

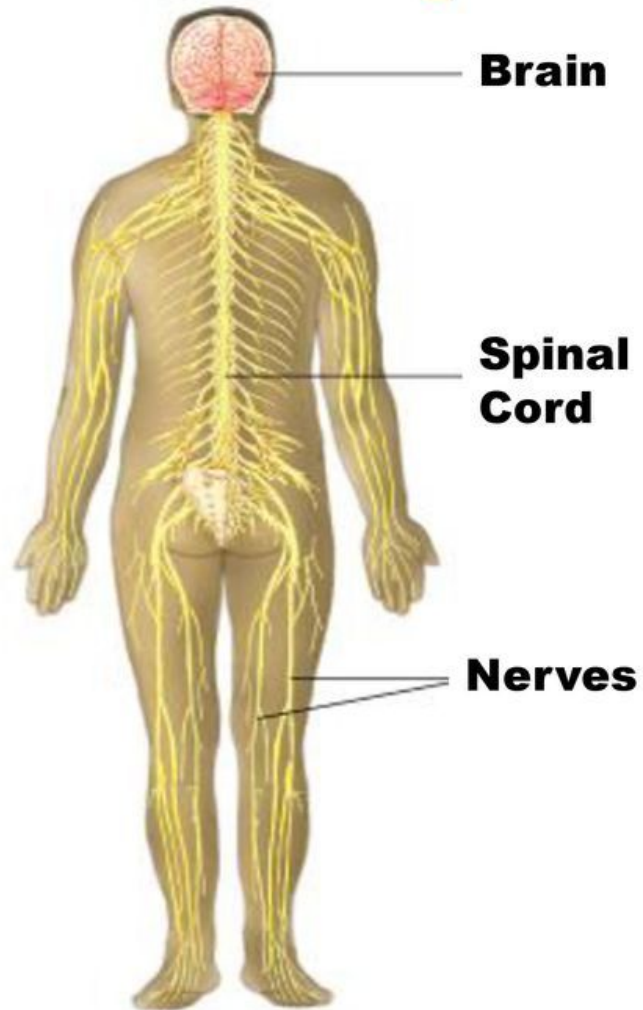
# The nervous system

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# THE NERVOUS SYSTEM

- a complex network of structures that permeates the entire body and provides self-regulation of its vital activity due to the ability to respond to external and internal influences (stimuli). The main functions of the nervous system are receiving, storing and processing information from the external and internal environment, regulating and coordinating the activities of all organs and organ systems.
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# The Nervous System



# General characteristics of the nervous system

- The whole variety of meanings of the nervous system follows from its properties.
- 1. Excitability, irritability and conductivity are characterized as functions of time, that is, it is a process that occurs from irritation to the manifestation of the response activity of the organ. According to the electrical theory of the propagation of a nerve impulse in a nerve fiber, it spreads due to the transition of local foci of excitation to neighboring inactive areas of the nerve fiber or the process of propagating depolarization of the action potential, representing the similarity of an electric current. Another chemical process takes place in synapses, in which the development of an excitation-polarization wave belongs to the mediator acetylcholine, that is, a chemical reaction.
- 2. The nervous system has the property of transforming and generating the energies of the external and internal environment and converting them into a nervous process.
- 3. A particularly important property of the nervous system is the property of the brain to store information in the process of phylogeny.

# The nervous system consists of neurons, or nerve cells, and neuroglia, or neuroglial (or glial) cells.

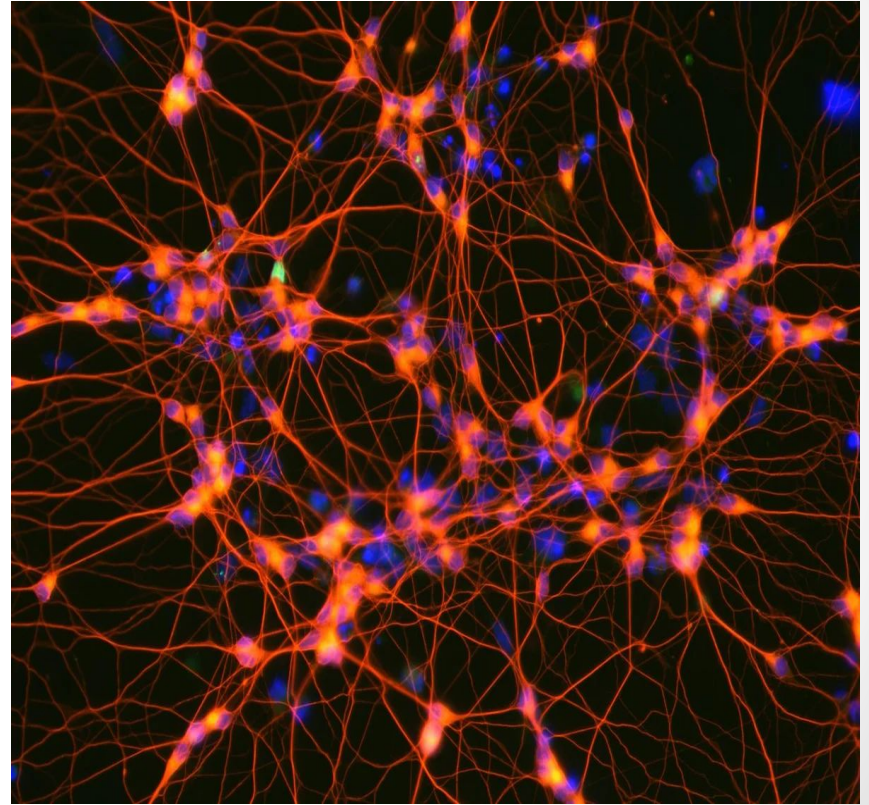
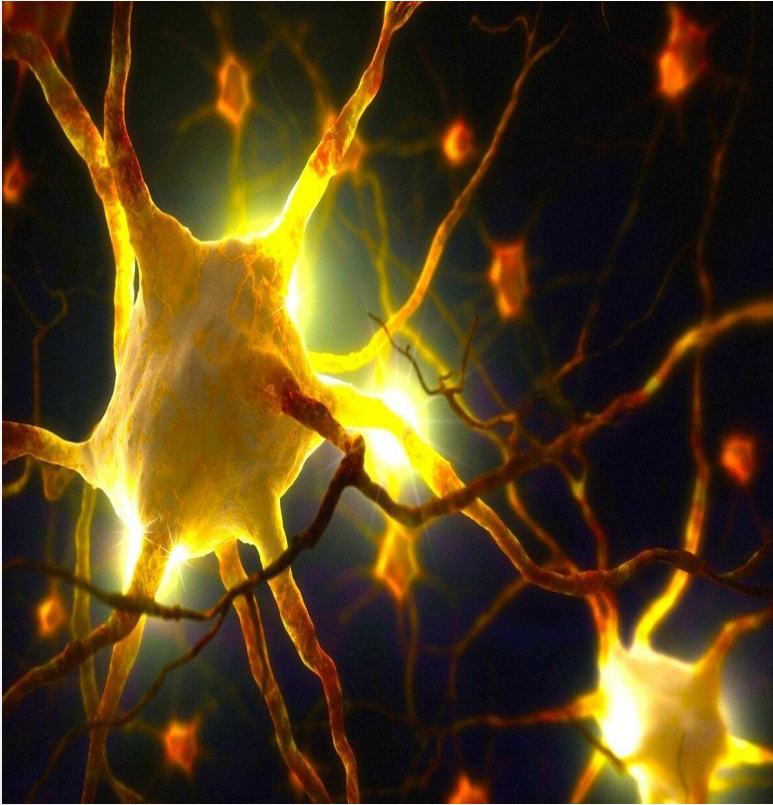
## Neurons

- The nervous system consists of neurons, or nerve cells, and neuroglia, or neuroglial (or glial) cells. Neurons are the main structural and functional elements in both the central and peripheral nervous system. Neurons are excitable cells, that is, they are capable of generating and transmitting electrical impulses (action potentials). Neurons have different shapes and sizes, form two types of processes: axons and dendrites. Dendrites can be many, several, one or not at all. Usually, a neuron has several short branched dendrites, along which impulses follow to the neuron body, and always one long axon, along which impulses go from the neuron body to other cells (neurons, muscle or glandular cells).  
(multi-process)

## Neuroglia

- Glial cells are more numerous than neurons and make up at least half of the volume of the central nervous system, but unlike neurons, they cannot generate action potentials. Neuroglial cells are different in structure and origin, they perform auxiliary functions in the nervous system, providing support, trophic, secretory, delimiting and protective functions.

# TYPES OF NEURONS



# Types of nervous systems

- **Diffuse nervous system** - presented in coelenterates. Nerve cells form a diffuse nerve plexus in the ectoderm throughout the animal's body, and when one part of the plexus is strongly irritated, a generalized response occurs — the whole body reacts.
- **The stem nervous system** (orthogon) — some nerve cells are assembled into nerve trunks, along with which the diffuse subcutaneous plexus is preserved. This type of nervous system is represented in flatworms and nematodes (in the latter, the diffuse plexus is greatly reduced), as well as many other groups of primary—mouthed - for example, gastrotrichs and cephalopods.
- **The nodular nervous system, or complex ganglionic system**, is represented in annelids, arthropods, mollusks and other groups of invertebrates. Most of the cells of the central nervous system are assembled into nerve ganglia. In many animals, the cells in them are specialized and serve individual organs.
- **Some mollusks** (for example, cephalopods) and arthropods have

# Functional division

- **Somatic (animal)** nervous system
- **Autonomous (autonomic)** nervous system
- **Sympathetic division of the autonomic**  
nervous system
- **Parasympathetic division of the autonomic**  
nervous system
- **Metasympathetic division of the autonomic**  
nervous system (enteral nervous system)



# Somatic (animal) nervous system

- part of the human nervous system, which is a set of afferent (sensitive) and efferent (motor) nerve fibers innervating muscles (in vertebrates — skeletal), skin, joints. The somatic system is a part of the peripheral nervous system that delivers motor (motor) and sensory (sensory) information to the central nervous system and back. This system consists of nerves attached to the skin, sensory organs and all the muscles of the skeleton. It is responsible for almost all conscious muscle movements, as well as for processing sensory information received through external stimuli: sight, hearing and touch. The name of the somatic nervous system comes from the Greek word "soma" (body). The somatic nervous system contains two main types of neurons: sensory (afferent) neurons that deliver information from nerve endings to the central nervous system, and motor (efferent) neurons that deliver information through the whole body

# Autonomous (autonomic) nervous system

- The autonomic nervous system[1] (from Lat. vegetatio - excitement, from lat. vegetativus - vegetable), ANS, autonomous nervous system, ganglionic nervous system (from Lat. ganglion - nerve node), visceral nervous system (from Latin. viscera - viscera), organ nervous system, ventral nervous system, systema nervosum autonomicum —PNA) - part of the nervous system of the body, a complex of central and peripheral cellular structures that regulate the functional level of the body necessary for an adequate response of all its systems.
- The autonomic nervous system is a department of the nervous system that regulates the activity of internal organs, glands of internal and external secretion, blood and lymphatic vessels[2]. It plays a leading role in maintaining the constancy of the internal environment of the body and in the adaptive reactions of all vertebrates.

# Sympathetic division of the autonomic nervous system

- part of the autonomic (autonomic) nervous system, the ganglia of which are located at a considerable distance from the innervated organs [1][2]. Activation causes the excitation of cardiac activity and increased metabolic processes.
- The name "sympathetic nervous system" was first used in 1732 by Jacob Winslow and was initially used to refer to the entire autonomous nervous system. Subsequently, this term began to be called only part of the nervous system.

# Parasympathetic division of the autonomic nervous system

- The parasympathetic nervous system is a part of the autonomic nervous system associated with the sympathetic nervous system and functionally opposed to it, supports homeostasis. The parasympathetic nervous system contains ganglia (nerve nodes).

# Parasympathetic division of the autonomic nervous system

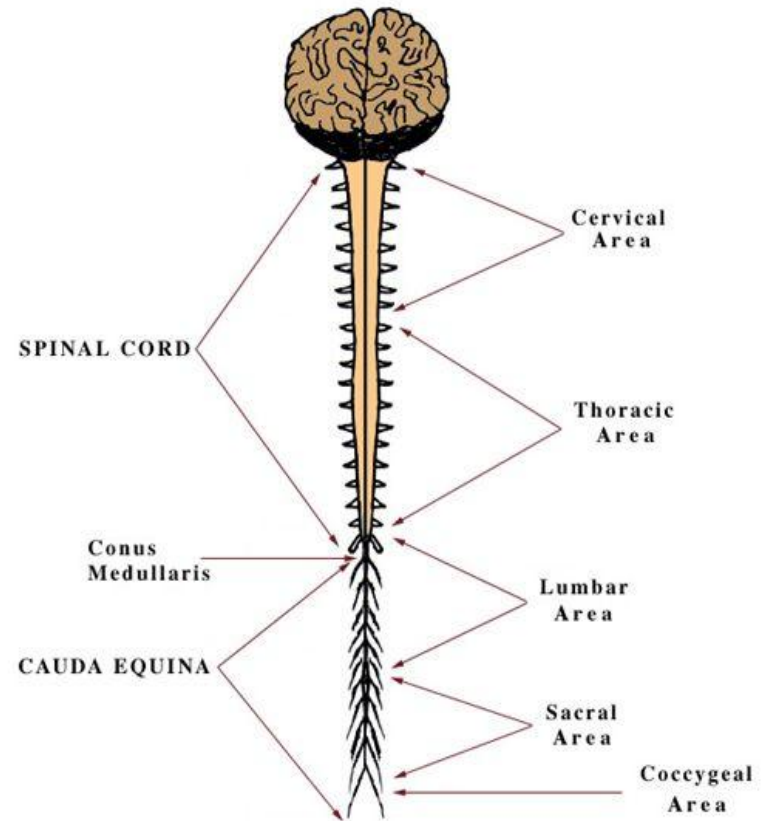
- The enteric nervous system (from the Greek εντερων - gut) is a part of the autonomic nervous system[1] that regulates the smooth muscles of internal organs with contractile activity.
- The nerve plexuses that make up the enteric nervous system are located in the walls of the hollow organs of the gastrointestinal tract (esophagus, stomach, small and large intestine, excretory bile and pancreatic ducts, sphincter Oddi, etc.), urinary system (pelvis and kidney cups, ureters, bladder, etc.). An important role in the rhythmic motor activity of these organs is played by such elements of the enteric nervous system as motor neurons and pacemaker cells.

# The central nervous system

- The central nervous system (CNS) is the main part of the nervous system of animals and humans, consisting of neurons, their processes and auxiliary glia; in invertebrates it is represented by a system of closely interconnected nerve nodes (ganglia), in vertebrates (including humans) - by the spinal cord and brain.
- The main and specific function of the central nervous system is the implementation of simple and complex reflexes. In humans and other higher animals, the lower and middle parts of the central nervous system - the spinal cord, medulla oblongata, midbrain, intermediate brain and cerebellum - regulate the activity of individual organs and systems of a highly developed organism, carry out communication and interaction between them, ensure the unity of the organism and the integrity of its activities. The higher department of the central nervous system — the cerebral cortex and the nearest subcortical formations - mainly regulates the connection and relationship of the organism as a whole with the environment.

# The Central Nervous System

## THE SPINAL CORD



# Structure and functions

- The central nervous system is connected to all organs and tissues of the body through the peripheral nervous system, including in vertebrates cranial nerves extending from the brain, spinal nerves - from the spinal cord, intervertebral nerve nodes; peripheral parts of the Autonomic nervous system - nerve nodes with nerve fibers, suitable and outgoing to them. The central nervous system consists of neuroglia cells, which perform a supporting and protective function in it, participate in the metabolism of nerve cells. The brain and spinal cord are surrounded by three meninges: dura, arachnoid and vascular. The brain is enclosed in a protective capsule - the skull, and the spinal cord - in the spine.
- Sensitive, or afferent, nerves carry excitation to the central nervous system from peripheral receptors; along the efferent (motor and autonomic) nerve fibers, excitation from the central nervous system is directed to the cells of the executive working apparatus (muscles, glands, vessels, etc.). Afferent and efferent cells with their processes



# Models

## The prosaic model

- The mosaic model assumes complete determination of the fate of an individual cell throughout the entire ontogenesis.

## The regulatory model

The regulatory model assumes random and variable development of individual cells, with only the neural direction being determined (that is, any cell of a certain group of cells can become anything within the possibility of development for this group of cells).

Thank you for your  
attention!