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CELL MEMBRANE

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ABSTRACT

This article will consider the structure, structure, components and functions of the cell membrane.

Keywords: flip-flop mechanism, phospholipids; integral, semi-integral, peripheral proteins; lipid anchors.

INTRODUCTION

The structure of the plasma membrane. According to the fluid mosaic model of S. Singer and G. Nicholson (1972), all biological membranes are built according to the same principle: they consist of an extended double layer of amphiphilic lipids about 5 nm thick, inside which proteins are embedded. In addition, carbohydrate molecules associated with lipids and proteins are located on the surface of some membranes. The ratio of lipids, proteins and carbohydrates is different for different membranes and different cell types. Membrane lipids are amphiphilic molecules with a polar hydrophilic head and a nonpolar hydrophobic tail. Inside the membranes, they are held by hydrophobic and weak van der Waals interactions. Thus, they retain a certain mobility, which explains the liquid properties of the membranes. The fluidity of membranes depends primarily on their lipid composition and temperature. It increases with an increase in the proportion of unsaturated lipids. The content of cholesterol also affects the fluidity of membranes. Cholesterol increases the fluidity of densely packed semi-crystalline membranes, but at the same time stabilizes membranes with a high content of unsaturated lipids. Like lipids, proteins in membranes also retain a certain mobility. If they are not tied in

place by special mechanisms, they move in the lipid layer, as in a two-dimensional film. Therefore, biological membranes are called "liquid mosaic". Lipids and proteins move freely within one layer of the membrane, but the transition from one layer to another (the “flip-flop” mechanism) is impossible for proteins, and for lipids (with the exception of cholesterol) it is very difficult. To move to another layer, they need auxiliary proteins (translocators, “flipases”). Phospholipids are the most important group of membrane lipids. These include phosphatidylcholine (lecithin), phosphatidylethanolamine, phosphatidylserine, phosphatidylinosito and sphingomyelin. In addition, animal cell membranes (with the exception of the inner mitochondrial membrane) contain cholesterol. Glycolipids such as cerebrosides and gangliosides,Together with glycoproteins, they form the outer covering of the cell (the glycocalyx). Lipids are unevenly distributed in the membrane. The outer layer contains more phosphatidylcholine and sphingomyelin, while the inner layer contains more phosphatidylserine and phosphatidylethanolamine. Phosphatidylinositol occurs only in the inner layer, while glycolipids occur only on the surface.

Membrane functions. Enclosure and isolation of cells and organelles (1). Membranes provide physical and chemical protection from the outside environment. The integrity of the plasma membrane is important for maintaining the necessary balance of substances between the internal parts of the cell and the external environment. The regulation of the transport of substances (2) provides the necessary composition of the intracellular environment and maintains homeostasis (the constancy of the concentration of substances and physiological parameters). Since cells and organelles are surrounded by membranes, the selective transport of substances through pores and tubules, as well as through specialized mechanisms, is a prerequisite for the normal functioning of the cell. Perception of extracellular signals (3) and transmission of these signals into the cell, as well as the formation of signals. Enzymatic catalysis (4).

Important enzymes are located in membranes (on the border between lipid and aqueous media). Here, reactions involving non-polar substances take place. Examples include lipid biosynthesis and the metabolism of non-polar xenobiotics. In membranes, such important energy conversion processes as oxidative phosphorylation and photosynthesis also occur. Interaction with other cells (5) for tissue fusion and formation, as well as interaction with the extracellular matrix. Fixation of elements of the cytoskeleton (6) to maintain the shape of cells and organelles, as well as to ensure transport processes.

Membranes are made up of lipids and proteins.

Membrane proteins perform various functions: they act as carriers, channels, receptors, enzymes, or structural elements and are either built into the membrane (integral proteins) or more or less strongly associated with its surface (peripheral proteins).

Types of membrane proteins.

Integral membrane proteins span the lipid bilayer. The regions of the peptide chain lying within the lipid layer usually consist of 20–25 mostly hydrophobic amino acid residues forming a right-handed α-helix. Type I and II membrane proteins contain only one transmembrane helix, while type III proteins may contain several. Rarely, type I and II polypeptides combine to form type IV transmembrane proteins. Type V and VI proteins contain lipid anchors. Anchors are fatty acids (palmitic or myristic), isoprenoids (farnesol, geranylgeraniol, dolichol), or glycolipids

(glycosylphosphatidylinositol) bound to the peptide chain by a covalent bond. Some integral membrane proteins, such as porins, form antiparallel layered structures within the membrane. Such a tertiary structure is called a ß-barrel.

Peripheral membrane proteins (not shown) are attached to the membrane surface. They can be associated with phospholipid heads via Ca2+ ions or with integral membrane proteins via protein interactions. Many membrane proteins found on the outer surface of the cell contain covalently attached branched carbohydrate chains of about 15 sugar residues; such proteins are called glycoproteins.

USED LITERATURE

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