Medical Biology

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The peripheral nervous system

The main components of the peripheral nervous system are the nerves, ganglia and nerve endings.

Nerves: - are bundles of nerve fibers surrounded by a series of connective tissue sheaths.

Nerve fibers: - consist of axons enveloped by a special sheath derived from cells of ectodermal origin. Nerve fibers exhibit differences in their enveloping sheaths, related to whether the fibers are part of the central or the peripheral nervous system. In peripheral nerve fibers, the sheath cell is the Schwann cell, and in central nerve fibers it is the oligodendrocyte. There are 2 types of nerve fiber:

1. Myelinated nerve fibers:

In the myelinated nerve fibers of the PNS, the plasmalemma of the covering Schwann cell winds and wraps around the axon. The layers of membranes of the sheath cell unite and form myelin. In PNS, each axon is surrounded by myelin formed by a series of Schwann cells. The myelin sheath shows gaps along its path called the Nodes of Ranvier represent the spaces between adjacent Schwann cells along the length of the axon. The distance between the 2 nodes is called an internode and consists of one Schwann cell. There are no Schwann cells in the CNS, there the myelin sheath is formed by the processes of the oligodendrocytes, which differ from Schwann cells in that different branches of one cell can envelope segments of several axons.



2. unmyelinated nerve fibers:

In both CNS and PNS, not all axons are sheathed in myelin. In the PNS, all unmyelinated axons are enveloped within simple clefts of the Schwann cells. Each Schwann cell can sheath many unmyelinated axons. Unmyelinated nerve fibers do not have nods of Ranvier, because abutting Schwann cells are united to form a continuous sheath.



	Myelinated axons		Non-myelinated axons
1.	Transmission of nerve impulse is faster	1.	Transmission of nerve impulse is slower
2.	Myelinated axon has a myelin sheath.	2.	Myelin sheath is absent
3.	Node of Ranvier is present between adjacent myelin sheaths.	3.	Node of Ranvier is absent
4.	Found in the brain, the spinal cord, the cranial and spinal nerves	4.	Found in autonomous and somatic neural systems
5.	Schwann cells are observed inside the myelin sheath	5.	Schwann cells are not observed inside the myelin sheath

Peripheral nerves:

Peripheral nerves are bundles of nerve fibers (axons) surrounded by several investments of connective tissue sheaths. Surrounding the whole nerve called epineurium, composed of collagen fibers, fibroblast, blood vessels, the bundles of nerve fibers each one surrounded by a sheath of C.T. called perineurium, within this perineurium are strands of fine C.T. extending between individual nerve fibers. These strands compose the endoneurium. These myelinated bundles (fascicles) appear white because of the presence of myelin. Each bundle of nerve fibers has both sensory and motor components.



Ganglia:

Ganglia are aggregations of cell bodies of neurons with glial cells located outside the CNS. They serve as relay stations in the PNS to transmit nerve impulses, one nerve enters and other exits from each ganglion. There are 2 types of ganglia: sensory and autonomic.

1. sensory ganglia: receive afferent impulses that go to the CNS. There are 2 types of sensory ganglia:

a. cranial ganglia: associated with cranial nerves.

b. spinal ganglia: associated with the dorsal root of the spinal nerves, thus it is called dorsal root ganglia.

The neurons of these ganglia are unipolar (pseudounipolar) and relay information from the ganglions nerve endings to the gray matter of the spinal cord.

2. autonomic ganglia: autonomic ganglia appear as bulbs dilatations in autonomic nerves. Some located within certain organs, especially in the wall of the digestive tract (intramural ganglia) these are devoid of the C.T. capsules and supported by the stroma of the organ they found. Autonomic ganglia usually have multipolar neurons.

The neurons of both dorsal root ganglia and autonomic ganglia are enveloped by a layer of Satellite cells, are small support cells resembling Schwann cells which surround the neuron cell bodies.

Clinical notes:

1. Demyelinating Diseases can affect either PNS or CNS, which are characterized by damage to myelin sheath, resulting in decreased or lost ability to transmit impulses along nerve fibers.

2. Guillian-Barre syndrome (GBS) is a PNS demyelinating disease, affected patient suffers from ascending muscle paralysis & loss of cutaneous sensation

3. Multiple sclerosis (MS) is a disease that attacks myelin in the CNS, in which oligodendrocytes are targeted by immune response. It is characterized by neurological deficits such as vision loss and lack of muscle coordination.

4. Injured fibers in peripheral nerves have a good capacity for regeneration and return to function depending on the type of nerve injury.