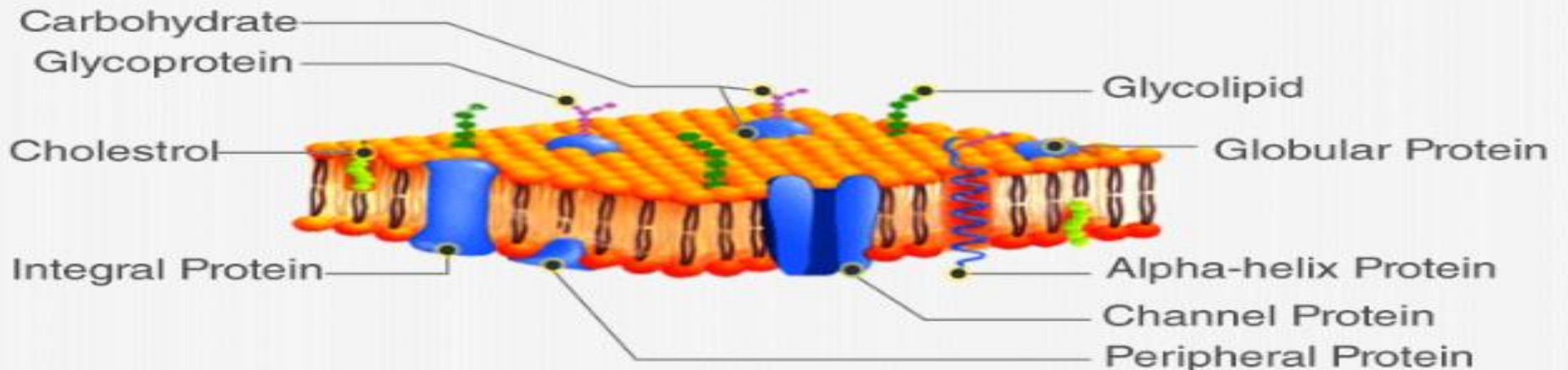


## Cell Membrane

Cell Membrane, also known as the plasma membrane is present in all organisms including plants, It is a semi-permeable membrane composed of **lipids and proteins**. The main functions of the plasma membrane or cell membrane include:

- 1, The plasma membrane forms the boundary between the outer environment and living systems.
- 2, Providing support and maintaining the shape of the cell.
- 3, The plasma membrane controls both the entry and exit of both solute and solvent between the cell and the environment.
- 4, The cell membrane also plays an important role in cell signalling and communication.
- 5, With regards to permeability characteristics, a plasma membrane can be semi-permeable, impermeable, permeable and selectively permeable in nature.

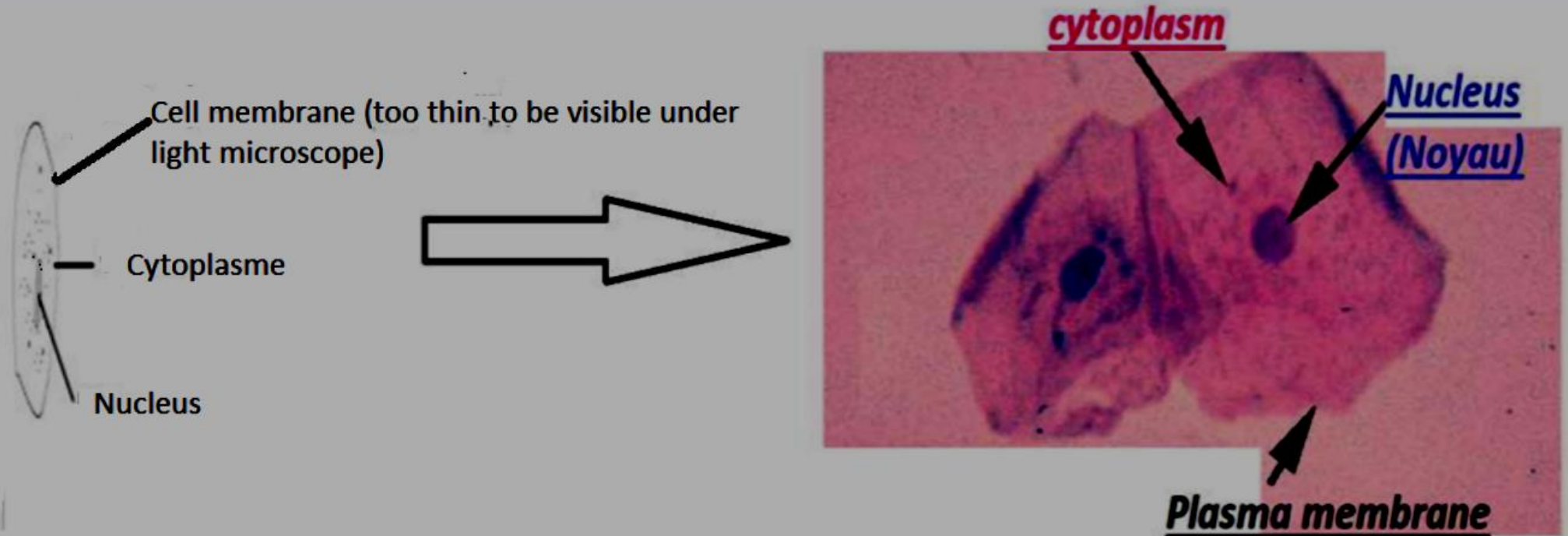
### CELL MEMBRANE



HOW CAN WE OBSERVE THE CELL MEMBRANE UNDER MICROSCOPE????

IN LIGHT MICROSCOPE 400 X magnification (Gr X 400) المجهر الضوء

Cell membrane (too thin to be visible under light microscope)



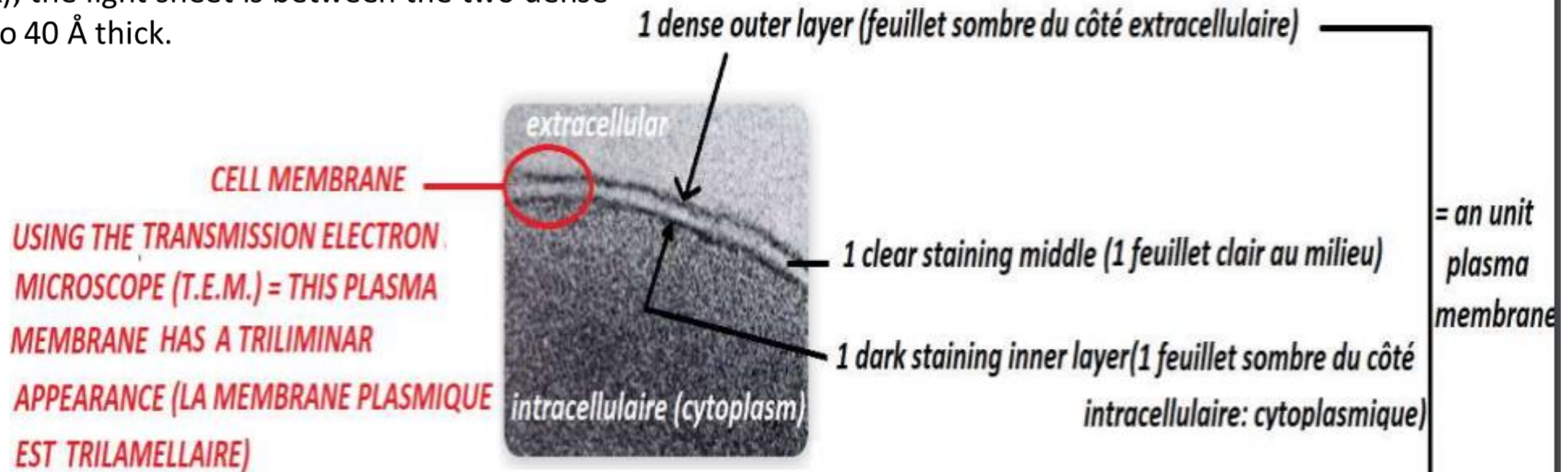
**THE CELL MEMBRANE IS VERY THIN (MINCE) TO BE VISIBLE UNDER LIGHT MICROSCOPE  
SO, WE MUST OBSERVE IT IN THE ELECTRON MICROSCOPE (MICROSCOPE ELECTRONIQUE)**

# HOW CAN WE OBSERVE THE CELL MEMBRANE UNDER MICROSCOPE????

IN TRANSMISSION ELECTRON MICROSCOPY (T.E.M.) المجهر الإلكتروني

300 000X magnification (Gr x 300 000)

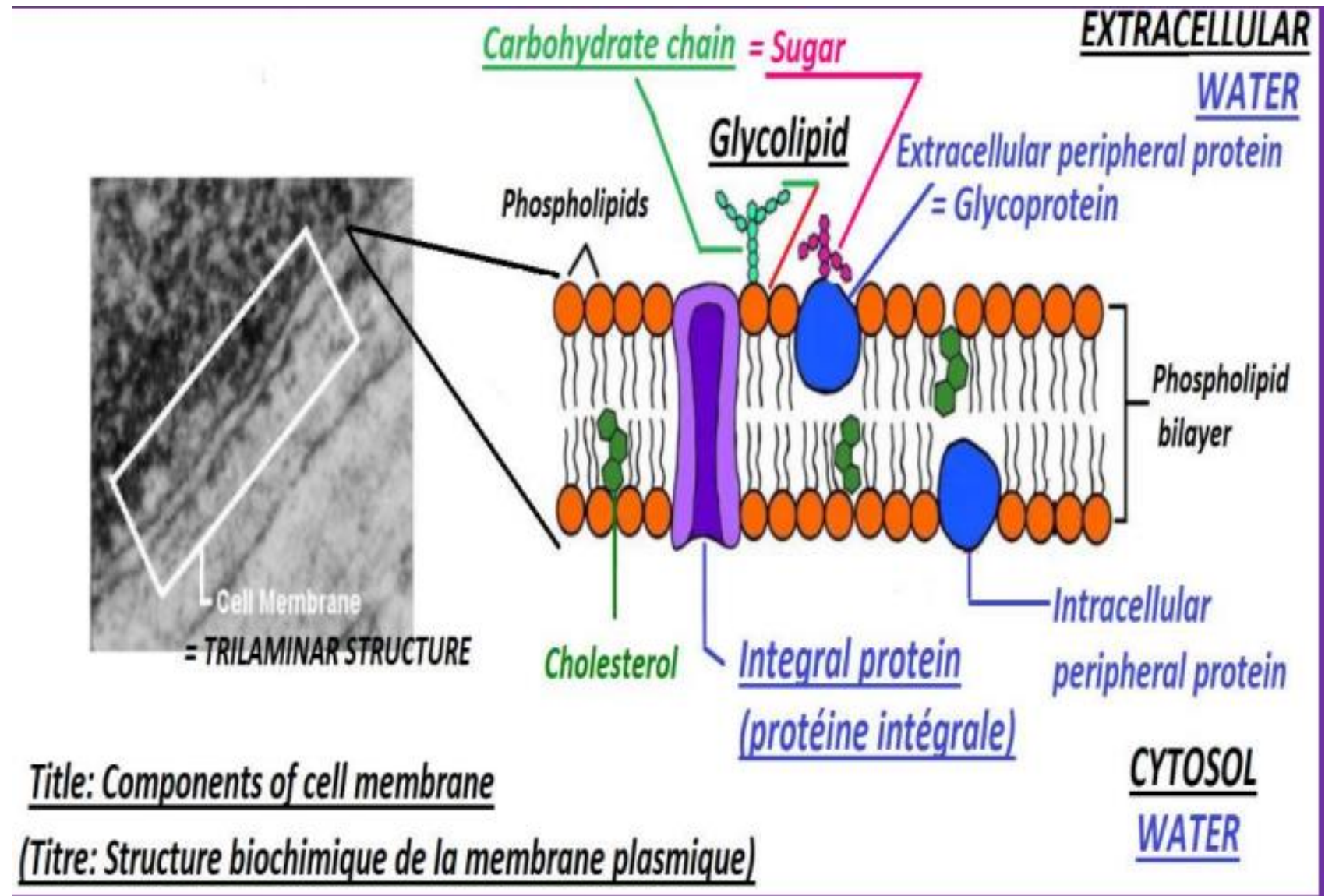
Observation of thin sections at the TEM shows that the plasma membrane is tristratified (trilaminar), it is formed by **two dense (dark) sheets (layers)** and **one clear sheet**. The two dense sheets (one inner and the other outer, are 20 to 25 Å thick), the light sheet is between the two dense sheets, it is 30 to 40 Å thick.





# WHAT IS BIOCHEMICAL COMPOSITION OF THE CELL MEMBRANE?

The membrane is described as a "fluid mosaic" (Singer & Nicolson, 1970), a mosaic because it is heterogeneous and fluid in composition because its constituents are constantly moving (so it is a dynamic structure).



# CELL MEMBRANE STRUCTURE:

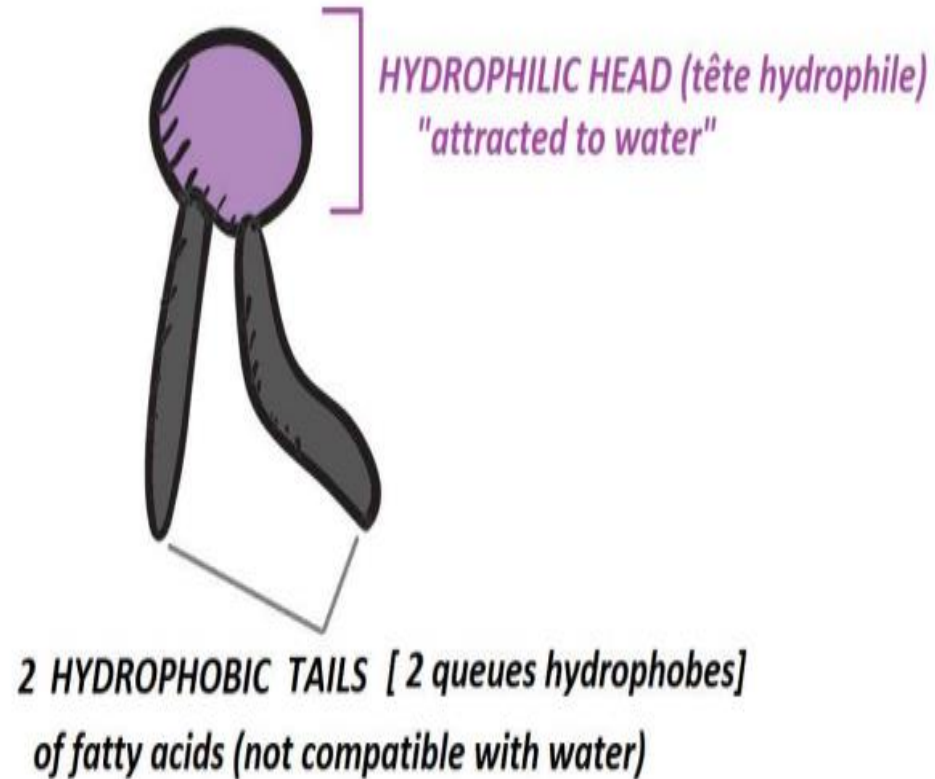
## Membrane Lipids

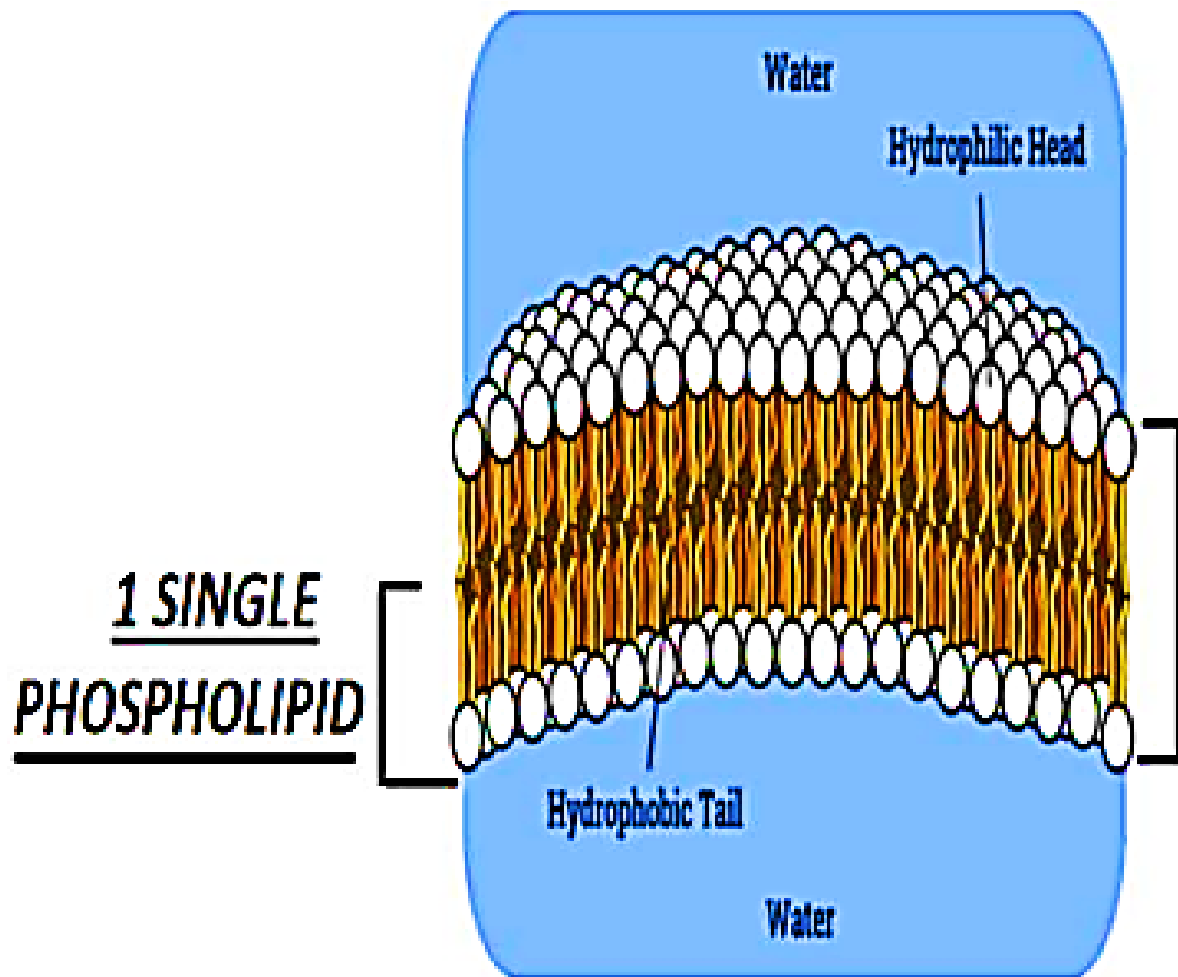
Membrane lipids include: **phospholipids, cholesterol and glycolipids**. These lipids have an asymmetrical distribution within the membrane, are mobile and determine membrane fluidity.

### 1- PHOSPHOLIPIDES

The Phospholipids of the membrane are amphiphilic, they possess a **hydrophobic TAILS** made up of 02 fatty acid chains (C14- C24): -**Saturated chain** and -**Unsaturated chain** (double bond) (oriented inside the bilayer)

**hydrophilic HEAD** oriented either to the extracellular aqueous medium or to the intracellular aqueous medium).



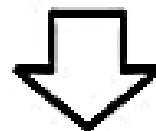


PHOSPHOLIPID BILAYER [double couche de phospholipides]



IN A WATER SOLUTION, PHOSPHOLIPIDS

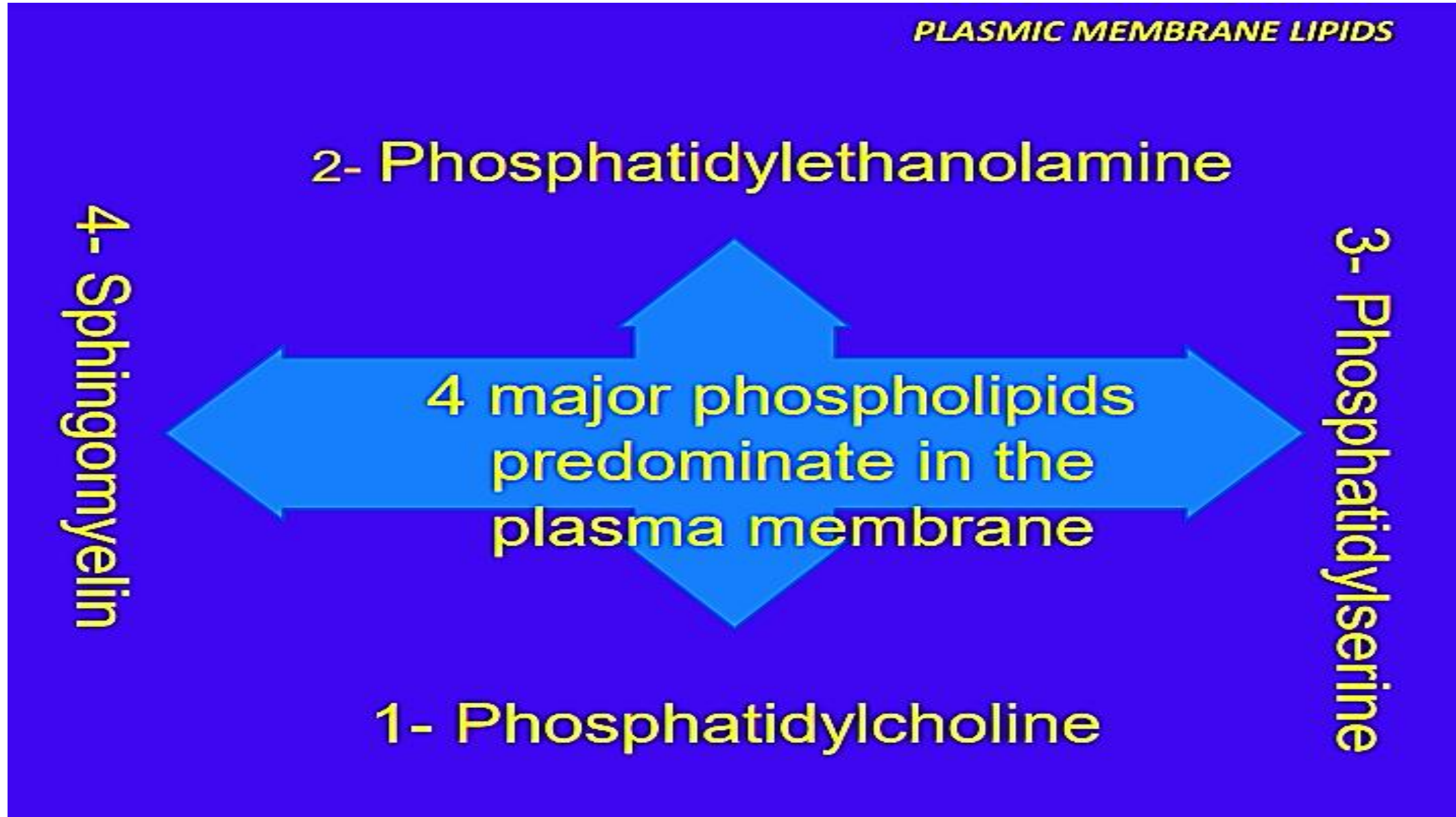
FORM A BILAYER



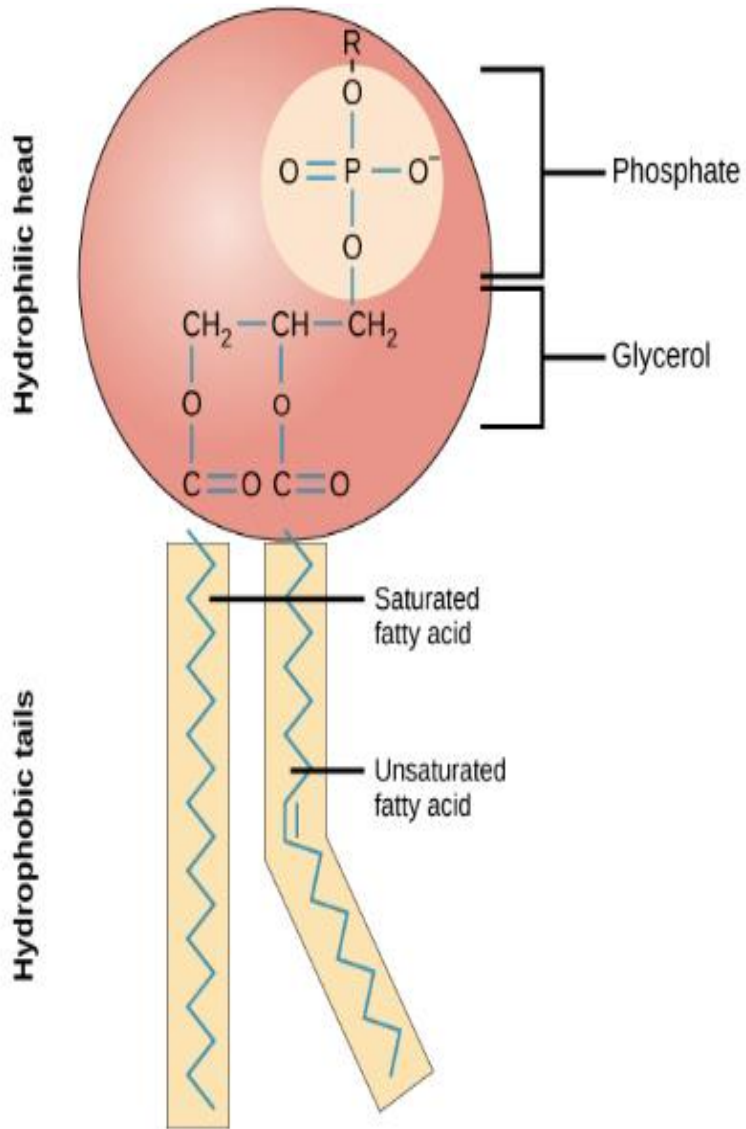
hydrophilic heads exposed to the water

hydrophobic tails point towards each other on the interior

# Major phospholipids







**There are 2 types of phospholipids:**

**1, Glycerophospholipids** are the combination of **glycerol**, **two fatty acids** (chains (C14- C24): -**Saturated chain** and -**Unsaturated chain** (double bond) (oriented inside the bilayer) , **one phosphoric acid** and **alcohol** or **amino acid**.

**The Different Classes of Glycerophospholipids**

The lipid is formed by the binding of **an alcohol** to **phosphatidic acid** (glycerol, two fatty acids, one phosphoric acid)

Depending on the alcohol or amino acid, different classes of lipids are obtained.

- **Phosphatidylserine** = Phosphatidic Acids + Serine
- **Phosphatidylethanolamines** = Phosphatide Acids + Ethanolamine
- **Phosphatidylcholines** = Phosphatide Acids + Choline

**2 , Sphingolipides**

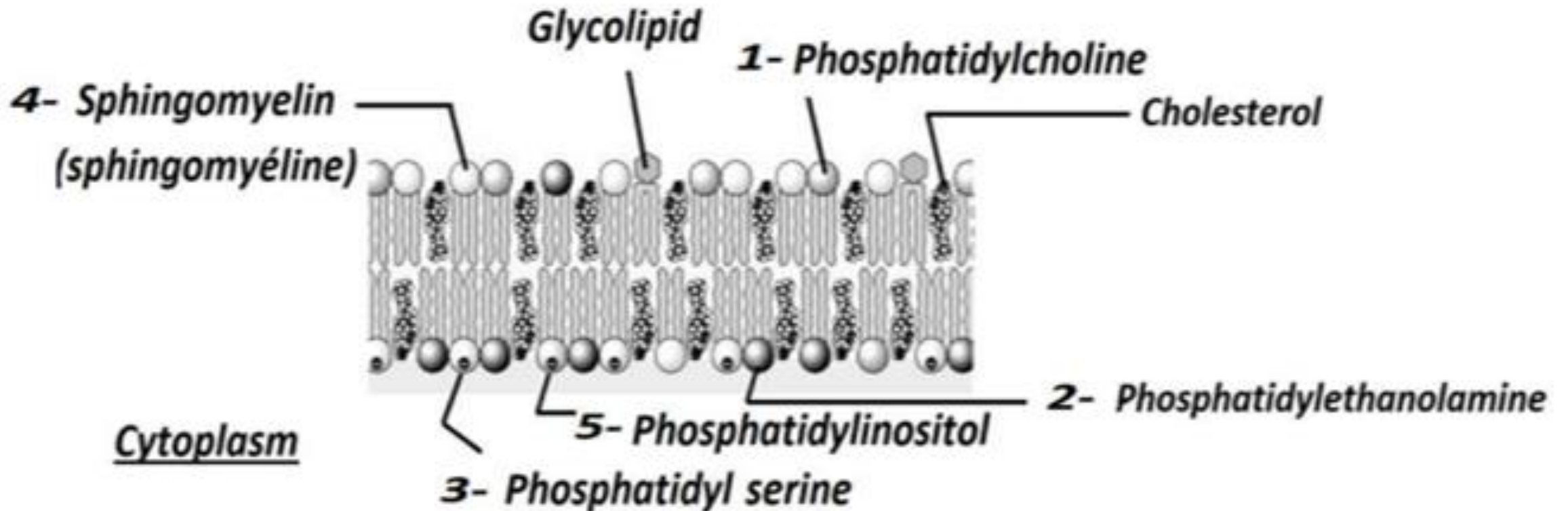
- In this group, glycerol is replaced by an amino alcohol, **sphingosine**



# Distribution of phospholipids in the phospholipid bilayer

These lipids have an asymmetrical distribution within the membrane

Outside of cell (water) [milieu extracellulaire]

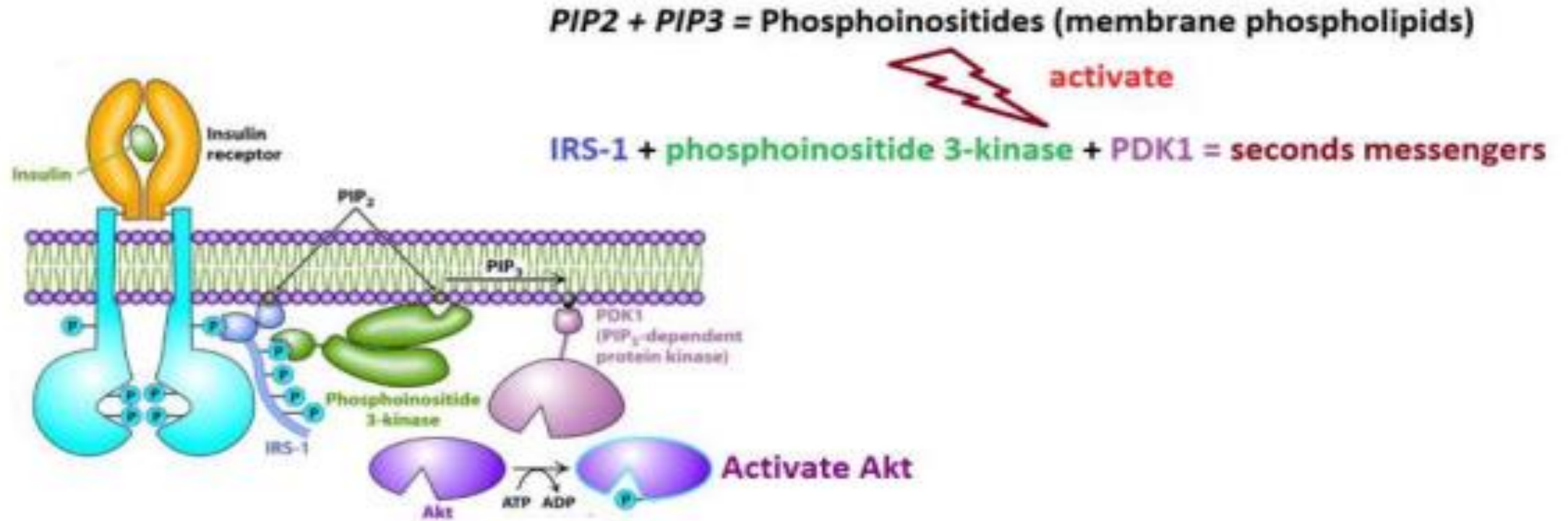


## EXAMPLE OF THE ROLE OF PHOSPHOLIPIDS

Phosphoinositides (PIPs) 10 % of cellular phospholipids

Act as second messengers

Involved in several cell-signaling pathways



Title: The insulin receptor & the molecular mechanism of insulin action

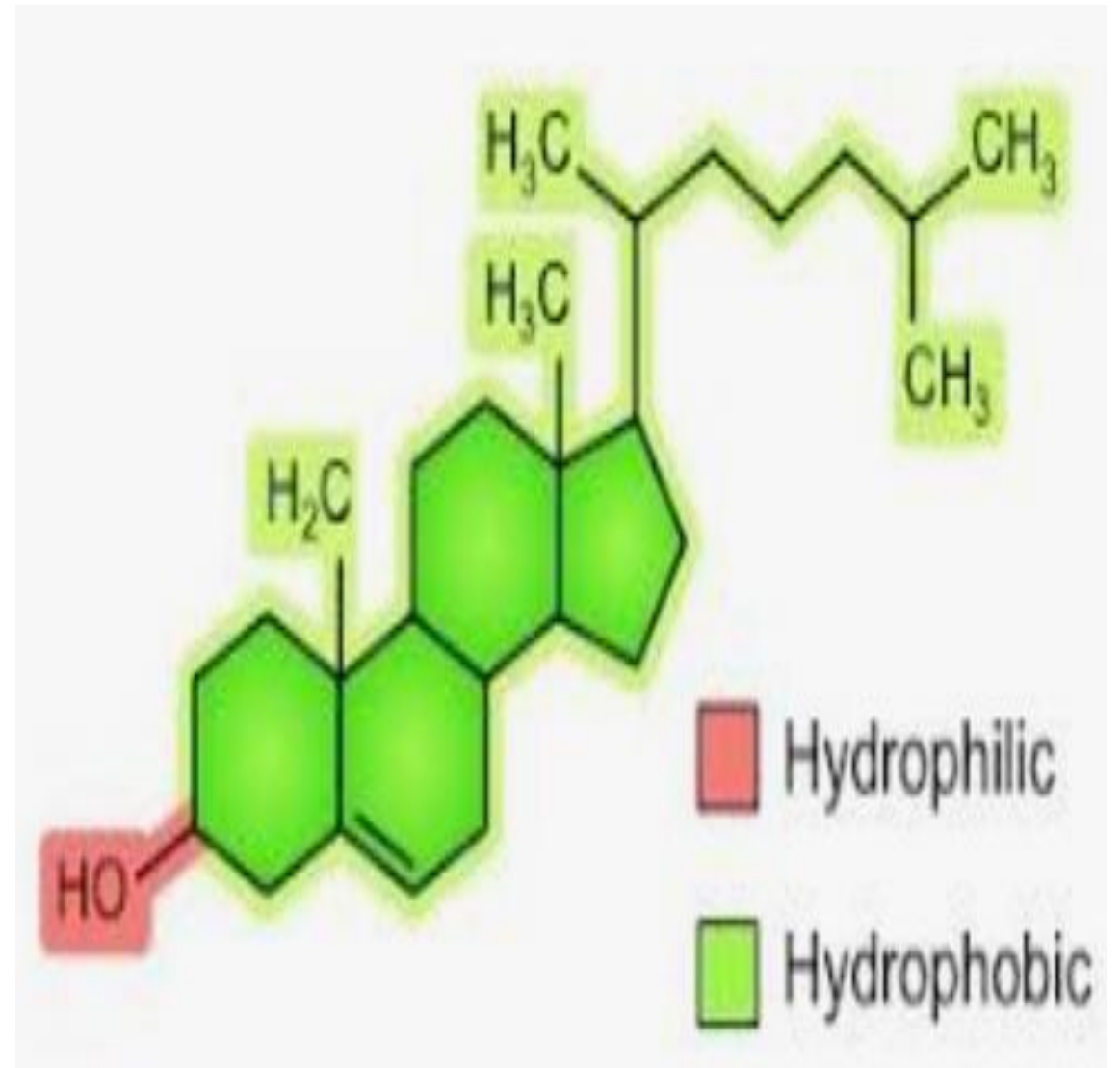
Titre: Le récepteur d'insuline & mécanisme moléculaire de l'action de l'insuline

## 2, CHOLESTEROL

Cholesterol is only present in the membranes of animal cells, as it is absent from plant cells and bacteria.

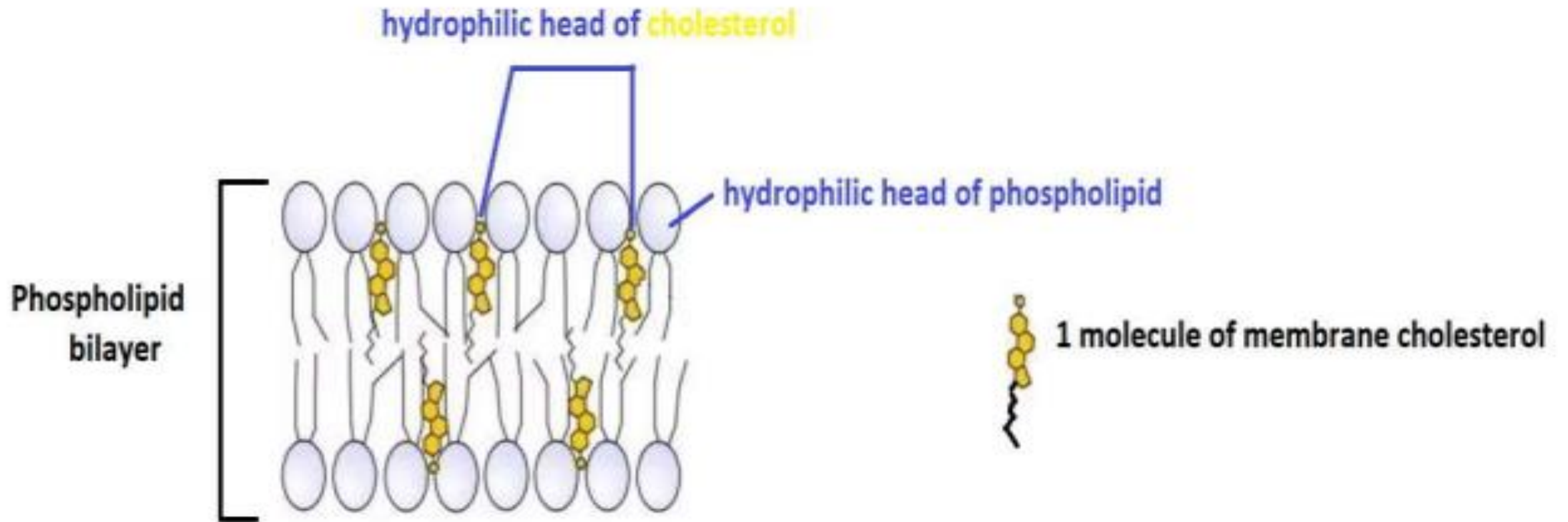
Cholesterol is composed of a hydrophobic steroid core (hydrophobic tail) and a hydrophilic alcohol function.

The molecule is therefore amphiphilic, accounts for about a quarter of membrane lipids and influences membrane fluidity.



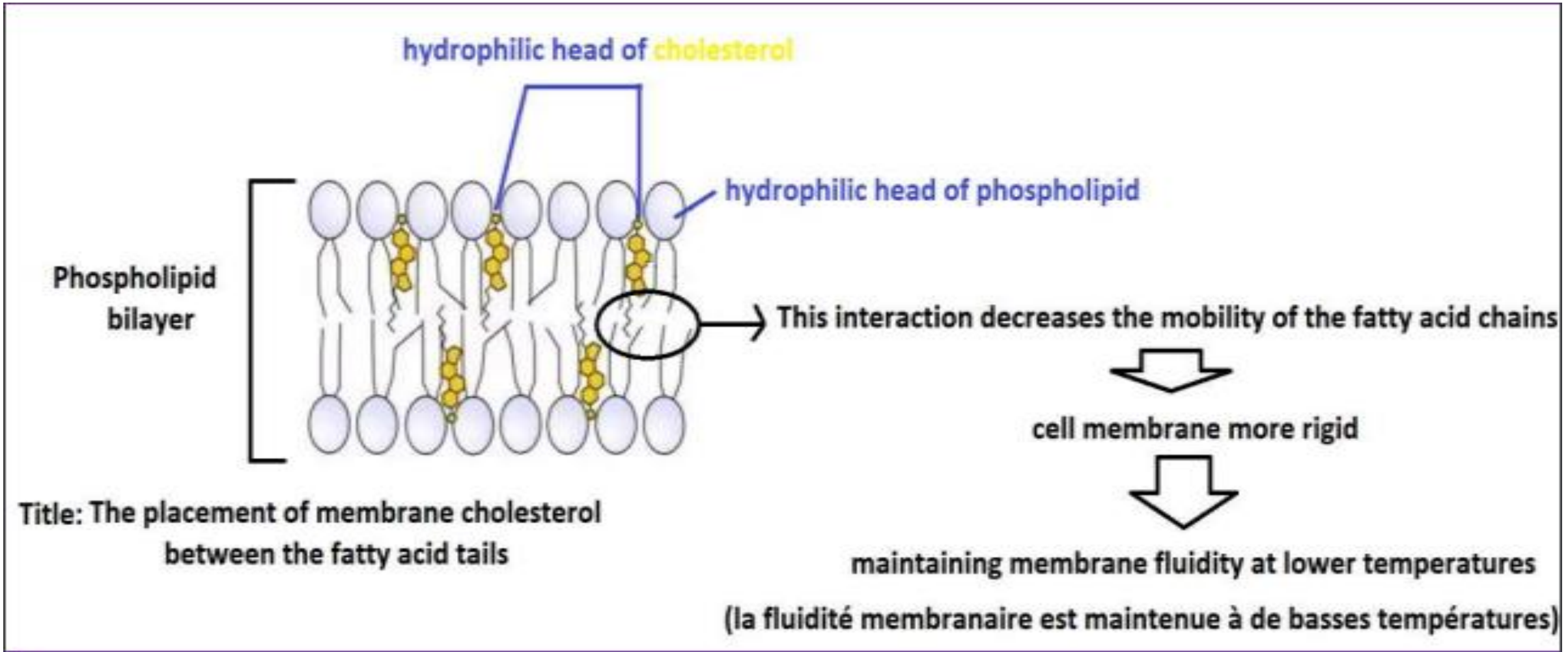
Simple cholesterol structure

## Placement of cholesterol in phospholipid bilayer

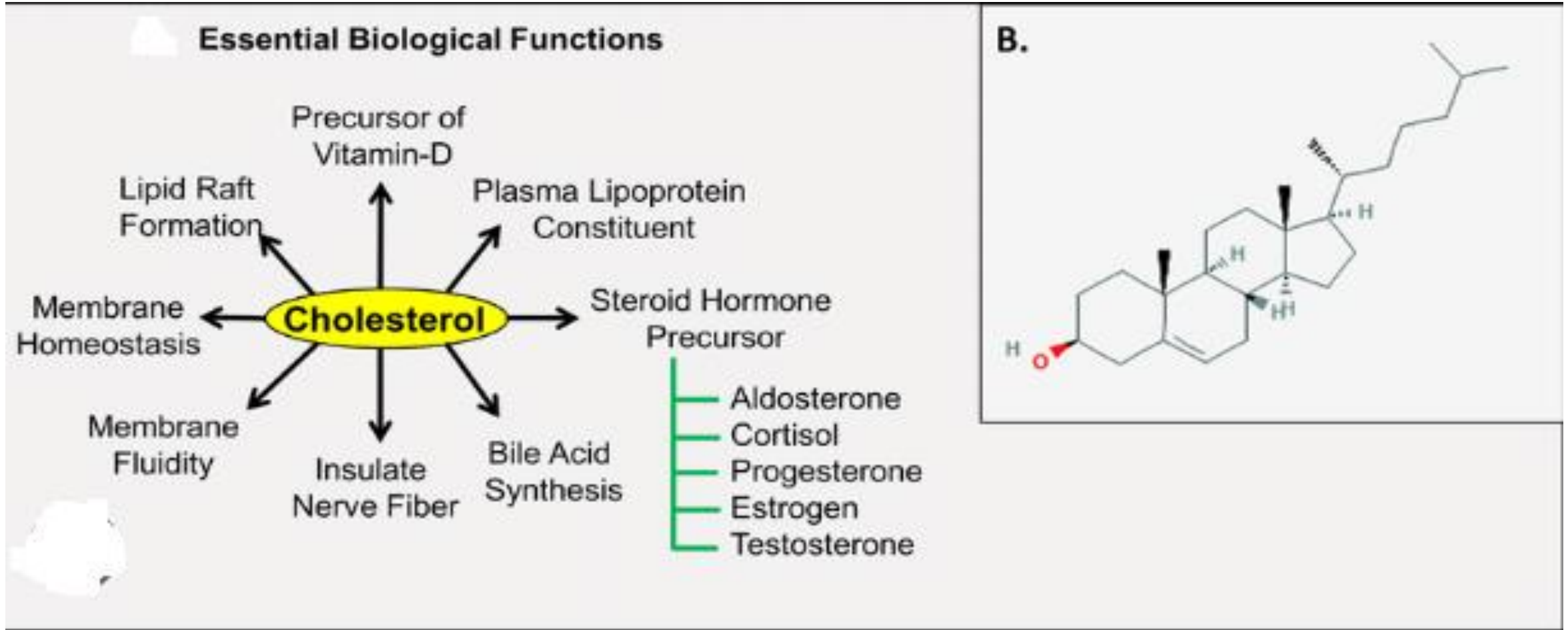




# WHY IS MEMBRANE CHOLESTEROL BETWEEN FATTY ACID TAILS?????



# Essential biological functions of cholesterol



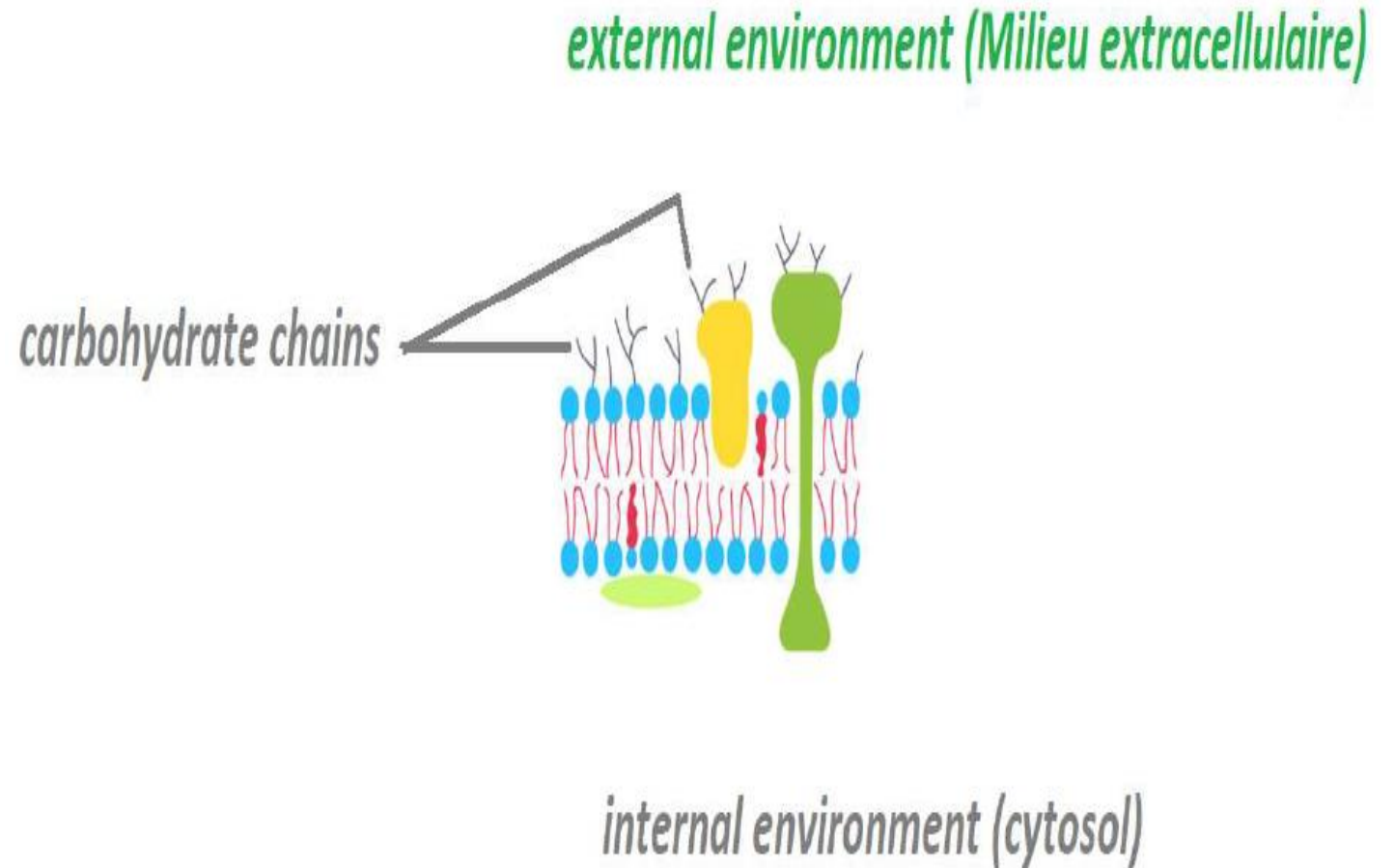
### 3, Glycolipids (lipids bound to sugars)

Glycolipids are lipids bound to sugars

Glycolipids are of two types, **glyceroglycolipids** and **sphingoglycolipids**.

NEVER: CARBOHYDRATE  
CHAINS IN THE INTERNAL  
ENVIRONMENT OF THE CELL

ALWAYS IN THE EXTERNAL  
ENVIRONMENT

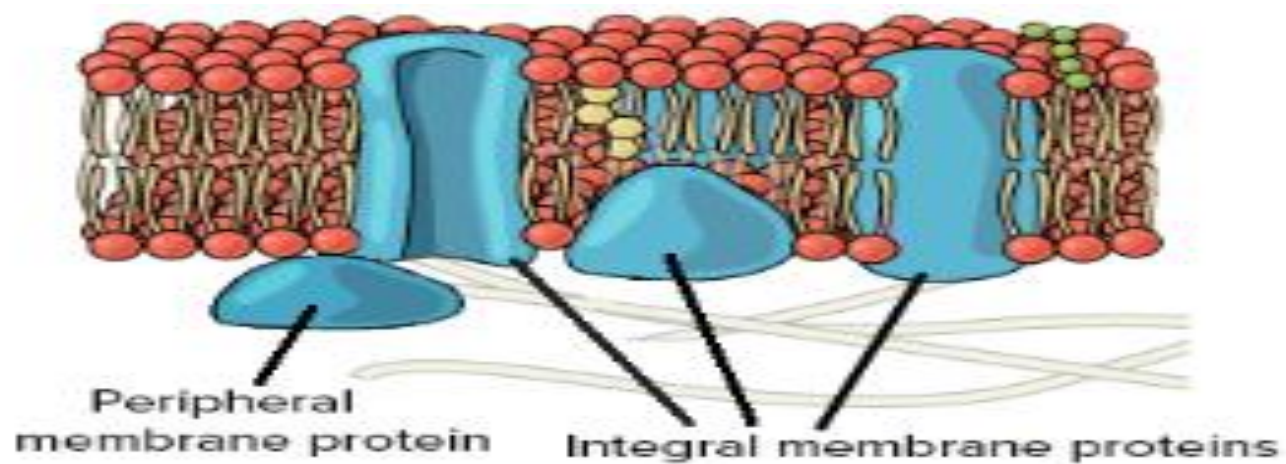


# CELL MEMBRANE STRUCTURE

## Membrane Proteins

### Proteins

Proteins are the second major component of plasma membranes. There are two main categories of membrane proteins: **integral** and **peripheral**.



**Peripheral membrane proteins** are found on the outside and inside surfaces of membranes, attached either to integral proteins or to phospholipids. Unlike integral membrane proteins, peripheral membrane proteins do not stick into the hydrophobic core of the membrane, and they tend to be more loosely attached.

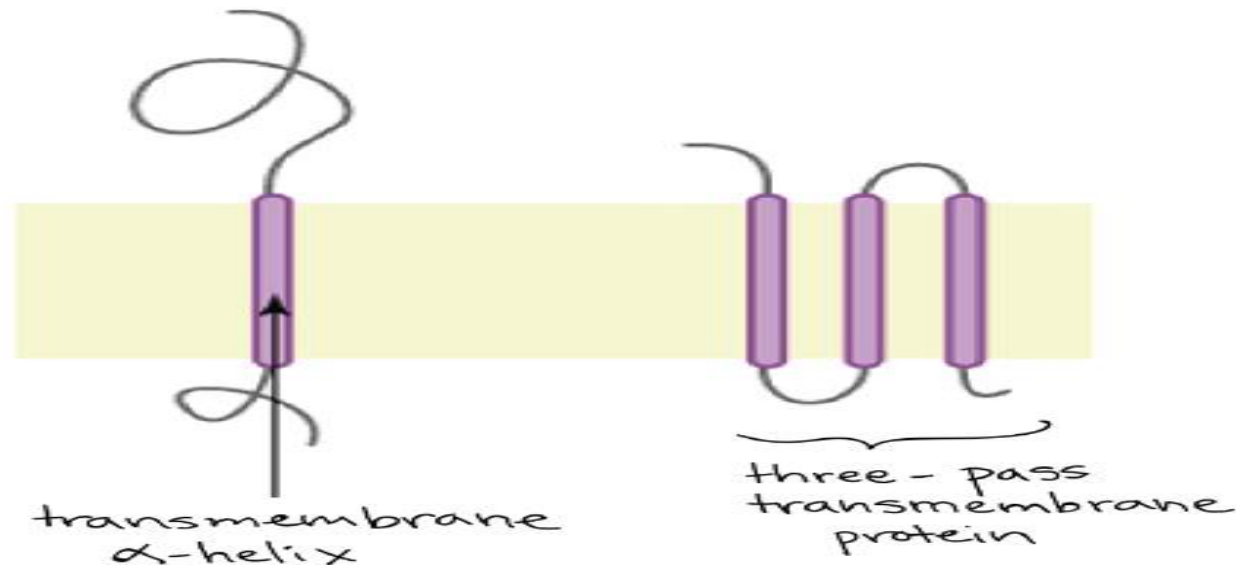


**Integral membrane proteins** are, as their name suggests, integrated into the membrane: they have at least one hydrophobic region that anchors them to the hydrophobic core of the phospholipid bilayer.

Some stick **only partway into the membrane**, while others **stretch from one side of the membrane to the other and are exposed on either side**

Proteins that extend all the way across the membrane are called **transmembrane proteins**.

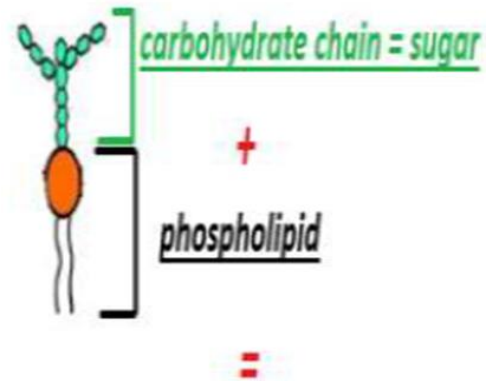
The portions of an integral membrane protein found inside the membrane are hydrophobic, while those that are exposed to the cytoplasm or extracellular fluid tend to be hydrophilic. Transmembrane proteins may cross the membrane just once or may have as many as twelve(12) different membrane-spanning sections.



- **CELL MEMBRANE STRUCTURE:**

- **Membrane Carbohydrates**

- Carbohydrates are 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 **glycolipids**).
- Along with membrane proteins, these carbohydrates form distinctive cellular markers, sort of like molecular ID badges, that allow cells to recognize each other.
- These markers are very important in the immune system, allowing immune cells to differentiate between body cells, which they shouldn't attack, and foreign cells or tissues, which they should.



**MEMBRANE GLYCOLIPID**



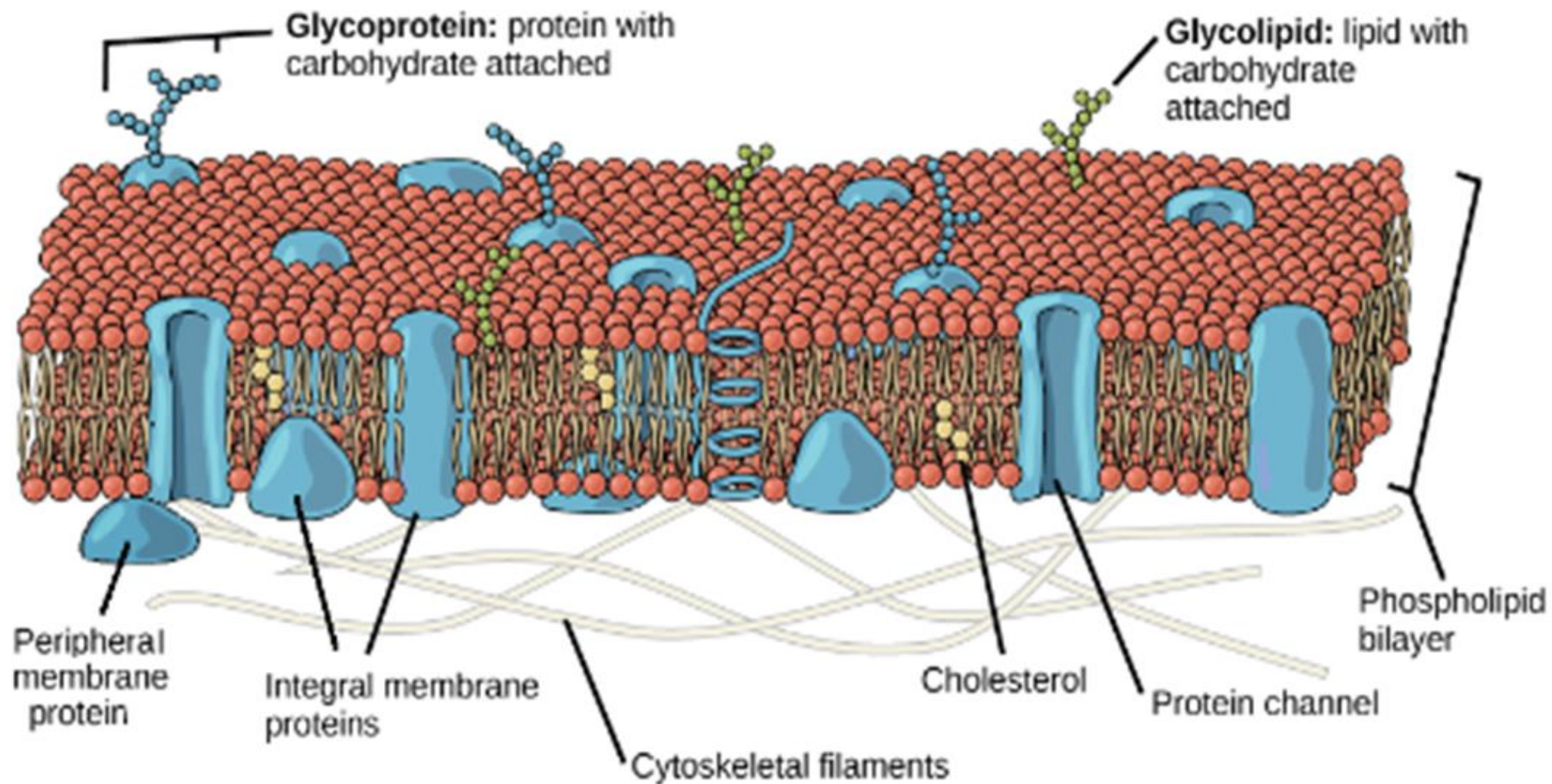
**carbohydrate chain bonded to a phospholipid**



**MEMBRANE GLYCOPROTEIN**



**carbohydrate chain bonded to a protein**



CELL MEMBRANE STRUCTURE