characteristics** that are a
like , i.e **Oxygen consumption to oxidize fuels;**
CHO, Fat, Proteins to release energy.

Two Types of Cells

- **Prokaryotic**

- **Eukaryotic**

Prokaryotes:

A. Have a few or **no organelles.**

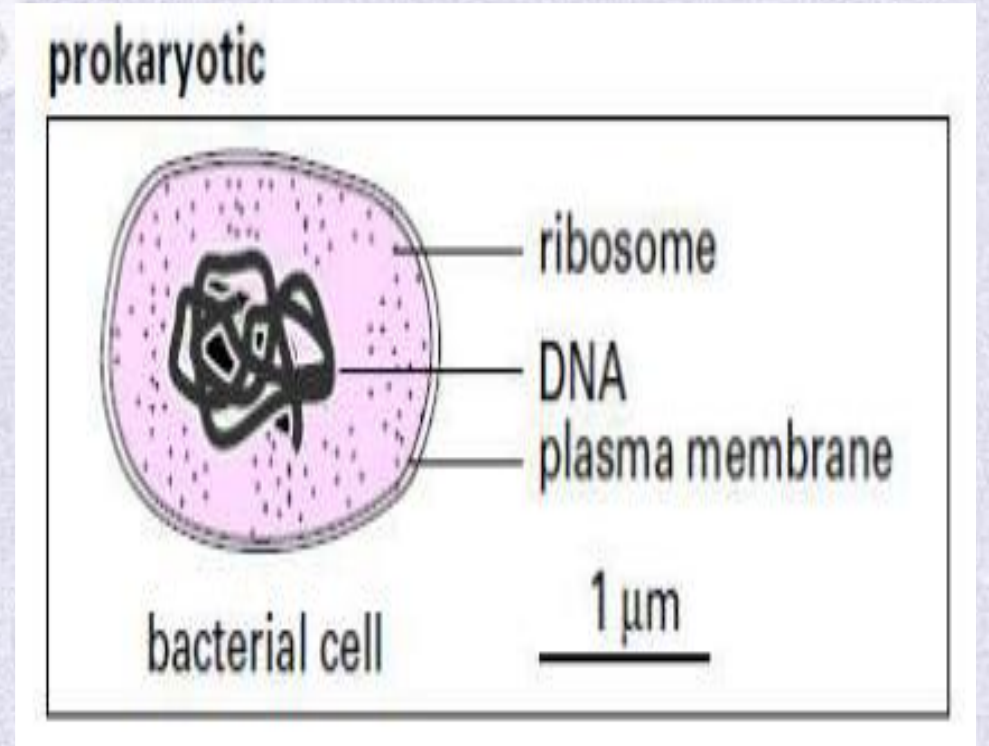
1. No nucleus.

2. DNA in cluster (less DNA).

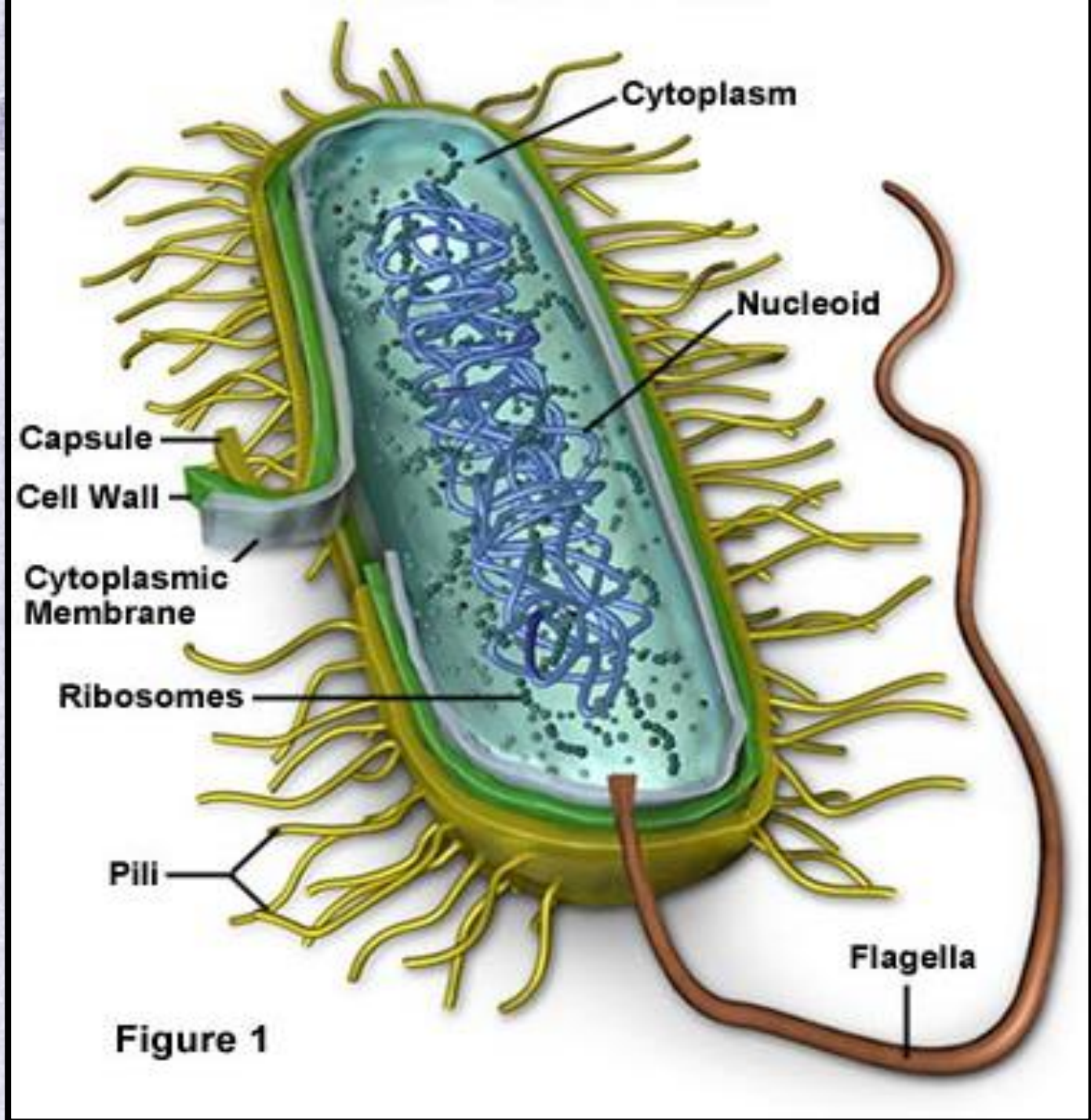
B. **Smaller in size.**

C. DNA is a **single circular chromosome.**

D. **Bacteria and viruses.**



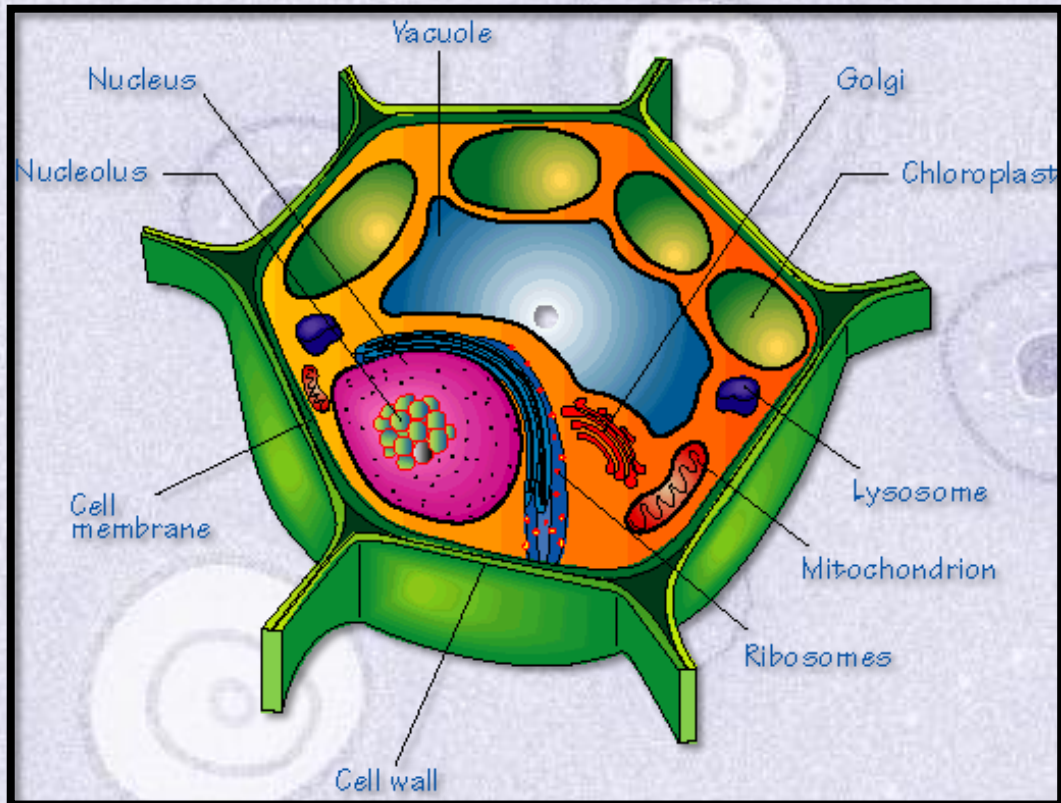
Prokaryotic cell structure



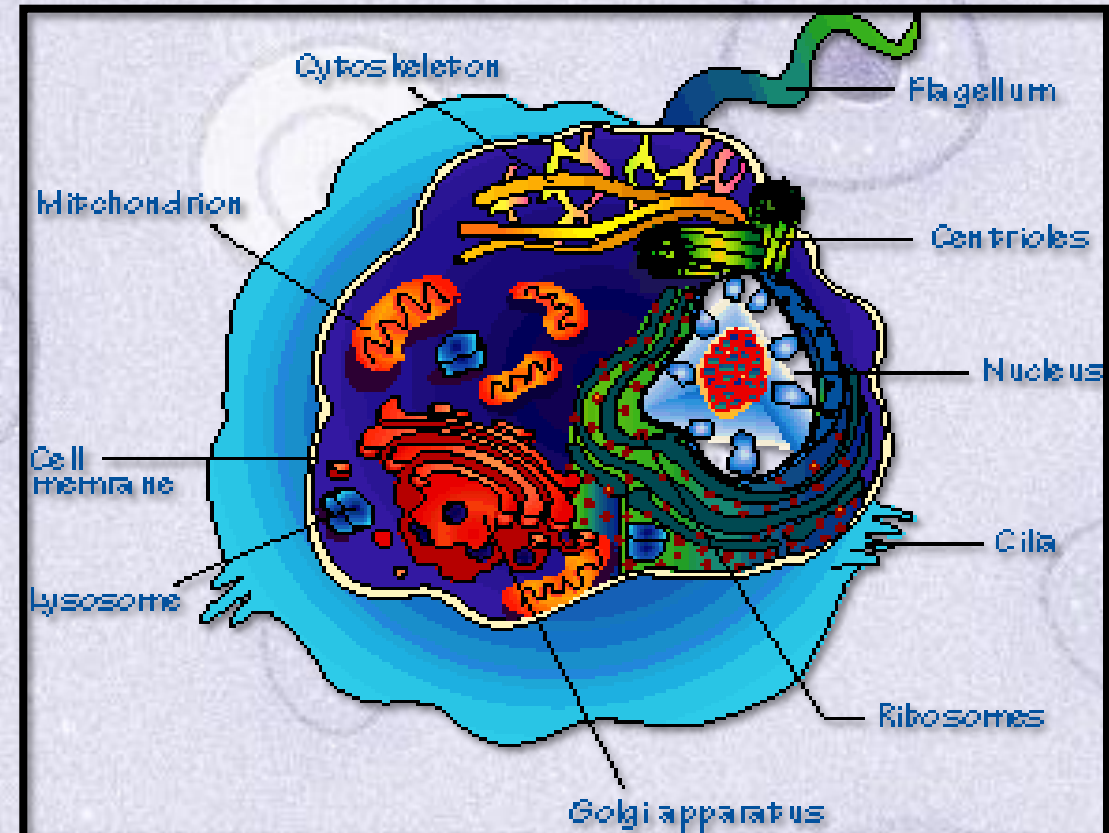
Eukaryotic Cells

- Contain organelles surrounded by membranes
- Most living organisms

Plant



Animal



Eukaryotes

A. Have organelles:

Organelles are sub-cellular distinct compartments which have distinct roles.

e.g. the **nucleus** contains the **DNA** (stored genetic information)

Organelles are covered with membranes.

Eukaryotes

B. Larger in size.

C. DNA is organized into **multiple linear units** called **chromosomes**.

D. Plants, fungi and animals are all **eukaryotes**.

Feature	Prokaryote	Eukaryote
Size	Small about 0.5 micrometers	Up to 40 micrometers
Genetic material	Circular DNA (in cytoplasm)	DNA in form of linear chromosomes (in nucleus)
Organelles	Few organelles: none membrane bound	Many organelles: •Double membranes e.g.: nucleus, mitochondria & chloroplasts •Single membrane e.g.: GA, ER & lysosomes
Cell walls	Rigid formed from glycoproteins	•Fungi: rigid, formed from polysaccharide, chitin. •Plant: rigid, formed from polysaccharides. E.g.: cellulose. •Animals no cell wall

Structure of the Eukaryotic Cell

- **The eukaryotic cell is composed of two basic parts; the Cytoplasm and the Nucleus enclosed in a limiting membrane called the Plasma membrane .**
- **The nucleus is separated from the cytoplasm by a nuclear membrane and the cytoplasm is separated from the surrounding by a cell membrane.**

Cell components

➤ **Different substances that make up the cell are collectively called **Protoplasm**.**

➤ **It is composed mainly of:**

1. Water.

2. Electrolytes.

3. Proteins.

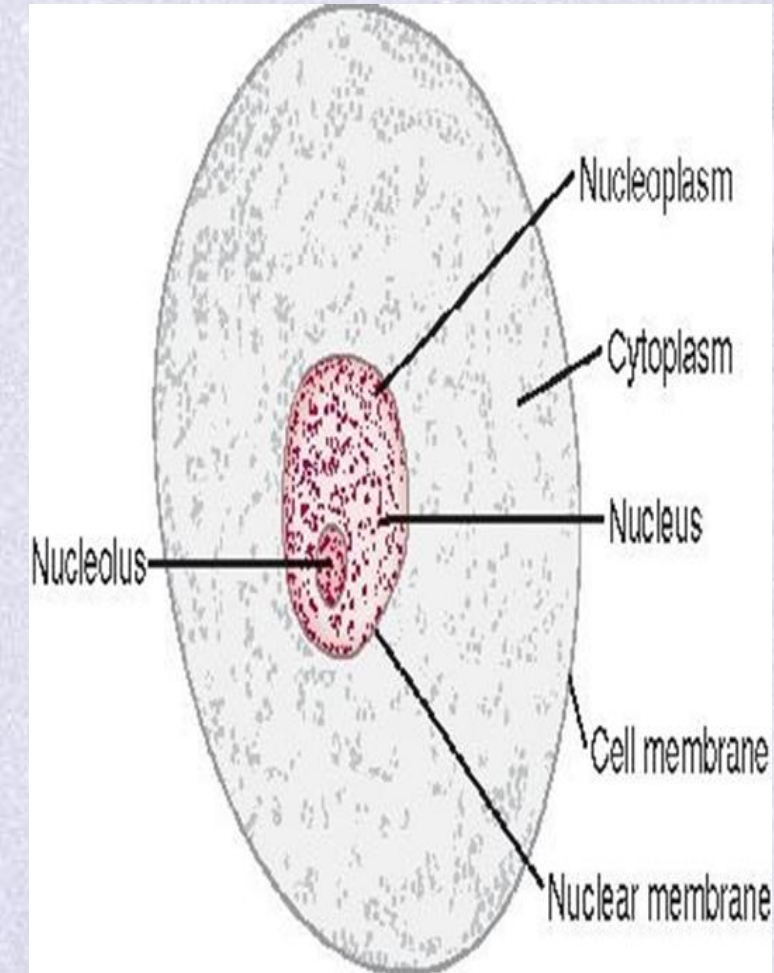
4. Lipids.

5. Carbohydrates.

6. Nucleic acids

Cell structures

- Cells vary in shape & size
- Structures common to most cells:
- **Cell membrane** outer boundary of cell
- **Nucleus** (only in eukaryotes) control center
- **Cytoplasm** material between cell membrane & nucleus .



Cell structures

Cell membrane

- **Cell membranes:** are dynamic structures, form closed compartments around cellular protoplasm to define cell boundaries, separate the internal environment of the cell from the external environment.
- **It is composed of:** two phospholipid layers, Protein, Carbohydrate and Cholesterol

Functions of the Plasma membrane

- 1. Communication through receptors on the outer surface**
- 2. Support of cell structure and protects cellular contents**
- 3. Provision of physical barrier between the intra and extra cellular compartments.**
- 4. Selective permeability**

Cell membrane components

Composed of several organic molecules :

1. Lipids

Double layer of lipid molecules (bilayer) forms basic unit from which cell membrane is constructed

2. Cholesterol

Protects membrane from being dissolved

Cell membrane components

3. Proteins

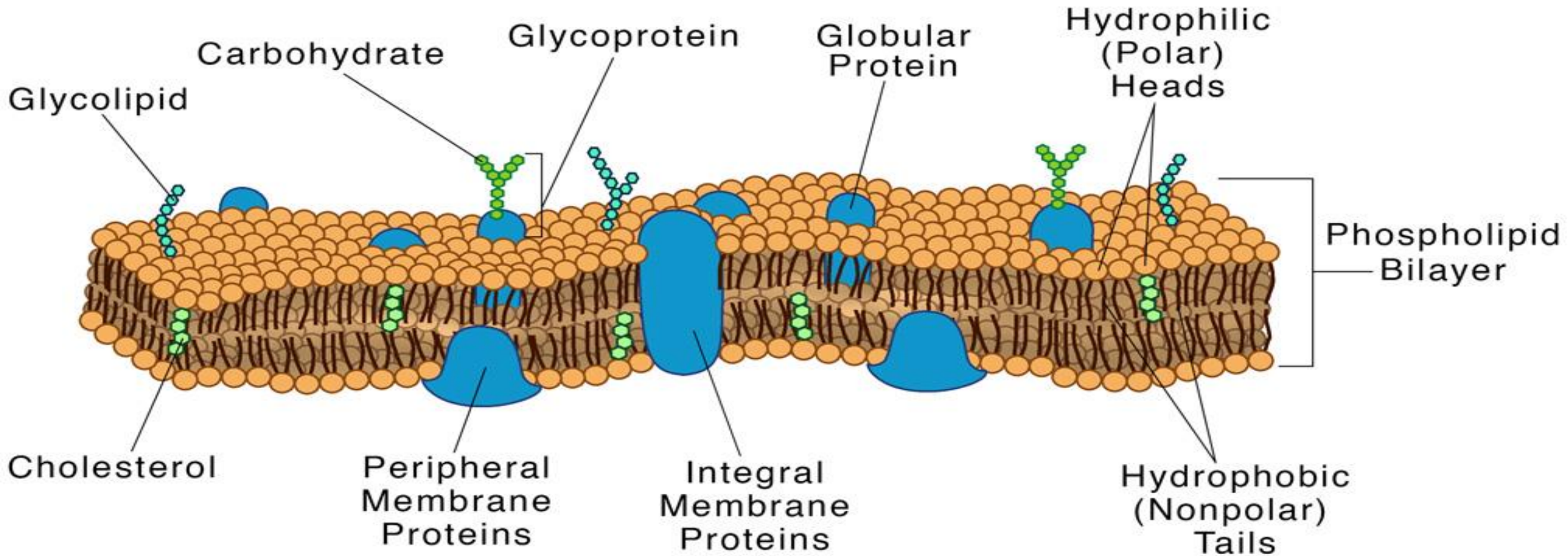
Stick to surface of lipid bilayer or free-moving act as channel through which molecules can pass.

4. Carbohydrates

Attached to proteins or lipids at membrane surface.

Cell Membrane

Extracellular side (outside the cell)



Cytoplasmic side (inside the cell)

Cell membrane components

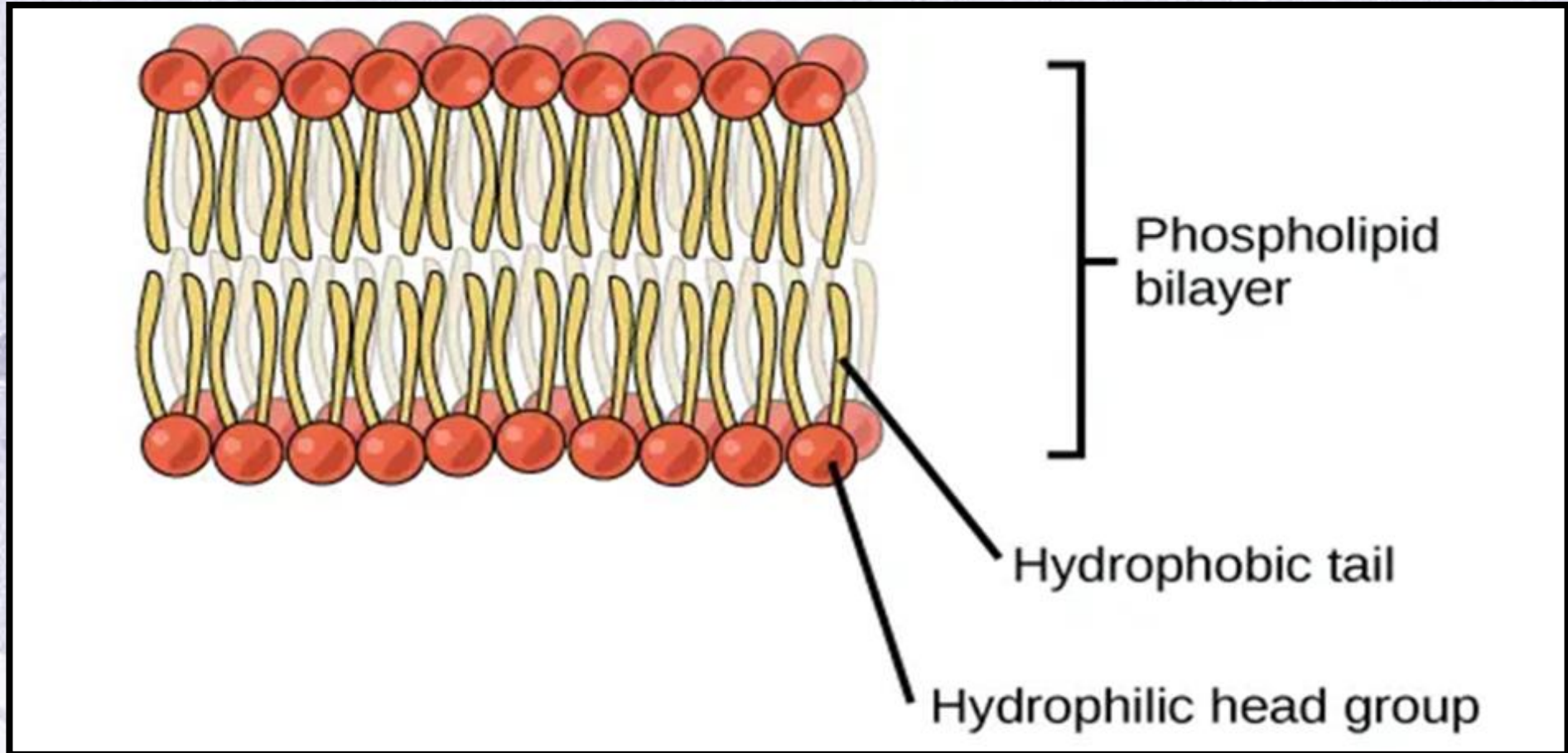
Lipid Bilayer:

A lipid bilayer is a fundamental structure in all cell membranes,

Composed of two layers of phospholipids:

- A. Phosphate head** (arranged to out side) is *polar* (water loving)
- B. Fatty acid tails** (arranged to inside) is *non-polar* (water fearig)
- C. Proteins and cholesterol** embedded in membrane

Phospholipid Bilayer



Lipid Bilayer functions

- 1. Selective Barrier:** controlling the movement of molecules in and out of the cell.
- 2. Cellular Boundaries**
- 3. Membrane Fluidity:** The lipid bilayer is not static; lipids can move and swap places within the membrane.
- 4. Protein Integration**
- 5. Signal Transduction**

Membrane proteins

- The membrane proteins occur in two forms (specific location within cell membrane):

1. Integral proteins:

Are embedded within the lipid bilayer (tightly linked)

- Regulate passage of material and active transport of specific molecules across the membrane.

Functions: transporter molecules, ion channels, receptors.

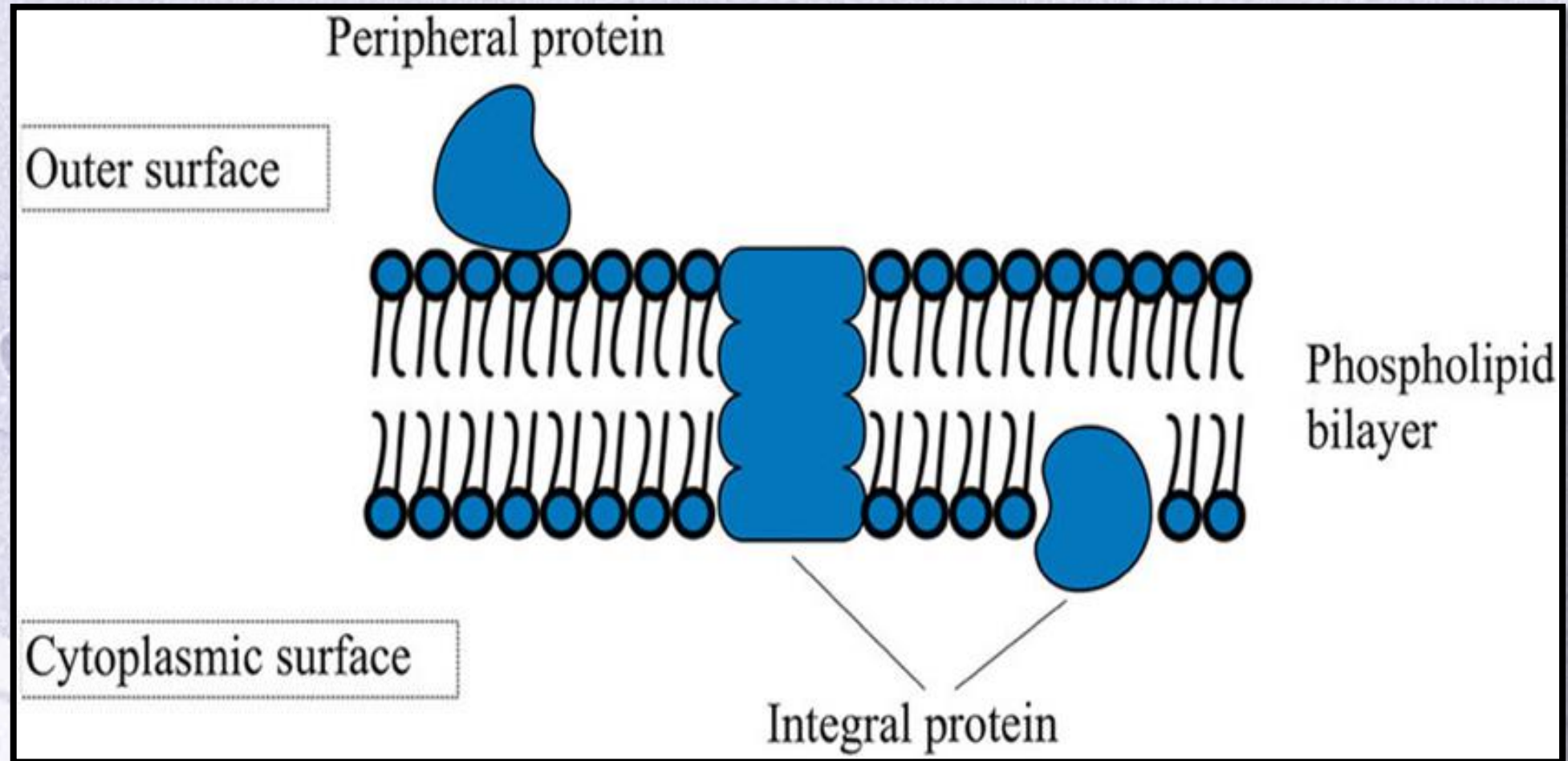
Membrane proteins

2. Peripheral proteins:

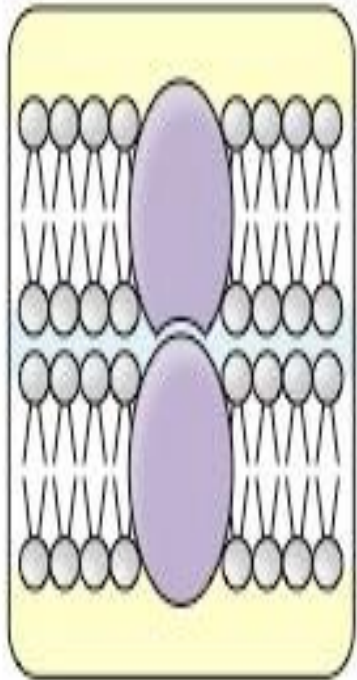
Are proteins associated with the inner or outer membrane surface, through electrostatic interactions or other non-covalent bonds (easily removed)

Functions: Involved in cell recognition and interactions

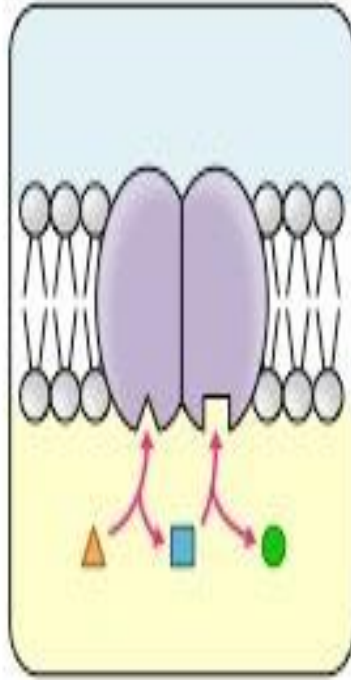
Membrane proteins



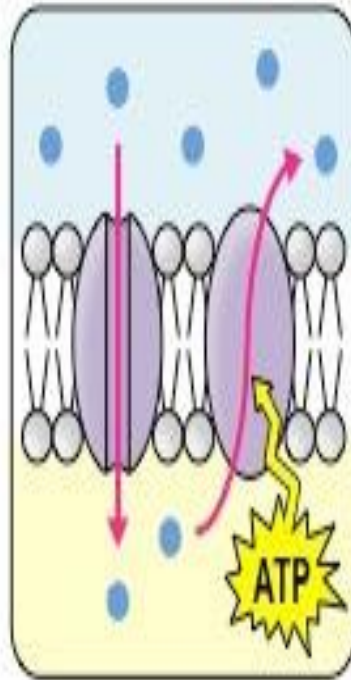
Functions of Membrane proteins



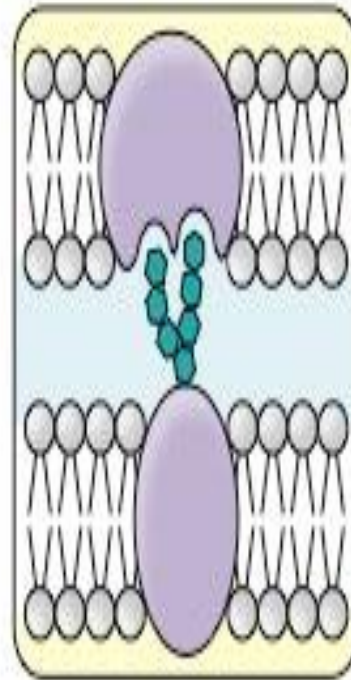
**Intercellular
Joinings**



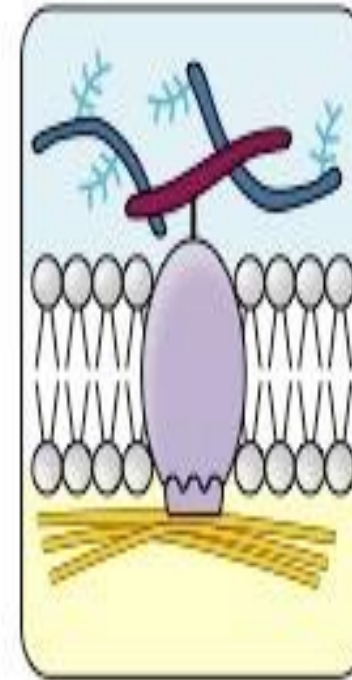
**Enzymatic
Activity**



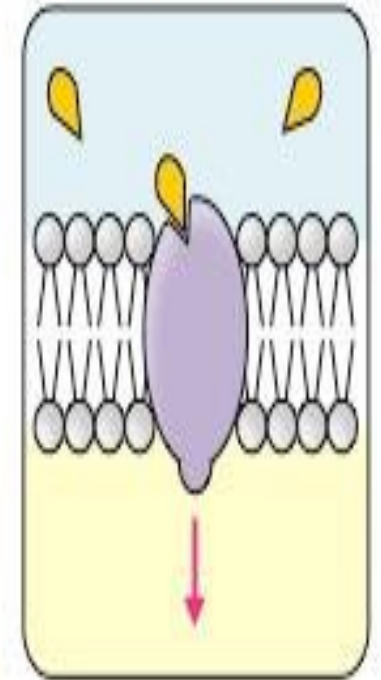
**Transport
(Active / Passive)**



**Cell-Cell
Recognition**



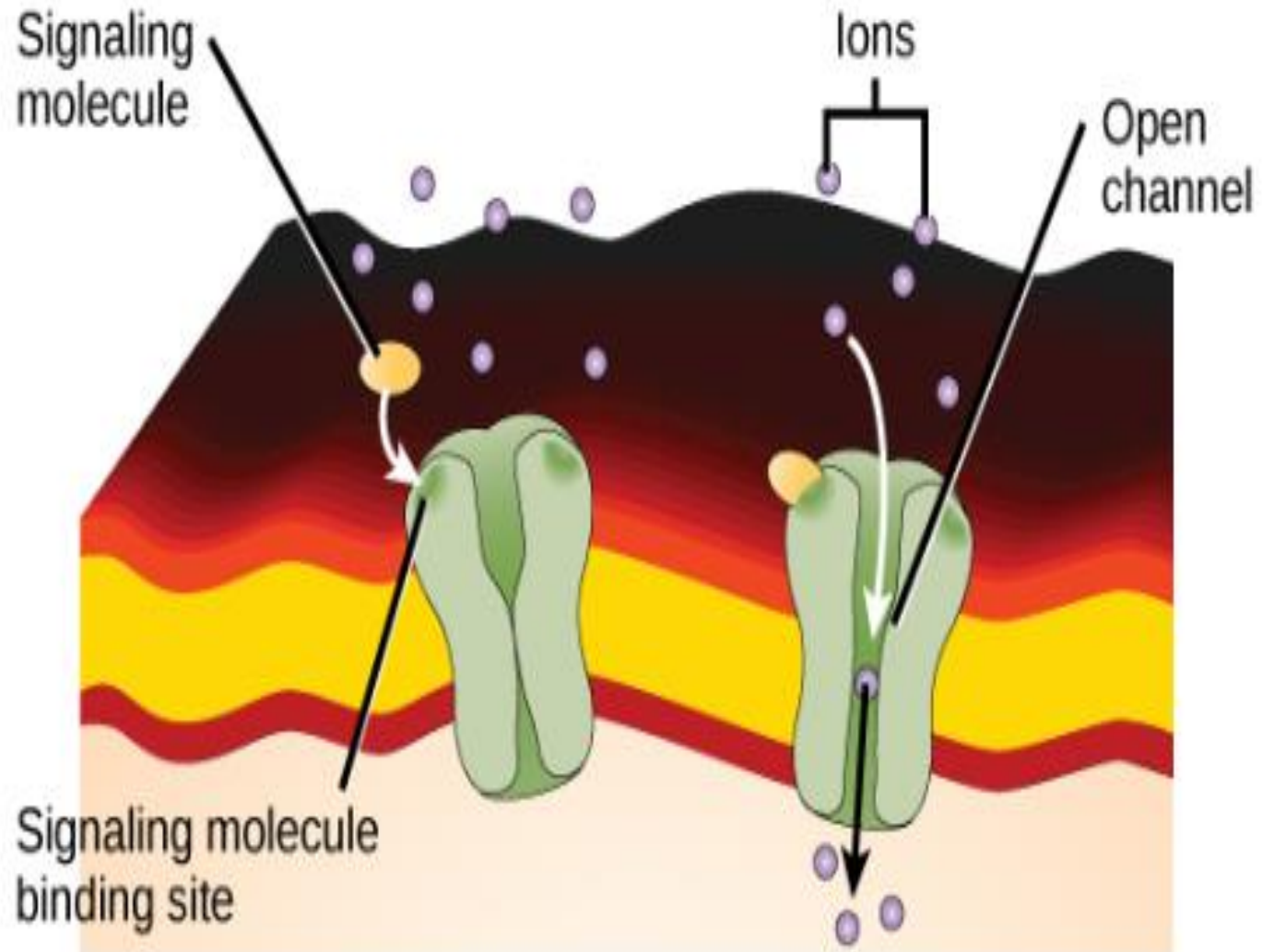
**Anchorage /
Attachment**



**Signal
Transduction**

Integral proteins

1. Ion channel receptors



Integral proteins

2. Receptors

Cell-surface receptors, also known as **transmembrane receptors**:

are proteins attached to the cell membrane, bind to external ligand molecules

- This type of receptor spans the plasma membrane and performs **signal transduction**.

Membrane carbohydrates

- Found on the outer surface of the cell membrane
- **Glycocalyx** is a complex of sugars, glycoproteins, and glycolipids
- **Glycocalyx include :**
 - **Glycoproteins** (carbohydrates attached to proteins)
 - **Glycolipids** (carbohydrates attached to lipids).

Membrane carbohydrates functions

- **Cell Recognition**
- **Immune Response**
- **Cell Signaling**
- **Cell Adhesion**
- **Protection**
- **The glycocalyx can act as a protective barrier**

Cholesterol structure

- **Consisting of a polar head, a rigid steroid ring, and a nonpolar hydrocarbon tail, allows it to integrate within the phospholipid bilayer**

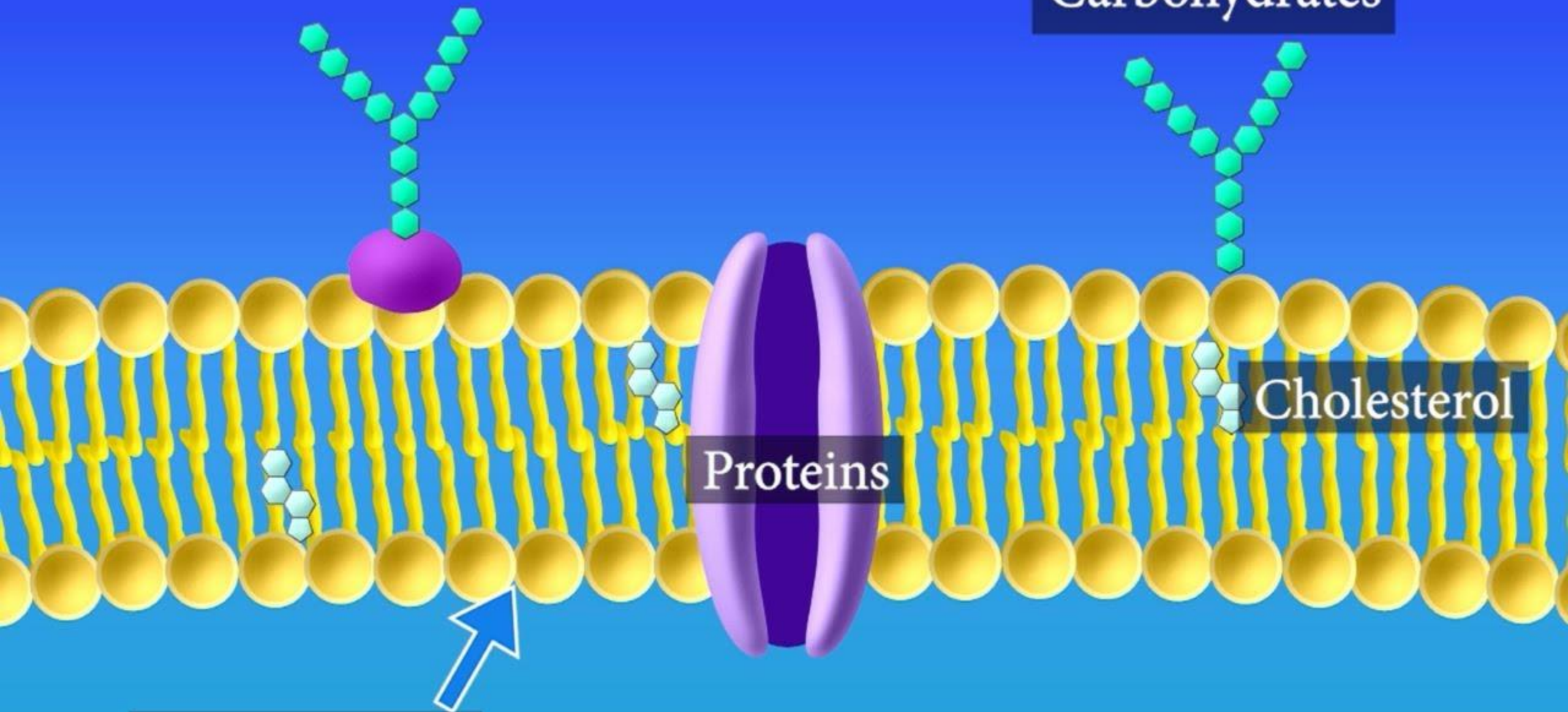
Functions of Cell Membrane Cholesterol

- **Modulating Membrane Fluidity**
- **At lower temperatures:** cholesterol prevents the phospholipid tails from clustering together, increasing fluidity.
- **At higher temperatures:** it restricts the movement of phospholipid tails, preventing excessive fluidity.
- **Enhancing membrane stability**

Functions of Cell Membrane Cholesterol

- **Influencing Membrane Protein Behaviour**
 - Bind to specific proteins, altering their conformation and activity.
 - Change the physical properties of the membrane, such as fluidity and thickness, which can indirectly affect protein function.
- **Maintaining Membrane Integrity**

Carbohydrates



Proteins

Cholesterol

Phospholipids

t h e

e n d