

Nervous System

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Except sponges, all multicellular animals possess simple or complex nervous system. In all these animals, nervous system is comprised of nervous tissue having specialized cells called neurons or nerve cells to respond to stimuli and coordinate animals' activities.

Nerve cells or neurons are, in fact, the structural and functional units of nervous system. In higher multicellular animals, the nervous tissue consists of nerve cells or neurons, nerve fibres, bundle of nerve fibres forming nerves, packing cells (neuroglia), ependymal cells and neurosecretory cells.

Structure of Neuron

The units which make up the nervous system are called nerve cells or neurons. Neuron is the largest cell in the body. It carries messages in the form of electrical signals called nerve impulses. Neuron is an elongated branched cell having three components – cell body, dendrites and axon.

- (i) **Cell body or Cyton:** Cell body is like a typical cell containing a central nucleus and surrounding cytoplasm. Around the nucleus there are granules called Nissl's granules. The cytoplasm has mitochondria, Golgi apparatus, neurofibrils, neurotubules. Cell body is concerned with metabolic maintenance and growth. It also receives nerve impulses from dendrites and transmits them to axon.
- (ii) **Dendrites:** Dendrites are several short, tapering, much branched protoplasmic processes stretching out from the cell body of a neuron. They receive sensation or stimulus, which may be physical, chemical, mechanical or electrical. The stimulus is passed onto cyton.
- (iii) **Axon:** Axon is the longest part of the neuron. It is a single, elongated fibre arising from one side of cyton. It conducts impulses away from the cell body.

Types of Neurons :

The neurons are of three types:

- (i) Sensory (receptor) neurons,
- (ii) Motor (effector) neurons, and
- (iii) Relaying (connector) neurons.

(i) **Sensory (receptor) neurons:** These often occur in sense organs, and receive stimuli by their dendrites.

The sensory neurons transmit impulses towards the central nervous system (brain and spinal cord) through their axons.

(ii) **Motor (effector) neurons :** The dendrites of these neurons synapse with axons of sensory neurons in

central nervous system. They transmit impulses from central nervous system towards effectors (muscles or glands). The latter respond to stimuli.

(iii) Relaying (connector) neurons : These occur in the central nervous system (brain and spinal cord).

These serve as links between sensory and motor neurons for distant transmission of nerve impulses.

Human Nervous System

Nervous system in humans consists of three parts:

(i) Central nervous system (CNS) consisting of brain and spinal cord. The brain and spinal cord receive

information from all parts of the body and integrate it.

(ii) Peripheral nervous system (PNS) consisting of nerves that arise from brain (cranial nerves) and from

spinal cord (spinal nerves). Through the nerves, the nervous system communicates with the muscles.

(iii) Autonomic nervous system (ANS) made up of parasympathetic and sympathetic nervous systems.

Though connected with the CNS, it works independently and regulates involuntary activities of the

body like heart beat, and peristaltic movements of alimentary canal.

Brain

The brain is broadly divided into three regions: Fore brain, mid brain and hind brain.

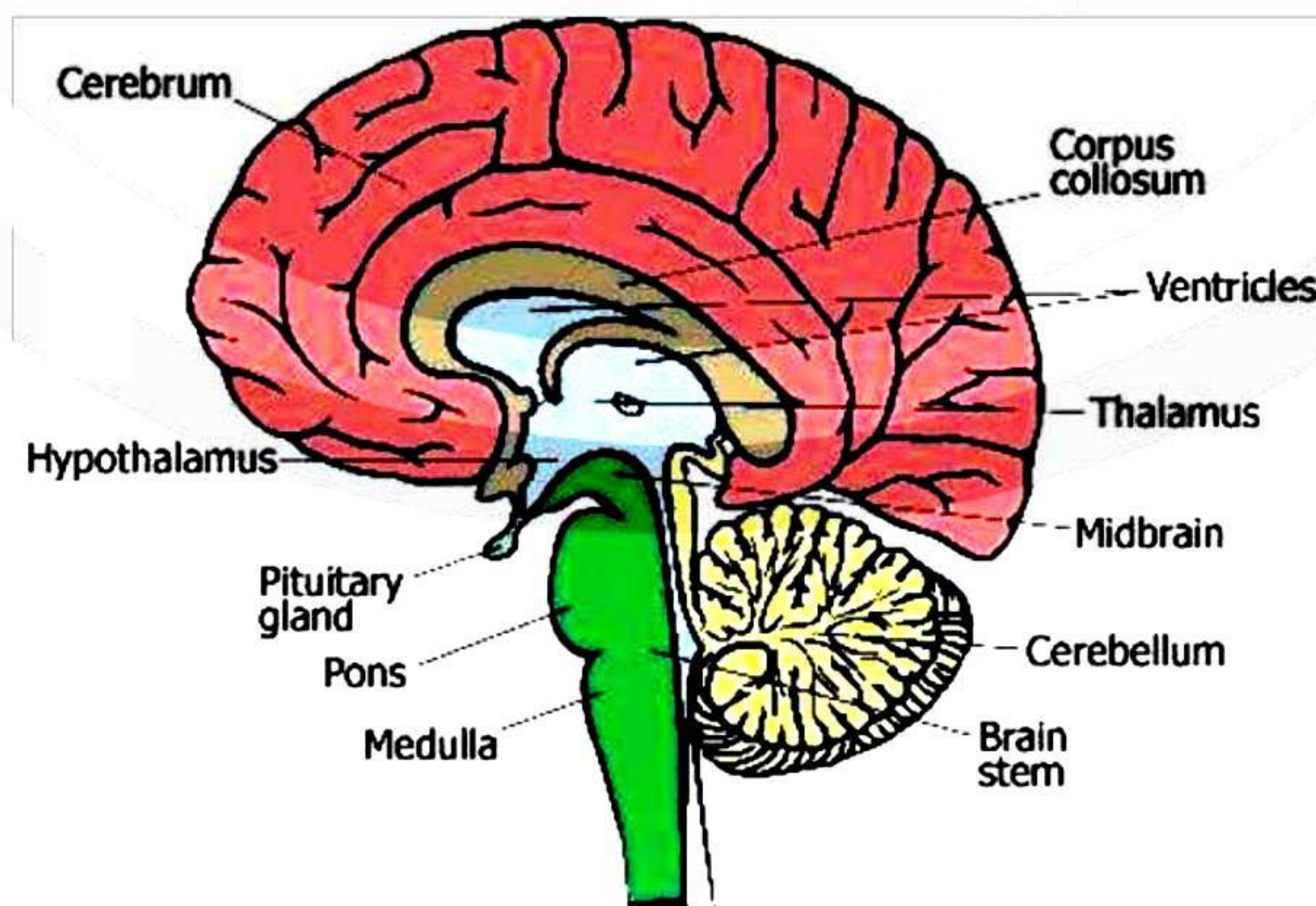
(i) Fore brain includes cerebrum (cerebral hemispheres), olfactory lobes and diencephalon.

Fore brain is the

main thinking part of the brain.

(ii) Mid brain includes optic lobes controls eye movement.

(iii) Hind brain includes cerebellum, pons and medulla oblongata



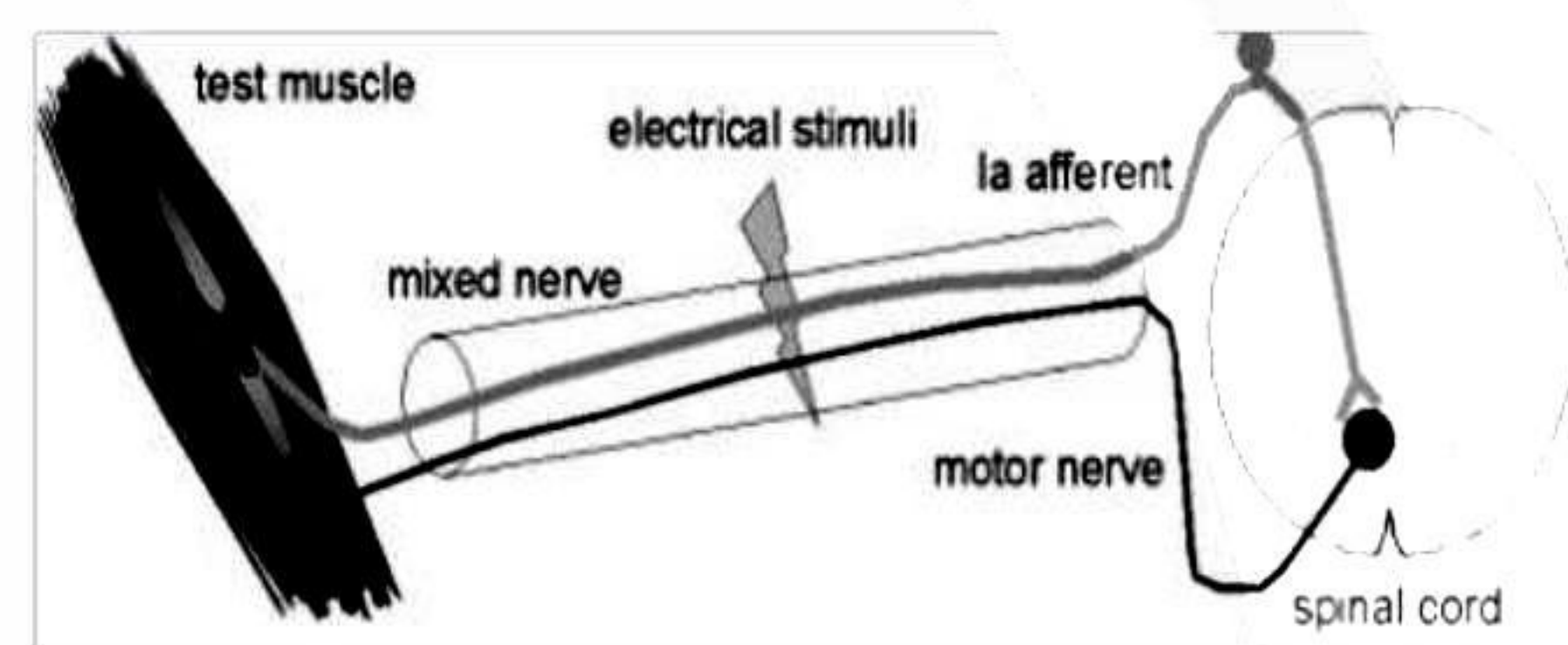
Cerebrum: It is the largest part of the brain and is proportionately larger in humans than in any other animal. It consists of two cerebral hemispheres (right and left) joined together by a broad curved thick band of nerve fibres called corpus callosum. Each cerebral hemisphere is divided into four lobes. These lobes control different activities of the body like those of muscular activities, touch, smell, temperature, hearing and sight.

Cerebellum : It lies at the roof of the hind brain. This region controls the coordination of body movements and posture. Pons lie just above the medulla and take part in regulating respiration) Medulla oblongata lies at the floor of the hind brain and continues into the spinal cord. It controls rate of heart beat, breathing movements, expansion and contraction of blood vessels to regulate blood pressure, swallowing, coughing, sneezing and vomiting.

Medulla Oblongata: It is the posterior most part of the brain and continues into the spinal cord. It controls involuntary functions of the body such as heart beat, rate of breathing, secretion of saliva, swallowing, coughing, sneezing and vomiting etc.

Spinal cord

Spinal cord extends from the medulla oblongata portion of the brain to the lumbar region, passing through the neural canal of the vertebral column. It is cylindrical in shape and from each segment of spinal cord, two spinal nerves arise. In man, 31 pairs of spinal nerves are present. Each spinal nerve is a mixed nerve and possesses both sensory and motor fibres.



Functions of spinal cord

The functions of spinal cord are given below :

- (i) Spinal cord is the main centre of reflex action.
- (ii) It is concerned with the conduction of nerve impulses to and from the brain.

Peripheral nervous system (PNS)

Peripheral nervous system constitutes the cranial and spinal nerves along with their branches.

- Cranial nerves arise from the brain and spread throughout the head. There are twelve pairs of cranial nerves. Cranial nerves I, II and VIII are sensory nerves; cranial nerves III, IV, VI, XI and XII are motor nerves; and cranial nerves V, VII, IX and X are mixed nerves (containing both sensory and motor nerve fibres).
- Spinal nerves arise from the spinal cord along most of its length and spread throughout the body. There are 31 pairs of spinal nerves – eight in the neck region, twelve in chest region, five in abdominal region, five in hip region and one in the coccyx region. Coccyx is the last bone of the vertebral column. These are all mixed nerves as they carry both sensory and motor nerve fibre.

Autonomic nervous system (ANS)

Autonomic nervous system means 'self governing nervous system'. It operates automatically or involuntarily. It includes all those responses against stimuli which are not under the control of animal (involuntary activities). Visceral nerves of autonomic nervous system control the activities of internal organs. Autonomic nervous system, therefore, is also termed as visceral nervous system.

The autonomic nervous system can be classified anatomically and functionally into sympathetic and parasympathetic nervous system.

Some basic terms in the functioning of nervous system

To understand the functioning of the nervous system, you should be familiar with the following basic terms :

1. Stimulus : Any change in the environment that usually results in change in the activity of the body.
2. Response : The activity of the body due to the stimulus.
3. Impulse : A wave of electrical disturbance that runs through the nerves.
4. Receptors : The nerve cell on receiving the stimulus sets up the waves of impulses towards the central nervous system.
5. Effector : Any muscle or gland on receiving the impulse from the brain (or the spinal cord), contracts or produce secretions.

The above terms can be understood by taking an example of sudden removal of hand on touching a hot object.

- Heat is the stimulus.
- The nerve cell in the skin that sends the sensation to the brain/spinal cord is the receptor.
- The ‘sensation’ travelling through nerve is the impulse.