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Journal of Biomedical Engineering and Medical Devices

Editorial

# An Editorial Note on Membrane lipid

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## EDITORIAL

Membrane lipids are a class of chemicals that form the double-layered surface of all cells and are structurally similar to fats and oils (lipid bilayer). Phospholipids, glycolipids, and cholesterol are the three major types of membrane lipids. Lipids are amphiphilic, meaning they have a polar end that is soluble in water and a nonpolar end that is soluble in fat. Membrane lipids can form a 'lipid bilayer' by generating a double layer with the polar ends pointing outwards and the nonpolar ends pointing inwards, which keeps the watery core of the cell distinct from the watery exterior. As part of the cell's metabolism, lipids and proteins operate as receptors and channel holes in the membrane, controlling the entry and exit of other molecules and ions. Membrane proteins are aided in their ability to rotate and diffuse laterally across a two-dimensional expanse of lipid bilayer by the existence of an annular lipid shell, which is a shell of lipids tightly bonded to the protein surface. Membrane lipids create a bilayer that serves as a living cell's containment unit. Membrane lipids also serve as a matrix for membrane proteins. Traditionally, lipids were assumed to only have a structural function. Lipids have a wide range of functions: They play a role in cell growth and adhesion regulation. They help to make other biomolecules through biosynthesis. They have the potential to boost enzyme enzymatic activity.

Monogalactosyl diglyceride (MGDG), a non-bilayer forming lipid, dominates the bulk lipids in thylakoid membranes, generating a reverse hexagonal cylindrical phase when hydrated alone. They do, however, create lipid bilayers when combined with other lipids and carotenoids/chlorophylls in thylakoid membranes. Phospholipids, also known as phosphatides, are lipids that have a hydrophilic "head" containing a phosphate group and two hydrophobic "tails" produced from fatty acids, which are connected by an alcohol residue (usually a glycerol molecule). The omega-3 fatty acids EPA and DHA are usually incorporated into the phospholipid molecule in marine phospholipids. Simple organic compounds like choline, ethanolamine, and serine can be used to modify the phosphate group. All cell membranes contain phospholipids, which are essential components. Because of their amphiphilic nature, they can form lipid bilayers. Interspersed among the phospholipids in eukaryotes' cell membranes is another type of lipid called sterol. The combination provides two-dimensional fluidity as well as mechanical robustness against rupture. Purified phospholipids are a type of phospholipid that may be manufactured commercially and have uses in nanotechnology and materials science. Lecithin, or phosphatidylcholine, was initially recognised as a phospholipid in biological tissues in 1847 by French chemist and pharmacist Theodore Nicolas Gobley in the egg yolk of chickens.

Glycolipids include a sphingosine with one or more sugar units connected in their heads (glyco- stands for sugar). The hydrophobic chains belong to one of two groups:

- Two fatty acids (FA) – in the case of phosphoglycerides, or two fatty acids (FA)
- In the case of sphingomyelin and glycolipids, one FA and the sphingosine hydrocarbon tail

Fatty acids in phospho- and glycolipids usually have an even number of carbon atoms, ranging from 14 to 24, with 16- and 18-carbon fatty acids being the most frequent. FAs can be saturated or unsaturated, with the double bonds almost invariably in a cis form. The length and degree of unsaturation of FAs chains have a significant impact on the fluidity of membranes.

The hydroxyl groups at C-1 and C-2 of glycerol are esterified to the carboxyl groups of the FAs in phosphoglycerides. Phosphoric acid is esterified from the C-3 hydroxyl group. The phosphatidate formed as a result is the simplest phosphoglycerate. Membranes contain only trace levels of phosphatidate. It is, nonetheless, a crucial step in the production of the other phosphoglycerides.

The amino alcohol sphingosine has a lengthy, unsaturated hydrocarbon chain. The amino group of sphingosine is connected to FAs via an amide bond in sphingomyelin and glycolipids. The main hydroxyl group of sphingosine is esterified to phosphoryl choline in sphingomyelin.

(a) Sphingomyelin

(b) Cholesterol space-filling models.

The sugar component of glycolipids is connected to this group. Cerebroside is the simplest glycolipid, with only one sugar residue, either Glc or Gal. Glycolipids with a branched chain of up to seven sugar residues, such as gangliosides, are more complicated.

**Sterols:** Cholesterol is the most well-known sterol, and it is found in humans. Cholesterol is also found in the membranes of other eukaryotes. Sterols have a tiny polar head group and a hydrophobic

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**Received:** October 07, 2021, **Accepted:** October 12, 2021, **Published:** October 17, 2021

**Citation:** Jing F (2021) An Editorial Note on Membrane lipid. J Biomed Eng & Med Dev.6:192.

four-membered fused ring rigid structure. Cholesterol is produced through a squalene cyclization of terpenoids from mevalonate. Cholesterol is required at high quantities in cell membranes, with an average of 20% cholesterol in the entire membrane and up to 50% cholesterol locally in raft regions (- percent is molecular ratio). It preferentially binds with sphingolipids (see diagram) in cholesterol-rich lipid rafts sections of eukaryotic cell membranes. The formation of lipid rafts encourages the aggregation of peripheral and transmembrane proteins, including SNARE and VAMP protein docking. Hopanoids and phytosterols, such as sitosterol and stigmasterol, play a comparable role in plants and prokaryotes.