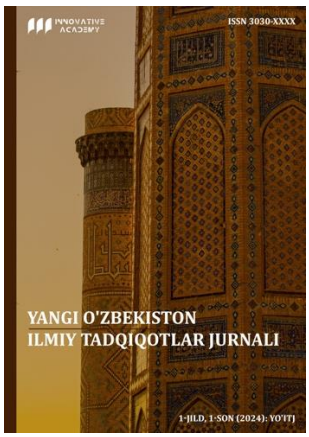

NORMAL REFLEX ARC. BRAIN AND SPINAL CORD CONDUCTION, CLINICAL SIGNIFICANCE. SENSORY PATHWAYS. PATHWAYS, CLINICAL SIGNIFICANCE.

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ABSTRACT

Conductive tracts, conducting tracts of the head and spinal cord - nerve fibers in the central nervous system; combined into a single morphological and functional system according to its structure and function. Conductive pathways convey external and internal environmental influences to brain cells (sensory pathways), and the resulting response to working organs (motor pathways). Most of the conduction pathways (long pathways) run through the spinal cord to the cerebral cortex and, conversely, from the cortex to the spinal cord and from there to the limbs. Short paths are confined to the area of the brain. Depending on their function, neurons are divided into three main groups: a) sensory receptors (afferent); b) executive (efferent); c) connection is made between intermediate neurons. Their cells are located in the gray matter of the cortex of the spinal cord and brain, and their nerve fibers are located in their white matter.

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1. The (pyramidal) path between the cerebral cortex and the spinal cord is a motor path, the effects of efferent fibers go from the precentral nucleus of the brain to the gray matter of the spinal cord and from there to the working organs through nerve fibers. This conductive pathway consists of two neurons.

2. The path between the cortex of the brain and the nuclei of the brain stem also has two neurons, the first neuron starts from the cortex, passes through the internal capsule, and ends in the nuclei of the nerves of the brain (III, IV, V, VI, VII and IX-XII pairs). And the second neurons emerge from these nerve nuclei as the III, IV, V, VI, VII and IX-XII pair of cranial nerves.

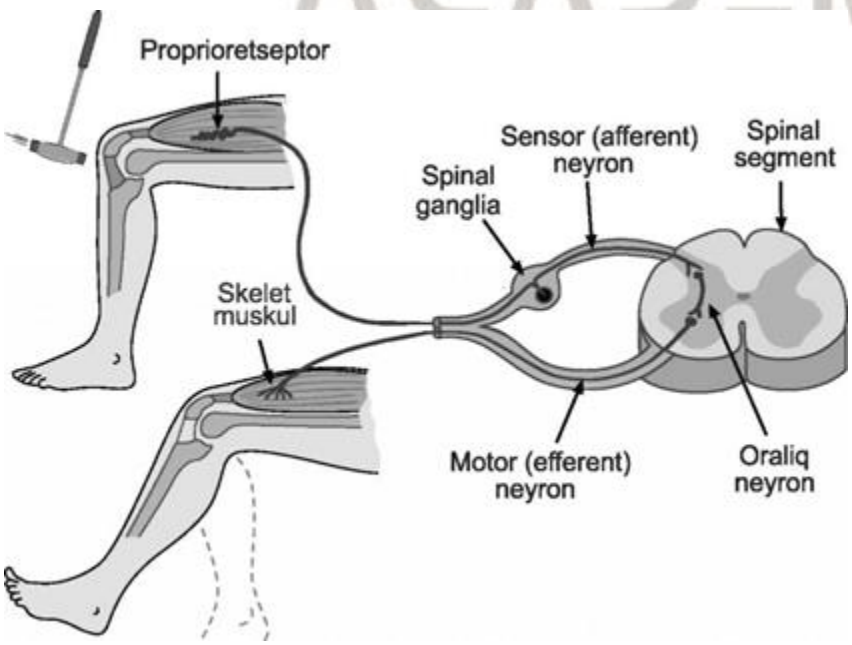
3. The pathway between the red nucleus and the spinal cord is a two-neuron motor pathway from the red nucleus in the midbrain to the anterior horn of the spinal cord and the muscles. This pathway controls the automatic functioning of the body's muscles.

4. The path that transmits pain and temperature between the spinal cord and the cerebral cortex consists of three neurons. It is located in the neurons of the conduction pathways, the spinal cord, the gray matter of the spinal cord, the optic chiasm, and the midbrain.

5. The deep sensory pathway between the spinal cord and the cerebral cortex is a three-neuron pathway that receives sensations through nerve endings starting from muscles and joints, the neurons of which are located in the spinal cord, medulla oblongata, optic lobe, and the central posterior part of the brain.

6. The anterior and posterior pathways between the spinal cord and the cerebellum consist of bones, joints, and muscles, and transmit sensations related to balance through the anterior and posterior pathways between the spinal cord and the cerebellum. Complex reflex pathways regulating movement in the cerebellum control muscle balance, balance, and muscle tone.

The path between the spinal cord and the optic disc provides the suspension of the body. Next are the auditory and visual pathways (see also Cerebrum, Optic plexus, Cerebellum, Back.



The withdrawal response (reflex), also known as the nociceptive flexion reflex, is an automatic response of the spinal cord that is critical in protecting the body from harmful stimuli. The first known definition of a reflex dates back to 1649 when René Descartes noted that specific bodily movements occurred instantaneously and independently of the process of thought. Modern definitions state that a reflex is an involuntary response of effector tissue caused by the stimulation of specific receptors.[1]

The reflex arc is the basic unit of a reflex, which involves neural pathways acting on an impulse before that impulse has reached the brain. Instead of traveling directly to the brain, sensory neurons of a reflex arc synapse in the spinal cord. This is an important evolutionary adaptation for survival, which allows faster actions by activating spinal motor neurons instead of delaying reaction time by signals first having to go to the brain.

The withdrawal reflex can occur in either the upper or lower limbs and is a polysynaptic reflex, which means that interneurons mediate the reflex between the afferent (sensory) and efferent (motor) signals. In contrast, the deep tendon reflex is monosynaptic and does not utilize interneurons to transmit information. Additionally, the withdrawal response is an intersegmental reflex arc, meaning that the outcomes of the reflex are mediated by the stimulation or inhibition of motor neurons from multiple levels of the same spinal cord.[2]

Go to:

Cellular Level

Body tissues that come into contact with noxious stimuli become damaged and release chemicals that activate sensory neuron nociceptors. These chemicals include globulin and protein kinases, arachidonic acid, histamine, and prostaglandins. Nociceptors detect tissue damage and can be divided into categories, including high threshold mechanonociceptors which respond to mechanical stimuli (e.g., cutting or pinching); chemical nociceptors, which respond to injury-related chemical stimuli, and thermal nociceptors, which respond to thermal and mechanical stimuli. In addition, polymodal nociceptors exist that respond to chemical, thermal, and mechanical stimuli.[3] If the strength of a stimulus is great enough, it can overcome the sensory neuron threshold, and an action potential can be initiated. The threshold represents the lowest stimulus that can evoke the depolarization of the neuron and result in an action potential.[4]

A sensory neuron that gets excited via its nociceptors delivers this excitement through pain fibers to the central nervous system (CNS). Notably, these fibers transmit excitation to the cell body of the sensory neuron, which resides in the dorsal root ganglia (DRG) of the spinal cord. The specific fibers that communicate mechanical, thermal, and chemical pain are the A-delta and C fibers. Once these fibers relay the action potential to the cell body of the sensory neuron in the DRG, the sensory neuron sends excitatory postsynaptic potentials (EPSPs) to motor neurons and interneurons, as previously explained. The sensory neuron accomplishes this by releasing neurotransmitters, with glutamate being the primary excitatory neurotransmitter in the CNS. Some interneurons involved in the withdrawal reflex are inhibitory and relay inhibitory postsynaptic potentials (IPSPs) by releasing inhibitory

neurotransmitters, with the primary inhibitory neurotransmitters in the CNS being GABA and glycine.[5]

The excited somatic motor neurons complete the withdrawal reflex by depolarizing and contracting their targeted muscles. This depolarization travels along the motor neuron, which exits the spinal cord and enters the peripheral nervous system (PNS). Within the PNS, the motor neuron releases the excitatory neurotransmitter acetylcholine (ACh), which binds to the nicotinic acetylcholine receptors on the sarcolemma of the muscle, initiating an action potential that travels down the T-tubules. The sarcoplasmic reticulum (SR) then releases calcium ions and binds troponin, changing its conformation. This change reveals the active site on actin by removing tropomyosin, and myosin can now form a cross-bridge with actin to induce contraction. ATP then powers the release of myosin from actin, calcium ions are actively transported back into the SR, and tropomyosin returns to its site to block actin. The somatic motor neurons inhibited in the spinal cord will not be depolarized, resulting in no contraction of their targeted muscle groups.[6]

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