

(4)

The Nervous System

1. Central nervous system(CNS)

It consists from the brain and the spinal cord

2. Peripheral nervous system(PNS)

It includes all nerves that connect the brain & the spinal cord with receptors, muscles and glands. it may be divided into:

- a. **Afferent nervous system:** it carries sensory information from peripheral receptors to the CNS.
- b. **Efferent nervous system:** it carries motor information from the CNS to muscles & glands, it can be subdivided into:

1, Somatic nervous system: it conducts motor impulse from the CNS to skeletal muscles. It is under voluntary control.

2, Autonomic nervous system: it conducts motor impulse from the CNS to smooth muscles, cardiac muscles& glands. it is under involuntary control. It can be divided into:

I. Sympathetic nervous system

II. Parasympathetic nervous system

Nerve cells (neurons): are the smallest structural and functional units of the nervous system. they are responsible for conducting impulses from one body part to another.

Structure of the neuron:

1. Cell body: it consists of nucleus and nucleolus, surrounded by cytoplasm that contain an organelle, such as: lysosomes, mitochondria and Golgi complex.

2. Dendrites: are cytoplasmic extension of the cell body. their function is to conduct an impulse toward the cell body.

3. Axon: is a single, long and thin that conduct impulses away from the cell body to another neuron or tissue. Sometimes it is covered by myelin sheath.

Spinal Cord:

The spinal cord is a cylindrical structure located in the spinal canal inside the vertebral column. It begins as a continuation of the medulla oblongata to the level of the second lumbar vertebra (length 42-45 cm).

The nerve arises from the lower part of the cord named the cauda equine means the horse's tail. The spinal cord consists of 31 segments.

Protection & covering:

The meninges are covering around the spinal cord and brain. They include 3 layers:

1. The dura matter (tough mother)

2. The arachnoid (spider later)

3. The pia matter (delicate mother)

The cerebrospinal fluid (CSF) is located in the subarachnoid space between the arachnoid and the pia mater.

Structure in cross section:

1. **Gray matter:** it consists of nerve cell bodies and unmyelinated axons. It forms an H- shaped area within the whit matter.
2. **White matter:** it consists of myelinated axons.

Functions of the spinal cord:

1. to conduct sensory and motor impulses to and from the brain by the ascending and descending reflexes.
2. to provide an integrating reflexes.

Spinal nerves:

There are 31 pairs of spinal nerves, are named and numbered according to the region of the spinal cord from which they are originated.

Cranial nerves=8 pairs

Thoracic nerves=12 pairs

Lumber nerves=5 pairs

Sacral nerves=5 pairs

Coccygeal nerves=1 pairs

Composition:

Each pair of the spinal nerve is connected to a spinal cord segment by two roots:

1. the posterior, (dorsal or sensory root) contains sensory nerves with the cell bodies in the dorsal root ganglion.
2. The anterior, (ventral or motor root) contains motor nerve fibers with the cell bodies in the anterior or lateral horn of the gray matter of the cord.

Autonomic Nervous System (ANS)

It controls the visceral functions of the body such as: arterial pressure, GIT motility & secretion, urinary bladder emptying, sweating and body temperature. The ANS have the efferent pathways which consist of 2 neurons:

1. Pre-ganglionic fiber, extend from the CNS to ganglia.
2. Post-ganglionic fiber, extend from the ganglia to the effector (muscle or gland).

Ganglion: a group of nerve cell bodies outside the CNS.

Nucleus: a group of nerve cell bodies inside the CNS.

Autonomic division:

1. **Sympathetic nervous system**, they originate from 12 thoracic segments and the first lumbar segment. They terminate in the "**paravertebral sympathetic ganglion chain**", then to the post ganglion nerves supplying many organs.
2. **Parasympathetic nervous system**, they originate from 2 areas: the brain stem and from the 2-4 sacral segments of the spinal cord.

- The cranial outflow supplies the head structures by the oculomotor, facial and glossopharyngeal nerves. It supplies the thoracic and abdominal structure by the vagus nerves.

Chemical transmitters of the autonomic junctions;

1. Acetylcholine.
2. Norepinephrine.
3. Dopamine.
4. Gonadotropin releasing hormone.

Autonomic effects on various organs:

Each organ in the body is supplied by both sympathetic and parasympathetic nerves. each one has an opposite effect.

1.Eye: ciliary muscles

Parasympathetic NS: contraction for near vision.

Sympathetic NS: relaxation for far vision.

2.Heart: heart rate and conduction velocity

Parasympathetic NS: decrease

Sympathetic NS: increase

3.Arterioles: coronary, skeletal and pulmonary

Sympathetic NS: dilation

Parasympathetic NS: constriction

4.Lung: bronchial muscle

Parasympathetic NS: contraction

sympathetic NS: relaxation

5.Stomach and intestine: motility and secretion

Sympathetic NS: increase

Parasympathetic NS: decrease

6.Salivary gland

Parasympathetic NS: profuse and watery secretion

sympathetic NS: thick and viscous secretion.

No.	Nerve	Function	
1.	Olfactory	Sensory for smell	
2.	Optic	Sensory for vision	
3.	Oculomotor	Motor for movement of eye ball Motor to ciliary & sphincter papillae muscles	
4.	Trochlear	Motor for movement of eye ball	
5.	Trigeminal	Sensory to skin & mucous membrane of head Motor to muscles of mastication	
6.	Abducent	Motor for movement of eyeball	
7.	Facial	Sensory for taste Motor for facial expression & salivation	
8.	Auditory	Vestibular	Sensory for balance and position of head
		cochlear	Sensory for hearing
9.	Glossopharyngeal	Sensory for taste Motor for swallowing & salivation	
10.	Vagus	Sensory from heart, lungs, bronchioles, trachea, pharynx & digestive tract Motor to heart, bronchioles & digestive tract	
11.	accessory	Motor to laryngeal, pharyngeal & palatal muscles Motor to sternocleidomastoid & trapius muscles	
12.	hypoglossal	Motor to muscles of tongue	