

EXCITATION AND INHIBITION PROCESSES IN THE CENTRAL NERVOUS SYSTEM

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Abstract: This article analyzes in detail the mechanisms of excitation and inhibition, which are the main physiological processes of the central nervous system. The central nervous system is a complex biological system that controls the activities of all organs and systems in the human body and ensures their mutual coordination. The functional activity of the nervous system is carried out mainly through neurons, and these processes are closely related to the phenomena of excitation and inhibition. Excitation is characterized by the transition of nerve cells to an active state in response to external or internal influences, and in this process nerve impulses are formed, which are transmitted to other cells through nerve fibers. Inhibition is one of the important protective mechanisms of the nervous system, which limits excessive excitation, ensures the balanced functioning of nerve centers, and ensures the orderly functioning of the body. The article discusses the mechanisms of excitation and inhibition processes at the neuronal level, the features of their implementation in synapses, and their role in the transmission of nerve impulses. The relationship of these processes with reflex activity, higher nervous activity of the cerebral cortex, memory, learning and mental processes is also scientifically analyzed. It is shown that the balance between the processes of excitation and inhibition in the central nervous system is of great importance in the adaptation of the organism to external and internal environmental factors. In addition, it is discussed that disruption of these physiological processes can cause the development of various neurological diseases. This article serves to provide a deeper understanding of the physiological foundations of

the functioning of the central nervous system and can serve as an important theoretical source for conducting scientific research in the fields of medicine, in particular neurology, neurosurgery and physiology.

Keywords: Central nervous system, neuron, excitation, inhibition, synapse, nerve impulse, reflex, mediators

Relevance of the topic: The central nervous system is one of the most complex and important systems in the human body, controlling the activities of all organs and systems, ensuring their mutual coordination. Any physiological processes in the body, motor activity, processing of information received through the sensory organs, and adaptation to the external environment are carried out precisely through the central nervous system. The basis of the activity of this system is the processes of excitation and inhibition. These processes determine the functional state of nerve cells and play an important role in the formation of reflex responses of the body.

The processes of excitation and inhibition are the main physiological mechanisms that ensure the normal functioning of the central nervous system. Due to their mutual balance, the body adapts to external and internal environmental factors, the activity of nerve centers is coordinated, and complex physiological and mental processes occur. If the balance between these processes is disturbed, various pathological conditions may occur in the body's activity. For example, in the development of epilepsy, neuroses, sleep disorders, and other neurological diseases, disturbances in the processes of excitation and inhibition play an important role. Nowadays, in-depth study of the activity of the central nervous system is of great scientific importance in modern medicine, especially in the fields of neurology, neurosurgery and psychiatry. Scientific analysis of the processes of excitation and inhibition helps to understand the mechanisms of the origin of diseases of the nervous system, to develop methods for their prevention and effective treatment. Therefore, the study of the processes of excitation and inhibition in the central nervous system is one of the urgent issues not only for theoretical, but also for practical medicine.

Purpose of the topic: The main purpose of this article is to study in-depth the physiological essence of the processes of excitation and inhibition occurring in the central nervous system, to scientifically analyze their significance in the activity of nerve cells and to shed light on their role in regulating the activity of the organism. Also, this article



analyzes the mechanisms of the occurrence of excitation and inhibition processes at the neuronal level, the processes of transmission of nerve impulses through synapses, and the role of these processes in the formation of reflex activity. In addition, one of the important tasks of the article is to demonstrate the importance of the balance between excitation and inhibition in the central nervous system in ensuring the normal functioning of the body. Through this study, a deeper understanding of the physiological basis of the central nervous system, an understanding of the pathogenesis of nervous system diseases, and the development of medical practice are possible. The article aims to highlight the possibilities of effective use of this knowledge.

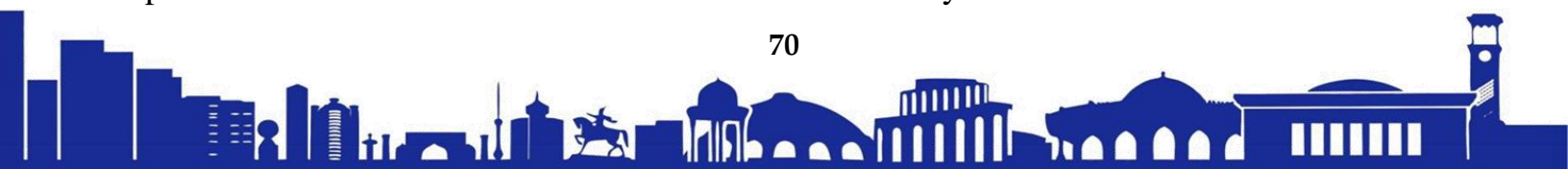
Main part: The central nervous system is one of the most important systems in the human body that performs the function of control and coordination. It consists of the brain and spinal cord and controls the activities of all organs of the body. The functional activity of the central nervous system is carried out mainly through nerve cells - neurons. Neurons have a specific structure, consisting of dendrites, a cell body and an axon. Nerve impulses are received, processed and transmitted to other cells through these structures. The main processes in the activity of the central nervous system are excitation and inhibition. Excitation is the process of nerve cells entering an active state in response to external or internal influences. As a result of this process, the electrical potential in the neuron membrane changes and a nerve impulse is generated. During excitation, the ion channels of the cell membrane open and sodium ions enter the cell. This leads to depolarization of the membrane. The electrical impulse generated as a result of depolarization spreads along the axon and is transmitted to other nerve cells. Nerve impulses are transmitted from one cell to another mainly through synapses. A synapse is a place of contact between two neurons or a neuron with another cell. In synapses, nerve impulses are transmitted using chemical mediators. These mediators are released into the synaptic cleft and act on receptors on the membrane of the next cell, resulting in a new excitation process. Mediators such as acetylcholine, noradrenaline, dopamine, and serotonin play an important role in the functioning of the nervous system. The inhibition process is one of the important protective mechanisms of the nervous system. Inhibition is a process that reduces or temporarily stops the excitability of nerve cells, which ensures the balanced functioning of the central nervous system. If there is only an excitation process in the body, the nervous system is overloaded, which can lead to various





pathological conditions. Therefore, the inhibition process controls excitation and prevents excessive activation of nerve centers. The inhibition process is divided into several types. In the process of postsynaptic inhibition, mediator substances act on the postsynaptic membrane, reducing the excitability of the cell. Presynaptic inhibition is carried out by reducing the strength of the nerve impulse reaching the synapse. Recurrent inhibition is also observed in the central nervous system. In this process, the nerve impulse returns to its source through special neurons, weakening its activity. Mediators such as gamma-aminobutyric acid (GABA) and glycine play an important role in the inhibition process. These substances cause hyperpolarization in the membrane of nerve cells, reducing the likelihood of excitation. As a result, excessive excitation of the nervous system is prevented and the normal functioning of the organism is ensured. The processes of excitation and inhibition are closely related and are important in maintaining the balance of the activity of the nervous system. These processes form the basis of reflex activity. A reflex is an organism's response to external or internal influences through the central nervous system. In any reflex process, the mechanisms of excitation and inhibition are involved together. In addition, the processes of excitation and inhibition also play an important role in the higher nervous activity of the cerebral cortex. Human thinking, memory, learning, attention and emotional states are formed precisely on the basis of the interaction of these processes. For example, during the learning process, excitation increases in certain nerve centers, and the inhibition process is activated to limit unnecessary information. At the same time, disruption of the processes of excitation and inhibition in the central nervous system can lead to the development of various neurological diseases. For example, in epilepsy, excessive excitability of nerve cells is observed. Insomnia, neuroses, and stress states can also be associated with an imbalance of these processes. Therefore, in-depth study of these mechanisms is of great scientific importance in modern medicine.

Conclusion: The processes of excitation and inhibition occurring in the central nervous system are one of the main physiological mechanisms of the body's activity. These processes ensure the functional activity of nerve cells and play an important role in the formation and transmission of nerve impulses. The excitation process ensures the body's response to the effects of the external and internal environment, while the inhibition process limits excessive activation of the nervous system and ensures its balanced



functioning. Due to the mutual harmony of the excitation and inhibition processes, the body quickly and effectively adapts to external environmental factors. These processes play an important role in the formation of reflex activity, the control of motor activity, as well as in human mental activity. Complex neural processes occurring in the cerebral cortex, including learning, memory, and thinking, are also based on the mechanisms of excitation and inhibition. Disruption of the balance between these processes in the central nervous system can cause the development of various neurological and mental diseases. Therefore, a deep study of the mechanisms of excitation and inhibition is of great importance in medical practice. This knowledge serves as an important scientific basis for the development of new diagnostic and treatment methods in the fields of neurology, neurosurgery, psychiatry and physiology. Thus, the processes of excitation and inhibition in the central nervous system are the main physiological processes that ensure the balanced functioning of the body, and their in-depth study is important in maintaining human health and preventing various diseases.

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