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The Importance of Ion Channels in Maintaining Cell Membrane Stability

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ABSTRACT

The basis of vital processes in biological organisms is the processes that take place directly at the cellular level. As a result of complex processes taking place in the cell membrane, many important vital processes take place, such as excitation, photosynthesis, and respiration. The cell membrane is generally composed of a lipid layer containing protein molecules. Protein molecules in the lipid layer on the membrane mainly form ion channels, ion pumps and receptors. The protein molecules that make up the ion channel in the membrane have the ability to selectively select a specific ion along a chemical gradient. Ion channels are divided into groups depending on the mechanisms of opening and closing, depending on the potential, sensitive to the action of ligands or activated by mechanical action

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Introduction

A special selectivity feature is characteristic for ion channels. The general electrical properties of cell membrane ion channels have been adequately studied [Sackmann, 1983]. During biological evolution, various complex orderly processes that take place in the cells of living organisms are carried out directly through the activity of ion transport systems. From this point of view, the scientific substantiation of the processes that take place in the tissue, in the whole organism, requires knowledge at the level of direct cellular ion transport systems. In particular, various pathological processes occur due to changes in the cell ion channels. The parameters of the function of ion channels in the cell change under the influence of various substances. In this case, the modulators act on the ion channel directly or through various receptor systems.

The passage of ions in the membrane takes place through a special system of proteins. These structures of protein molecules in the membrane are called ion channels. The ion channels operate on a gate mechanism, and when the channel is opened, the ions move into or out of the cell.

Ion channels also include channels in the membranes of some cell organelles. For example, it plays an important role in the activity of megacanal cells, apoptosis and necrosis due to Ca2 + ions in the membranes of mitochondria.

Ionophore molecules are relatively small molecules that have a ring structure and an ion in the center of the ring. When an ionophore molecule passes through a membrane, it carries the ion into or out of the cell. Ionophores are so diverse that some ionophore molecules carry only one ion across the membrane, while in other transport mechanisms, several ionophore molecules carry a single ion. In ionology, the ionophore valinomycin of K + ions is well studied. In this case, the natural ionophore forms a complex with

valinomycin K + ions, which are cyclic polypeptides. That is, K + ions are exchanged between the valinomycin molecule on the basis of compatibility with the hydrate shell and the hydrophobic shell of the valinomycin molecule consisting of aliphatic residues, and thus pass through the membrane.

The ion channel consists of several domains, and other membrane protein macromolecules bind to receptors, such as cell skeletons or mucopolysaccharides. While the hydrophobic amino acids in the macromolecule make contact with the lipid layer of the membrane, the hydrophilic amino acids form a pore inside the channel. Inside the bribe is a selective filter consisting of 5-6 negatively charged oxygen atoms, which provides the properties of the channel. Potassium channels are 7.3 in diameter and sodium channels are 8.1 in diameter.

The inner part of the channel can be opened and closed by a gate mechanism, a process that changes the conformation of the macromolecule. This process is controlled by "gate" currents in electrically driven membranes, sensory voltages, and chemicals, or mediators, in chemically driven membranes. It has been found that 107-108 ions can pass through the ion channel in one second. The velocities of the ions in the water correspond to the velocity of the passage through the channel, so the channel is also considered to be water pores. Under the influence of blockers, ie attenuators, the activity of ion channels located in the membrane decreases to 0. For example, tetrodotoxin, saxitoxin, etc. have a weakening effect on the activity of the ion channel. The blocking properties of Sa2 + ion channels located in the cell membrane have been studied in depth. Substances such as verapamil and D-600 have been shown to reduce the dose-dependent function of this ion channel gate mechanism.

The results of many years of experiments show that the maintenance of the stability of the membranes depends in many respects on the normal functioning of the ion channels located in it. Impairment of the selectivity of ion channels due to exposure to various harmful substances, which in turn leads to disruption of cellular processes. First the cell membrane, then the cell organelles in this order, end up with processes that eventually lead to cell death.

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