The Nervous System

The nervous system is responsible for the stimulus-response interaction between the environment and the organism so co-ordination of other body systems performs by it, it control and combine with the endocrine, immune and sensory organs.

The nervous system is divided into:

1. **Central nervous system (C.N.S) which consist of the brain and spinal cord.**
2. **Peripheral nervous system (P.N.S) which composed of cranial and spinal nerves.**
3. **Automatic nervous system (visceral system) which composed of sympathetic and parasympathetic nervous system.**

The brain and the spinal cord are containing gray and white matters, the gray matters are containing the structural and functional units of the nervous system which called Neurons, which are excitatory cells either motor or sensory.

- **The sensory neurons receive the stimulus from the internal or external environment.**
- **The motor neurons send the order to the target or effecting organ via the nerve fibers, so the result is contraction of muscles, secretion of glands, etc.**

The neurons are classified into:

A. **Unipolar neuron**
B. **Bipolar neuron**
C. **Multipolar neuron**

The unipolar neuron: has one extension arising from the body of neuron and act as sensory and motor.

The bipolar neuron: are act as axon (motor) and the other dendrite (sensory).

The multipolar neuron: the cell have many extensions, one of them act as axon, others act as dendrite.

Structure of the neuron (nerve cell):

The neuron is a great cell with nucleus of large size and nucleolus in the center, with nissil granules in the cytoplasm associated with RER for synthesis of protein, mitochondria and Golgi apparatus also demonstrated in the cytoplasm, but there is no centrioles in the cell, microtubules and microfilaments are present in the cytoplasm and axon of cell.

Axon: is an extension from the cell body, containing many microtubules in pairs to convey the materials from the cytoplasm to the effecter organ.

Dendrites: are extensions from the body of neuron containing cytoplasm and microfilaments with certain number of microtubules, responsible for conveying the stimulus toward the cell body.

Supporting cells:

The brain and spinal cord have many types of cells but not excitatory but related with other many functions in the nervous system. The central nervous system have the following type of supporting cells:

A. **Glial cells**
B. **Oligodendrocytes**
C. **Fibrous astrocytes**
D. **Protoplasmic astrocytes**
E. **Ependymal cells**

The peripheral nervous system have supporting cells which are

A. **Schwann cells**

The glial cells: are responsible for removing the debris of nervous system, act as macrophages.

The oligidendrocytes: are responsible for covering the nerve fibers in C.N.S with myelin.

The fibrous astrocytes: formation of brain scar in cases of brain injury.

The protoplasmic astrocytes: assist in the formation of blood-brain barrier.

The ependymal cells: assist in the formation of the lining of the cavities in the brain (ventricles) and central canal of spinal cord.

The Schwann cells assist in the formation of the myelin around the spinal nerves.

Synapses:

These are sites of meeting between the nerve ending and target or effector organ, this area is supplied by the neurotransmitters secreted by the neuron and pass through axon to the nerve ending to be arriving to the muscle, gland or even other nerves, the neurotransmitters when released directed to the opposite structure to do its action. The neurotransmitters which are released such as Acetyl-choline, Adrenaline, Dopamine.

Nerve fiber:

Is present either in the C.N.S in the white matter or outside the C.N.S formed by spinal nerves . Each nerve fiber is formed by axon surrounded by myelin sheath produced by oligodendrocytes or Schwann cells, the nerve fiber ensheathed by segments of myelin (lipoprotein), in between each two segments, there is node of Ranvier to potentate the stimulus by jumping of electrical impulses from node to other node of ranvier .

The nerve fibers are:

a) **Small (with this myelin)**
b) **Medium size**
c) **Large size**

When nerve fiber is large, means the impulse is pass quickly (120 m/sec), when nerve fiber is medium size, means the impulse is pass (30-50 m/sec), when nerve fiber is small, means the impulse is pass (10 m/sec), some have no node of Ranvier.

Cerebro Spinal Fluid (C.S.F):

Is clear, colorless fluid formed from the blood plasma by the choroid plexus of the brain, the choroid plexus consist of an epithelium and the underlying pia matters, they adhere to the walls of the ventricles. The C.S.F flows into the sub arachnoid space of the ventricles. The C.S.F acts as cushions to the C.N.S and acts as a chemical buffer, also transport nutrients and waste products, therefore taking over the function of the lymphatic lacking in the brain.

Automatic Ganglia:

Are aggregation of neurons (multipolar) outside the C.N.S, usually associated with the sympathetic nerves, the nerve cells are surrounded by supporting cells called Stellate cells, the most of the nuclei of these neurons are located peripherally and the cytoplasm have lipofuschin pigments.