

**Programme: F.Y BSc**

**Subject: Microbiology**

**Paper Code: MIC 101**

**Paper Title: Microbiology and Biochemistry I**

**Unit: II**

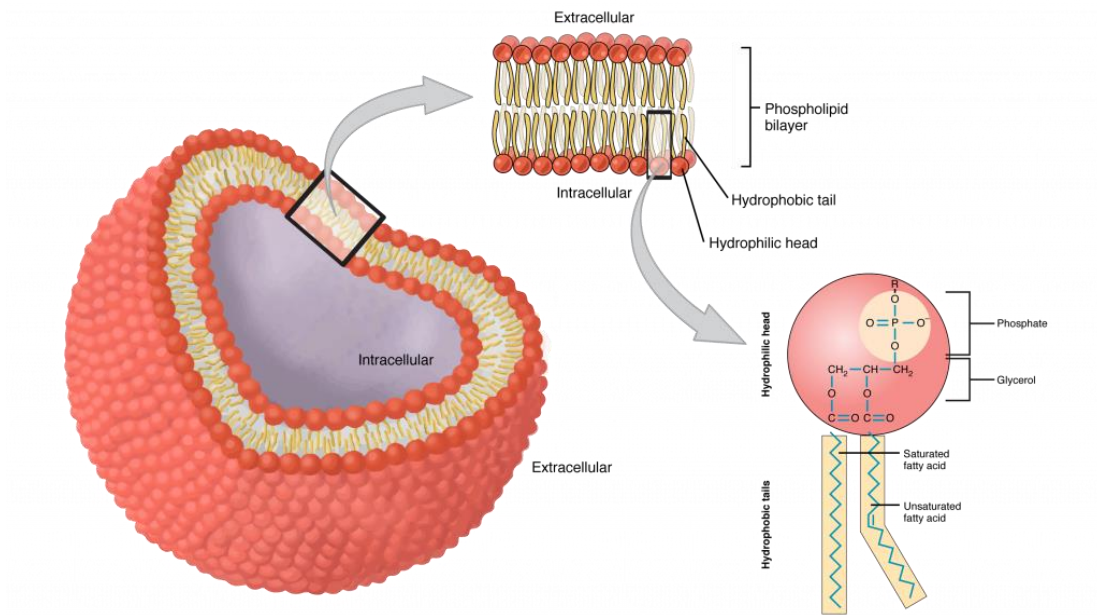
**Module Name: Cell membrane: Structure, functions**

**Module No: 16**

**Name of the Presenter: Rajani Prabhu**

### **16\_Notes**

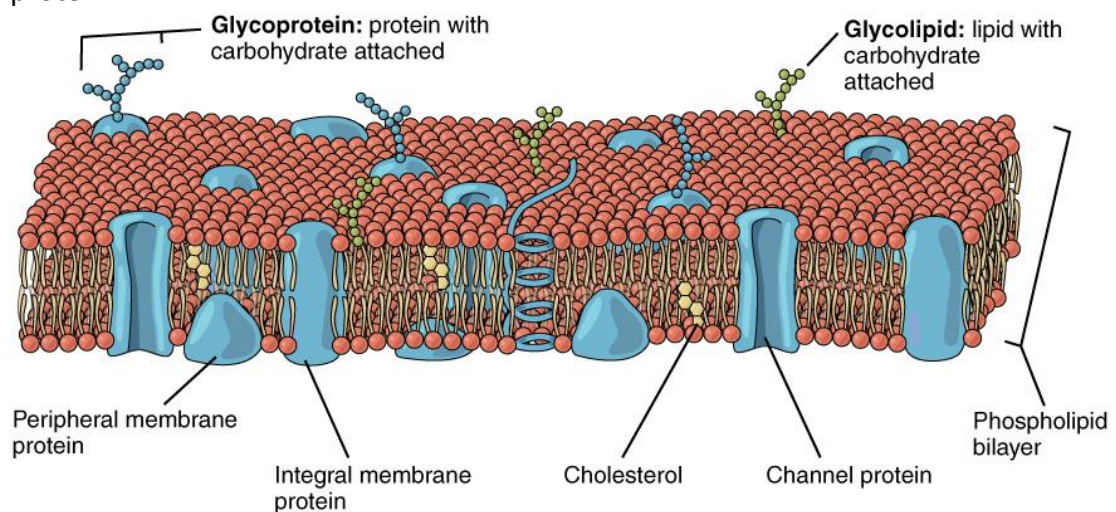
- Bacterial membranes composition: 40% phospholipid, 60 % protein.
- The phospholipids are amphiphilic molecules: a polar -glycerol "head" attached via an ester bond to two nonpolar fatty acid tails
- The cell membrane is an extremely pliable structure composed primarily of two layers of phospholipids (a "bilayer").
- Various structural and enzymatic proteins are dispersed within the bilayer
- A single phospholipid molecule has a phosphate group on one end, called the "head," and two side-by-side chains of fatty acids that make up the lipid "tails" (Figure 1.1). The lipid tails of one layer face the lipid tails of the other layer, meeting at the interface of the two layers. The phospholipid heads face outward, one layer exposed to the interior of the cell and one layer exposed to the exterior (Figure1.1).



- Figure 1.1 – Phospholipid Structure and Bilayer: A phospholipid molecule consists of a polar phosphate “head,” which is hydrophilic and a non-polar lipid “tail,” which is hydrophobic. Unsaturated fatty acids result in kinks in the hydrophobic tails. The phospholipid bilayer consists of two adjacent sheets of phospholipids, arranged tail to tail. The hydrophobic tails associate with one another, forming the interior of the membrane. The polar heads contact the fluid inside and outside of the cell.
- The phosphate group is negatively charged, making the head polar and hydrophilic—or “water loving.” A hydrophilic molecule (or region of a molecule) is one that is attracted to water. The phosphate heads are thus attracted to the water molecules of both the extracellular and intracellular environments. The lipid tails, on the other hand, are uncharged, or nonpolar, and are hydrophobic—or “water fearing.” A hydrophobic molecule (or region of a molecule) repels and is repelled by water.
- Phospholipids are thus amphipathic molecules. An amphipathic molecule is one that contains both a hydrophilic and a hydrophobic region. In fact, soap works to remove oil and grease stains because it has amphipathic properties. The hydrophilic portion can dissolve in the wash water while the hydrophobic portion can trap grease in stains that then can be washed away. A similar process occurs in your digestive system when bile salts (made from cholesterol, phospholipids and salt) help to break up ingested lipids.
- Since the phosphate groups are polar and hydrophilic, they are attracted to water in the intracellular fluid. Intracellular fluid (ICF) is the fluid interior of the cell. The phosphate groups are also attracted to the extracellular fluid. Extracellular fluid (ECF) is the fluid environment outside the enclosure of the cell membrane (see above Figure). Since the lipid tails are hydrophobic, they meet in the inner region of the membrane, excluding watery intracellular and extracellular fluid from this space.

In addition to phospholipids and cholesterol, the cell membrane has many proteins detailed in the next section.

- Membrane Proteins
- The lipid bilayer forms the basis of the cell membrane, but it is peppered throughout with various proteins. Two different types of proteins that are commonly associated with the cell membrane are the integral protein and peripheral protein (Figure 1.2).
- an integral protein is a protein that is embedded in the membrane. Many different types of integral proteins exist, each with different functions. For example, 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 proteins 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.



- Figure 1.2- Cell Membrane: The cell membrane of the cell is a phospholipid bilayer containing many different molecular components, including proteins and cholesterol, some with carbohydrate groups attached.
- Some integral proteins serve as cell recognition or surface identity proteins, which mark a cell's identity so that it can be recognized by other cells. Some integral proteins act as enzymes, or in cell adhesion, between neighbouring cells.
- A receptor is a type of recognition protein that can selectively bind a specific molecule outside the cell, and this binding induces a chemical reaction within the cell. Some integral proteins serve dual roles as both a receptor and an ion channel. One example of a receptor-channel interaction is the receptors on nerve cells that bind neurotransmitters, such as dopamine.
- Some integral membrane proteins are glycoproteins. A glycoprotein is a protein that has carbohydrate molecules attached, which extend into the extracellular environment. The attached carbohydrate tags on glycoproteins aid in cell recognition. The carbohydrates that extend from membrane proteins and even from some membrane lipids collectively form the glycocalyx.