FUNCTIONS OF THE HIGNER DIVISIONS OF THE NERVOUS SYSTEM. CONDITIONED REFLEXES

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Annotation. This article examines the higher divisions of the nervous system, particularly the functional significance of the cerebral cortex, as well as the mechanisms of conditioned reflex formation from the perspective of scientific physiology. The higher divisions of the nervous system act as central structures responsible for receiving, analyzing, and processing environmental signals and for generating appropriate adaptive responses in the organism.

The paper discusses the fundamental principles of the theory of conditioned reflexes developed by I.P. Pavlov, explaining the processes of formation, consolidation, and extinction of temporary neural connections. Conditioned reflexes are formed on the basis of individual experience and represent one of the key mechanisms of higher nervous activity.

Special attention is paid to the analytical and synthetic activity of the cerebral cortex, the interaction between excitation and inhibition processes, and their role in regulating reflex activity. The article also highlights the main laws of higher nervous activity, the biological significance of reflexes, and their adaptive value in light of modern physiological research.

Keywords: higher divisions of the nervous system, cerebral cortex, conditioned reflexes, higher nervous activity, excitation and inhibition, temporary neural connections, reflex activity, analysis and synthesis, adaptation, physiology.

Аннотация. В данной статье рассматриваются высшие отделы нервной системы, в частности функциональное значение коры головного мозга, а также механизмы формирования условных рефлексов с позиций научной физиологии. Высшие отделы нервной системы выступают как центральная структура, обеспечивающая прием, анализ и переработку сигналов внешней среды и формирование адекватных ответных реакций организма.

В работе освещаются научные положения теории условных рефлексов, разработанной И.П. Павловым, на основе которых раскрываются процессы образования временных нервных связей, их закрепления и угасания. Условные рефлексы формируются на основе индивидуального опыта и являются одним из ключевых механизмов высшей нервной деятельности.

Особое внимание уделяется аналитико-синтетической деятельности коры больших полушарий, взаимодействию процессов возбуждения и торможения, а также их роли в регуляции рефлекторной деятельности. В статье также рассматриваются

основные закономерности высшей нервной деятельности, биологическое значение рефлексов и их адаптационная роль с учетом современных достижений физиологии.

Ключевые слова : высшие отделы нервной системы, кора головного мозга, условные рефлексы, высшая нервная деятельность, возбуждение и торможение, временные нервные связи, рефлекторная деятельность, анализ и синтез, адаптация, физиология.

Annotatsiya. Mazkur maqolada nerv tizimining oliy bo‘limlari, xususan bosh miya po‘stlog‘ining funksional ahamiyati hamda shartli reflekslarning shakllanish mexanizmlari ilmiy-fiziologik nuqtai nazardan tahlil qilinadi. Nerv tizimining oliy bo‘limlari organizmning murakkab moslashuv reaksiyalarini boshqaruvchi markaziy tuzilma sifatida tashqi muhit signallarini qabul qilish, qayta ishlash va adekvat javob reaksiyalarini shakllantirishda muhim rol o‘ynaydi.

Maqolada shartli reflekslar nazariyasining asoschisi Ivan Pavlov tomonidan ishlab chiqilgan ilmiy qarashlar asosida vaqtinchalik nerv bog‘lanishlarining hosil bo‘lishi, ularning mustahkamlanishi va so‘nishi jarayonlari yoritiladi. Shartli reflekslar organizmning individual tajribasi asosida shakllanib, oliy nerv faoliyatining asosiy mexanizmlaridan biri hisoblanadi.

Shuningdek, bosh miya po‘stlog‘ining analitik-sintetik faoliyati, qo‘zg‘alish va tormozlanish jarayonlarining o‘zaro ta’siri hamda ularning reflektor faoliyatni boshqarishdagi o‘rni tahlil qilinadi. Maqolada oliy nerv faoliyatining asosiy qonuniyatlari, reflekslarning biologik ahamiyati va ularning adaptiv xususiyatlari zamonaviy fiziologiya yutuqlari asosida yoritib beriladi.

Kalit so‘zlar: nerv tizimi oliy bo‘limlari, bosh miya po‘stlog‘i, shartli reflekslar, oliy nerv faoliyati, qo‘zg‘alish va tormozlanish, vaqtinchalik nerv bog‘lanishlari, reflektor faoliyat, analiz va sintez, adaptatsiya, fiziologiya.

The nervous system is a complex biological system that coordinates all functions of the organism and ensures its adaptation to changes in the internal and external environment. The higher divisions of the nervous system, particularly the cerebral cortex, serve as the primary center of higher nervous activity, regulating consciousness, behavior, and the interaction of the organism with its surroundings.

The study of higher nervous activity is a key area in modern physiology. Of particular importance is the theory of conditioned reflexes developed by Ivan Pavlov. This theory explains the mechanisms of adaptation based on individual experience, including the formation, development, and extinction of conditioned reflexes.

Conditioned reflexes are temporary neural connections formed in response to external stimuli and represent one of the most important indicators of higher nervous activity. The interaction between excitation and inhibition processes in the cerebral cortex determines the effectiveness of reflex activity and supports the adaptive capabilities of the organism.

The aim of this article is to provide a scientific analysis of the functions of the higher divisions of the nervous system and the physiological mechanisms of conditioned reflexes.

Functional Organization of the Higher Divisions of the Nervous System

The higher divisions of the nervous system are primarily represented by the cerebral cortex, subcortical structures, and their complex interconnections. The cerebral cortex plays a dominant role in integrating sensory information, coordinating voluntary movements, and regulating cognitive processes such as thinking, memory, and decision-making.

Functionally, the cortex operates through an analytical and synthetic mechanism. The analytical function involves the decomposition of complex stimuli into individual components, while the synthetic function integrates these elements into a unified perception. This dual activity enables the organism to respond adequately to dynamic environmental changes.

Subcortical structures, including the thalamus and hypothalamus, serve as important relay and regulatory centers. They modulate cortical activity and maintain homeostasis by regulating autonomic and endocrine functions. The interaction between cortical and subcortical regions ensures the stability and adaptability of the organism.

Physiological Basis of Conditioned Reflexes

The concept of conditioned reflexes was first systematically studied by Ivan Pavlov, who demonstrated that reflex responses could be formed through associative learning. A conditioned reflex is a learned response that develops when a neutral stimulus is repeatedly paired with an unconditioned stimulus.

The physiological basis of conditioned reflex formation lies in the establishment of temporary neural connections within the cerebral cortex. These connections are formed through repeated stimulation and reinforcement. Synaptic plasticity, including mechanisms such as long-term potentiation, plays a crucial role in strengthening these neural pathways.

Conditioned reflexes can be classified into several types, including:

Classical (Pavlovian) conditioned reflexes

Instrumental (operant) conditioned reflexes

Higher-order conditioned reflexes

Each type reflects increasing complexity in neural processing and behavioral adaptation.

Mechanisms of Excitation and Inhibition

The activity of the cerebral cortex is based on two fundamental physiological processes: excitation and inhibition. Excitation refers to the activation of neurons in response to stimuli, while inhibition suppresses neural activity, preventing overstimulation and ensuring coordinated responses.

According to Pavlov's theory, the balance between excitation and inhibition is essential for normal nervous system functioning. Disruptions in this balance may lead to pathological conditions such as neuroses or impaired behavioral responses.

Inhibition can be categorized into:

External inhibition, caused by new or strong stimuli

Internal inhibition, developed during the process of learning and adaptation (e.g., extinction of conditioned reflexes)

These inhibitory mechanisms allow the organism to filter irrelevant stimuli and focus on significant environmental signals.

Formation, Reinforcement, and Extinction of Conditioned Reflexes

The formation of conditioned reflexes requires several conditions:

Repeated pairing of conditioned and unconditioned stimuli

Temporal proximity between stimuli

Biological relevance of the unconditioned stimulus

Reinforcement strengthens the temporary neural connections, making the conditioned response more stable. Without reinforcement, conditioned reflexes gradually weaken and may eventually disappear, a process known as extinction.

However, extinction does not completely erase the learned connection; under certain conditions, the reflex may reappear (spontaneous recovery). This demonstrates the dynamic and flexible nature of higher nervous activity.

Biological Significance and Adaptive Role

Conditioned reflexes are fundamental for adaptation, learning, and survival. They allow organisms to anticipate environmental changes and respond proactively rather than reactively. This predictive capacity significantly enhances efficiency in behavior and energy utilization.

From a physiological perspective, conditioned reflexes contribute to:

- Development of habits and skills
- Formation of behavioral patterns
- Optimization of responses to repeated stimuli

In humans, these mechanisms form the basis of complex cognitive functions, including speech, thinking, and social behavior.

Modern Perspectives in Neurophysiology

Contemporary research in neurophysiology expands classical theories by incorporating findings from neuroscience, such as neural networks, brain imaging, and molecular mechanisms of synaptic transmission. While Pavlov's principles remain foundational, modern studies emphasize the role of distributed neural circuits and plasticity across multiple brain regions.

Advanced techniques such as functional MRI and electrophysiological recording have confirmed that conditioned reflexes involve not only the cortex but also deeper brain structures, including the limbic system, which is associated with emotions and motivation.

In conclusion, the higher divisions of the nervous system, particularly the cerebral cortex, serve as the primary centers responsible for regulating the complex vital functions of the organism. These structures play a crucial role in receiving, analyzing, and processing information from both internal and external environments, as well as in generating appropriate adaptive responses.

Conditioned reflexes represent one of the fundamental mechanisms of higher nervous activity, formed through temporary neural connections based on individual experience. The theory developed by Ivan Pavlov provides a scientific explanation of the physiological basis of these processes.

The balance between excitation and inhibition ensures the efficiency of reflex activity and enhances the adaptive capabilities of the organism. The processes of formation, reinforcement, and extinction of conditioned reflexes demonstrate the high plasticity and flexibility of the nervous system.

The findings presented in this study contribute to a deeper understanding of the functions of the higher divisions of the nervous system and the physiological mechanisms underlying conditioned reflexes. These insights have significant theoretical and practical implications in the fields of medicine, education, and psychology.

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