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BRAIN MORPHOLOGY STRUCTURE AND FUNCTION

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Abstract
The brain is one of the most complex and important structures in the human body. It is responsible for all physiological and psychological processes, including perception, thinking, memory, emotions, and movement control.
The brain is made up of two main types of tissues: Gray matter – includes neurons, their bodies, and dendrites. It is mainly responsible for the processing and transmission of information. White matter consists mainly of axons of neurons covered with myelin, which accelerates the transmission of nerve impulses. Gray and white matter are found in different parts of the brain: Gray matter is located in the cerebral cortex (cerebral cortex). White matter is located deeper and consists of long nerve fibers that transmit signals between different parts of the brain.

Introduction

Major brain regions: The brain is made up of several key structures, each with specific functions. The main regions include: The cerebral hemispheres (Cerebrum) are the largest part of the brain, which is divided into two hemispheres: the right and left. Each hemisphere has several functional areas that are responsible for different processes: The frontal lobe is responsible for higher cognitive functions such as thinking, planning, decision-making, and movement control. The parietal lobe (parietal lobe) plays an important role in the perception of sensory information, as well as in the coordination of movements. The temporal lobe is responsible for the perception of sounds, the processing of memory and emotions. Occipital lobe is responsible for processing visual information. The cerebellum (Cerebellum) is located at the back of the brain and is responsible for coordination of movements, balance and accuracy of movements. It plays an important role in maintaining postural control and coordination.
The brain stem connects the brain to the spine and includes three main parts:Medulla oblongata – regulates vital functions such as breathing, heart rate, and blood pressure.Pons – participates in the coordination of movements and controls functions such as sleep and breathing.Midbrain – plays a role in processing visual and auditory signals, and is also involved in the regulation of movements.
Microscopic structure of the brain. At the cellular level, the brain is made up of two main types of cells: neurons and glial cells. They consist of:Soma (neuron body) – contains the nucleus and the rest of the organelles. Axon is a long process that transmits nerve impulses from the neuron body to other neurons or muscle cells. Dendrites are short processes that receive signals from other neurons. Neurons communicate with each other through synapses — connections that allow signals to be transmitted between cells.
Glial cells perform supportive and protective functions. They provide neurons with nutrients, protect against toxins, maintain homeostasis, and are involved in the repair of damaged tissues.

Glial cells include: Astroglia – maintain the structure of nervous tissue and regulate the metabolism between neurons. Oligodendrocytes form myelin, which insulates axons, speeding up the transmission of nerve impulses. Microglia – play a role in immune defense by removing damaged or dead cells.

Each brain tissue has its own special microscopic structure. Let's take a closer look at the structure of gray and white matter:Gray matter is mainly made up of neuronal bodies and their dendrites. It is found in the cerebral cortex (the outer layer), as well as in some structures, such as nuclei located in the deeper parts of the brain. In the cerebral cortex, several layers can be distinguished, each of which has its own composition of cells. For example, there are six layers in the cerebral cortex, each of which plays a different role in information processing. White matter consists mainly of axons of neurons, which are covered with myelin sheaths. These shells are made up of fatty substances that give them a white color. Myelin increases the speed of transmission of nerve impulses, allowing rapid communication between different parts of the brain and spinal cord. White matter is located deep in the brain, under gray matter, and forms large nerve pathways such as the corticospinal and corticobulbar tracts.

Histological Research Methods

Various methods are used to study the histological structure of the brain. One of the most common is the microscopy method, which allows the study of tissue structure at the cellular level using various dyes and sample processing methods. For example, hematoxylin-eosin staining makes it possible to distinguish between cellular components such as nuclei and cytoplasm. Modern methods, such as immunohistochemistry, make it possible to study the expression of specific proteins in brain cells.

Each part of the brain has unique functions, and they are all closely interrelated: The cerebral hemispheres are responsible for higher mental functions such as attention, perception, memory, decision-making, and movement. The cerebellum regulates motor coordination, balance, and movement accuracy. The brain stem controls the body's automatic functions, such as breathing, heart rate, and swallowing.

Conclusion

The morphology of the brain is a complex and highly organized structure, where each section has its own specific role in maintaining the vital functions of the body and performing cognitive functions. The study of brain morphology is the basis for understanding many neurobiological processes and developing treatments for various diseases associated with brain disorders. The study of the microscopic structure of the brain allows us to better understand the mechanisms underlying various neurological diseases, as well as to develop methods for their diagnosis and treatment.

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