

Lecture 8

Nerve tissue

The human nervous system is by far the most complex system in the human body and is formed by a network of more than 100 million nerve cells (neurons). Assisted by many more glial cells, each neuron has, on average, at least a thousand interconnections with other neurons, forming a very complex system for communication.

Neurons are grouped as circuits, like electron circuits, neural circuits are highly specific combination of elements that make up system of various sizes and complexities

Although a neural circuit may be single, in most cases it is a combination of two or more circuits that interact to generate a function.

A neural function is a set of coordinated processes intended to produce a definite result. A number of elementary circuits may be combined to form higher-order system.

Nerve tissue is distributed throughout the body as an integrated communications network. Anatomically the nervous system is divided into:

- Central nervous system: consisting of the brain and the spinal cord
- Peripheral nervous system composed of nerve fibers and small aggregates of nerve cells called nerve ganglia.

structurally nerve tissue consists of two cell types: nerve cells or neurons, which usually show numerous long processes, and several

types of glial cells (Gr, glia . glue), which have short processes, support and protect neurons, and participate in neural activity, neural nutrition, and the defense processes of the central nervous system. Neurons respond to environmental changes (stimuli) by outer surfaces of their membranes, cells with this property (e.g., neurons, muscle cells, some gland cell) are called excitable, or irritable. Neuron reacts promptly to stimuli with a modification of electrical potential that may be spread (propagated) throughout the neuron by the plasma membrane. This propagation, called the action potential or nerve impulse, is capable of traveling long distances; it transmits information to the neurons, muscles, and glands.

By creating, analyzing identifying and integrating information, the nervous system generates two great classes of functions: stabilization of the intrinsic condition (e.g., blood pressure, O₂ and CO₂ content. PH blood glucose levels, and hormones levels) of the organism within normal ranges; and behavioral patterns (e.g., feeding, reproduction, defense, interaction with other living creatures)

Neurons

Nerve cells or neurons are responsible for the reception, transmission, and processing of stimuli, the triggering of certain cell activities and the release of neurotransmitters and other informational molecules.

Most neurons consist of 3 parts:

1. the dendrites which are multiple elongated processes specialized in receiving stimuli from the environment, sensory epithelial cells , or other neurons,
2. The cell body, or perikaryon (Gr. Peri, around + karyon, nucleus). Which is the trophic center for the whole nerve cell and is also receptive to stimuli,
3. The axon (axon, exis), which is a single process specialized in generating or conducting nerve impulses to other cells (nerve, muscle, and gland cells) axon may also receive information from other neurons, this information mainly modified the transmission of action potentials to other neurons, the distal portion of the axon is usually branched and constitutes the terminal arborization.

Each branch of this arborization terminates on the next cell in dilatation called and bulbs (boutons). Which interact with other neurons or non-nerve cells, forming structures called synapses. Synapses transmit information to the next cell in the circuit.

Neurons and their processes are extremely variable in size and shape. Cell bodies can be spherical, ovoid, or angular. Some is very large measuring up to 150 Mm in diameter –large enough to be visible to the naked eye. Other nerve cells are among the smallest cells in the body, for example, the cell bodies of granule cells of the cerebellum are only 4-5 Mm in diameter.

According to the size and shape of their processes, most neurons can be placed in one of the following categories:

- Multipolar neurons, which have more than two cell processes, one processes being the axon and the dendrites. Most neurons of the body are multipolar
- Dipolar neurons, with one dendrite and one axon. Bipolar neurons are found in the cochlear and vestibular ganglia as well as in the retina and the olfactory mucosa
- Psuedounipolar neurons, which have a single process that is close to the perikaryon and divides into two branches. The process then forms a T shape, with one branch extending to a peripheral ending and the other toward the central nervous system. Psuedounipolar neurons are found in the spinal ganglia (the sensory ganglia located in the dorsal roots of the spinal nerves). They are also found is most cranial ganglia.

In pseudounipolar neurons, stimuli that are picked up by the dendrites travel directly to the axons terminal without passing through the perikaryon.

Neurons can also be classified according to their functional roles.

- **Motor (efferent) neurons** control effectors organs such as fibers and exocrine and endocrine glands
- **Sensory (afferent) neurons** are involved in the reception of sensory stimuli from the environment and from within the body.

Interneurons establish relationships among other neurons, forming complex functional networks or circuits (as in the retina).

