

Nervous tissue

The embryology of nervous tissue:

1-The neurons of the nervous tissue developed from the embryonic ectoderm.

2-In early embryonic stages, the neural tube separates from the ectoderm at the midline of the embryo.

3-Other cells also originated from ectoderm form cellular bands between the neural crest.

4-The sympathetic and parasympathetic ganglia are formed when some of the indifferent cells leave the central nervous system and migrate into various parts of the body where they become as ganglia.

5-The connective tissue surrounding the peripheral nerve , and the meninges sheath surrounding the central nervous system are originated from the mesenchymal neural tube.

General structures of the nervous tissue:

The nervous tissue consisted of the neurons and their cytoplasmic processes and supportive cells. In neurons, the cytoplasmic processes is distributed entire body. Where as the cell bodies of the neurons are found in central system and the ganglia.

the essential function of this tissue is to receive stimuli from both external and internal environments and regulates an animals response.

The function of the nervous system is based on two fundamental properties of living organism.

- 1- The ability to react to various physical and chemical agents. Its called irritability.
- 2- The ability to transmit the excitation to the C.N.S. where are analyzed and integrated to produce appropriate, co-ordinated responses in various effector organs. This is called conductivity.

The responses may be limited to :

- 1- Movement of the body or of a body part, in which case called a somatic response.
- 2- Alterations in activity of smooth muscle, cardiac muscle and glands, in which case it is a visceral response.
- 3- An organized alteration in both somatic and visceral organs toward some evident, in which case the response is known a behavioral response such response are feeding, drinking and sexual behavior .

The component of nervous tissue :

A- Cellular components.

1- Neurons.

2- Supportive cells or neuroglial cells

a- Oligodendrocytes.

b- Ependyma.

c- Astrocytes.

d- Microglia.

These four types supporting cells are found within the central nervous system. Within the peripheral nervous system the supporting cells called (Schwann) cells.

B- Nerve fibers.

1-axons.

2-Dendrites.

Neuron :

It is considered to be the basic structural, functional and genetic unit of the nervous system.

Neurone is composed of a cell body and one or more associated processes these cytoplasmic processes are of two types:-

a- Short and numerous dendrites highly branched.

b- Single long unbranched axon.

Ultra structural of neuron :

Neuron despite great variation in size and shape in different parts of neurons system. All the neurons have the same basic structures .

1- The nucleus of the nerve cell is relatively large has single large nucleolus. Its appears pale stained vesicle because the most contained of it is euchromatin.

2- The cytoplasm of the neuron called neuroplasm. It contains the following organelles.

- a- Neurofibrils.
- b- Golgi complex.
- c- Nissls bodies.
- d- Mitochondria .
- e- Centrosome (it is found only in embryonic nerve cell called neuroblast).
- f- Various inclusions.

Neurofibrils:

Neurofibrils are distributed as a complicated network throughout the cell body, and spread into all the processes as parallel bundles throughout the length of the axon and dendrites. They do not found in the terminal extremity of the axon.

Nissls bodies:

- 1- They are important organelles represent large aggregations of rough endoplasmic reticulum, they are intensely basophilic. Its necessary for the production of the enzymes involved in neurotransmitter synthesis.
- 2- Nissls bodies are much more prominent feature in large neurons, such as somatic motor neurons, than in smaller neurons such as those of the autonomic nervous system.

The cytoplasmic processes of neurone:

there are two types of processes extend from the cell body :

1- Dendrites .

2- Single axon.

Dendrites :

They are extended directly from the cell body, highly branched, short, and tapering processes which either end in specialized sensory receptors or form synapses with neighboring neurons from which they receive stimuli. They are considered as the afferent components of neuron. The dendrites contain all the cytoplasmic organelles except the pigmented granules and the nucleus. Branches of dendrites most often arise at oblique or acute angles with the cell body.

Axon:

Single axon arise from a cone-shaped portion of the cell body called axon hillock. Axon extends as cylindrical process of variable length terminating on either other neuron or effector organs. Axon contain all cytoplasmic organelles except nucleus, nissls bodies and pigmented granules. The axons are considered as efferent component of the neuron that conduct impules from neuron toward the effectors organ.

Classification of neuron:

The nervous system contain a large numbers of neurons which vary in size, shape, number and mode of processes. So there are different classifications:

1- Neurons may be classified according to the length of their axon into :

a- Golgi type 1

b- Golgi type 11.

Golgi type I:

These neurons have axons of considerable length that leave the place of their origin in the gray matter in the C.N.S. and transvers the white matter and became peripheral nerve fibers and terminate at some distance in organs of the body.

Golgi type II:

In these neurons the axons are relatively short and dose not leave the C.N.S. where their bodies lies.

2- Neurons may be classified according to the shape of the cell body.

- Spherical – shape.
- Oval – shape.
- Spinal – shape.
- Star – shape.
- Pyramid – shape.

3- The neurons may be classified according to the number of processes arising from the cell body.

- Unipolar neuron.
- Pseudounipolar neuron.
- Bipolar neuron.
- Multipolar neuron.

1- Unipolar neuron :

Single process (axon) arising from the cell body which spherical in shape. These neuron are rare, present only in the embryonic stage. Such as the neuroblasts.

2- Pseudounipolar neuron:

A single axon arise from the cell body. this process is subdivided as T shape into two branches. These neuron located in the craniospinal ganglia.

3- Bipolar neuron:

The neuron has one main dendrite and one axon. The cell body as spindle shape. This neuron found in retina.

4- Multipolar neuron:

The common form of nerve cell which have numerous dendrites and one axon. The cell body is star- shape found in the gray matter of C.N.S. as mature nerve cell.

Cerebrum :

The cerebral cortex , the gray matter presents six layers of cells with different forms and size. The outer layer of gray matter consists of dendrites and axons of neurons from underlying layers.

Cerebellum:

The cerebellum cortex has three layers , an outer molecular layer, a central layer of large purkinje cells, and inner granular layer. The granular layer formed by very small neuron.

Spinal cord:

In cross section of the spinal cord , the white matter is peripheral and gray matter is central formed the shape of an H. the H shape have two anterior horns. These contain motor neurons whose make up the ventral

roots of the spinal nerve. Two posterior horns which receive sensory fibers from neurons in the spinal ganglia.

Meninges:

The central nervous system is protected by the skull and the vertebral column. It is also encased in membranes of connective tissue called meninges.

Dura matter:

Starting with the outermost layer, near from the internal surface of the cranial bone. Dura matter composed of dense connective tissue. Dura matter separated from the arachnoid by the thin subdural space.

Arachnoid :

The arachnoid is composed of connective tissue devoid of blood vessels. Its surface are covered by the same type of simple squamous epithelium that cover the dura matter.

Pia matter:

The pia matter is a loose connective tissue containing many blood vessels . although it is located quite close to the nerve tissue.