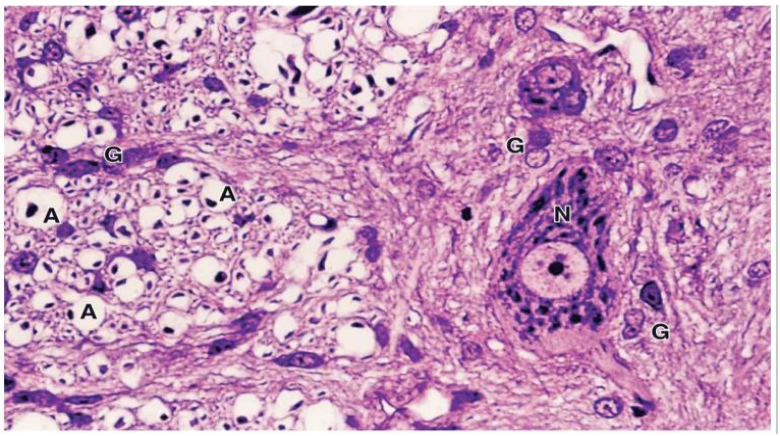
الكلية	العلوم
القسم	علوم حياة
المادة باللغة الانجليزية	Histology
المادة باللغة العربية	علم الانسجة
المرحلة الدراسية	الثالثة
اسم التدريسي	د.هند يونس خلف عبدالله
عنوان المحاضرة باللغة الانجليزية	Nervous Tissue
عنوان المحاضرة باللغة العربية	النسيج العصبي-2
رقم المحاضرة	6
المصادر والمراجع	
	Junquera Basic Histology Text and Atlas.Copyright © 2013 by McGraw-Hill Education

CENTRAL NERVOUS SYSTEM

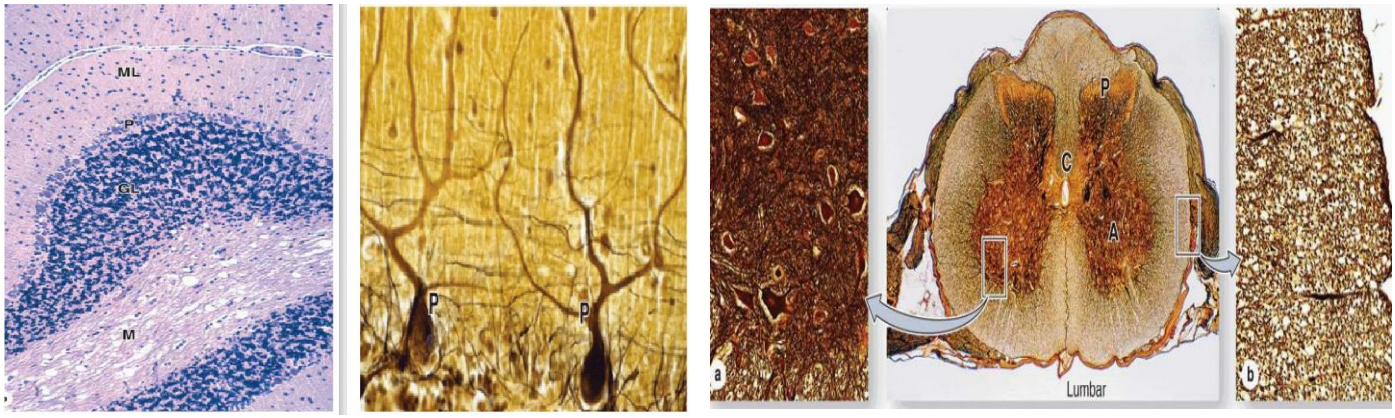
The major regions of the central nervous system (CNS) are the cerebrum, cerebellum, and spinal cord . The CNS is covered by three connective tissue layers, the meninges, but contains very little collagen or fibrous tissue throughout its substance, making it relatively soft and easily damaged by injuries affecting its protective cranium or vertebral bones. The entire CNS displays organized areas of **white matter** and **gray matter**, differences caused by the differential distribution of myelin. The main components of white matter are myelinated axons and oligodendrocytes, White matter contains very few neuronal cell bodies, but astrocytes and microglia are present. Gray matter contains abundant neuronal cell bodies, dendrites, the initial unmyelinated portions of axons, astrocytes, and microglial cells. Gray matter is where most synapses occur, and it occupies the thick surface or cortex of both the cerebrum and the cerebellum; most white matter is found in deeper regions. Deep regions of the CNS also have darker aggregates called **nuclei** consisting of large numbers of neuronal cell bodies and surrounded by white matter.



The gray matter has many glial cells (G), neuronal cell bodies (N), and neuropil; white matter also contains glia (G) but consists mainly of axons (A)

cortex. The most conspicuous of these cells are the efferent pyramidal neurons that come in many sizes. Neurons of the cerebral cortex function in the integration of sensory information and the initiation of voluntary motor responses.

The cerebellar cortex, which coordinates muscular activity throughout the body, also has a layered organization: an outer molecular layer, a central layer of very large neurons called Purkinje cells (named for the 19th century Czech histologist Jan Purkinje), and an inner granule layer. the granule layer is formed by very small neurons (with diameters of only 4-5 μm).



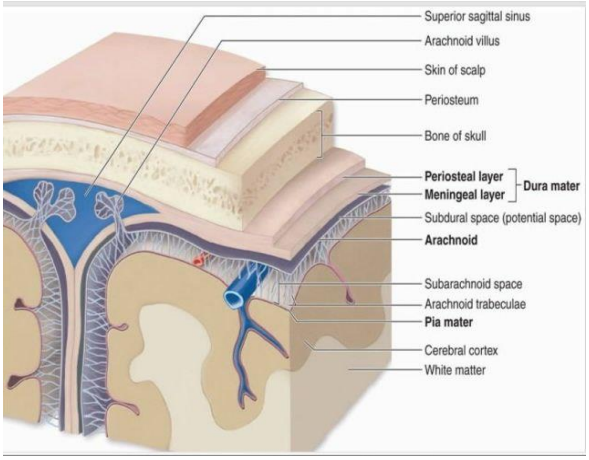
The spinal cord in cross section always shows bilateral symmetry around the small, CSF-filled central canal (C). Unlike the cerebrum and cerebellum, in the spinal cord the gray matter is internal, forming a roughly H-shaped structure that consists of two posterior (P) horns (sensory) and two anterior (A) (motor) horns, all joined by the gray commissure around the central canal **(a)** The gray matter contains abundant astrocytes and large neuronal cell bodies, **(b)** The white matter surrounds the gray matter and contains primarily oligodendrocytes.

Meninges The skull and the vertebral column protect the CNS, but between the bone and nervous tissue are membranes of connective tissue called the meninges. Three meningeal layers are distinguished:

the dura, arachnoid, and pia maters. Dura Mater The thick external dura mater consists of dense, fibroelastic connective tissue that is continuous with the periosteum of the skull.

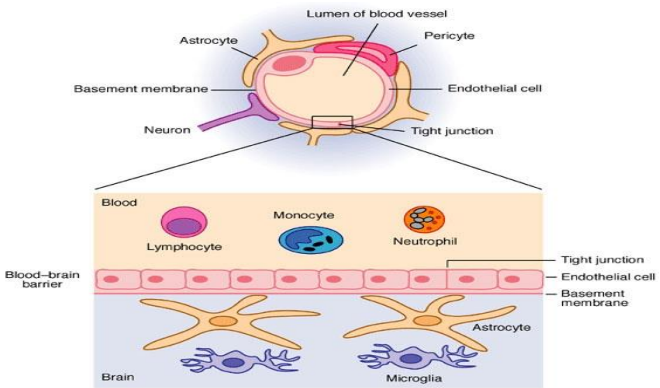
Arachnoid The arachnoid has two components: (1) a sheet of connective tissue in contact with the dura mater and (2) a system of loosely arranged trabeculae composed of collagen and fibroblasts, continuous with the underlying pia mater layer. Surrounding the trabeculae is a large, sponge-like cavity, the subarachnoid space, filled with CSF. This fluid-filled space helps cushion and protect the CNS from minor trauma.

Pia Mater The innermost pia mater consists of flattened, mesenchymally derived cells closely applied to the entire surface of the CNS tissue. The pia does not directly contact nerve cells or fibers, being separated from the neural elements by the very thin superficial layer of astrocytic processes (the glia limitans), which adheres firmly to the pia mater. Together, the pia mater and the layer of astrocytic end feet form a physical barrier separating CNS tissue from CSF in the subarachnoid space



Blood-Brain Barrier

The main structural component of the BBB is the capillary endothelium, in which the cells are tightly sealed together with well-developed occluding junctions and with little or no transcytosis activity. The limiting layer of perivascular astrocytic feet that completely envelops the basal lamina of the capillaries in most CNS regions forms another BBB component and further regulates passage of molecules and ions from blood to brain. The BBB protects neurons and glia from bacterial toxins, infectious agents, and other exogenous substances, and helps maintain the stable composition and constant balance of ions in the interstitial fluid that is required for normal neuronal function. The components of the BBB are not found in the choroid plexus where CSF is produced, in the posterior pituitary which releases hormones, or in regions of the hypothalamus where plasma components are monitored



Choroid Plexus The choroid plexus consists of highly specialized tissue with elaborate folds and many villi projecting into the four large ventricles of the brain (Figure 9–20a). It is found in the roofs of the third and fourth ventricles and in parts of the two lateral ventricular walls, all regions in which the ependymal lining directly contacts the pia mater.

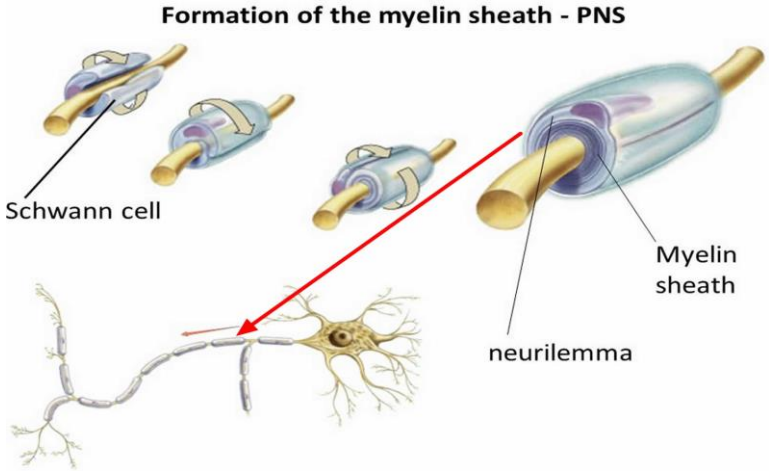
PERIPHERAL NERVOUS SYSTEM

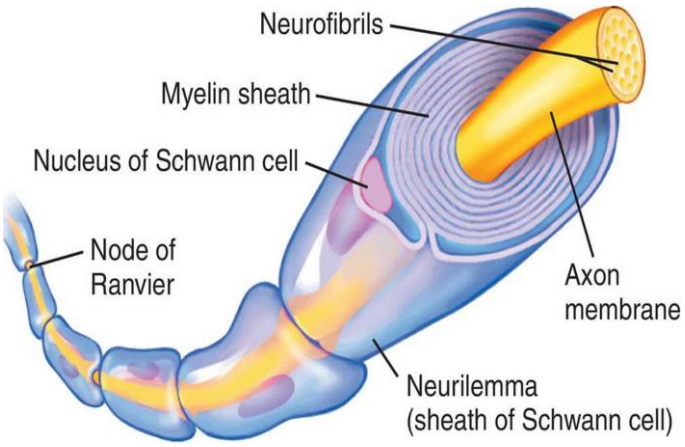
The main components of the peripheral nervous system (PNS) are the nerves, ganglia, and nerve endings. Nerves are bundles of nerve fibers (axons) surrounded by Schwann cells and layers of connective tissue.

Nerve Fibers

Nerve fibers are analogous to tracts in the CNS, containing axons enclosed within sheaths of glial cells specialized to facilitate axonal function. In peripheral nerve fibers, axons are sheathed by Schwann cells, or neurolemmocytes . The sheath may or may not form myelin around the axons, depending on their diameter.

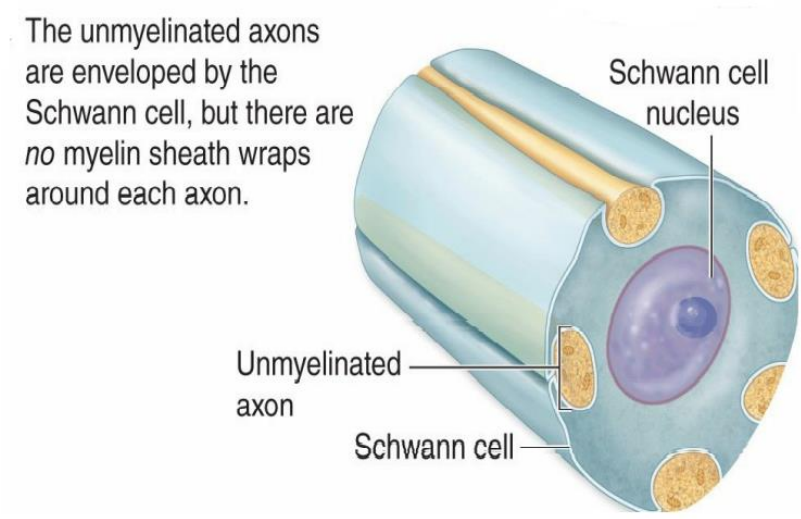
1-Myelinated Fibers As axons of large diameter grow in the PNS, they are engulfed along their length by a series of differentiating neurolemmocytes and become myelinated nerve fibers. The plasma membrane of each covering Schwann cell fuses with itself around the axon, and the fused membrane (or mesaxon) becomes wrapped around the axon as the glial cell body moves circumferentially around the axon many times . The multiple layers of Schwann cell membrane unite as a thick myelin sheath. Composed mainly of lipid bilayers and membrane proteins



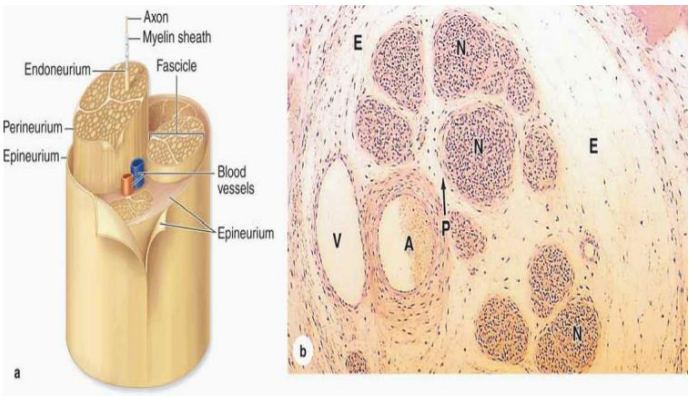


Membranes of Schwann cells have a higher proportion of lipids than do other cell membranes, Between adjacent Schwann cells on an axon the myelin sheath shows small nodes of Ranvier, whoch has a much higher concentration of voltage-gated Na+ channels, which renew the action potential and produce saltatory conduction of nerve impulses.

Unmyelinated Fibers Unlike the CNS where many short axons are not myelinated at all but run free among the other neuronal and glial processes, the smallest-diameter axons of peripheral nerves are still enveloped within simple folds of Schwann cells . In these unmyelinated fibers the glial cell does not form the multiple wrapping of a myelin sheath . In unmyelinated fibers, each Schwann cell can enclose portions of many axons with small diameters. Without the thick myelin sheath, nodes of Ranvier are not seen along unmyelinated nerve fibers. Moreover, these small diameter axons have evenly distributed voltage-gated ion channels; their impulse conduction is not saltatory and is much slower than that of myelinated axons.



Nerve Organization In the PNS nerve fibers are grouped into bundles to form nerves. Except for very thin nerves containing only unmyelinated fibers, nerves have a whitish, glistening appearance because of their myelin and collagen content. Axons and Schwann cells are enclosed within layers of connective tissue. Immediately around the external laminae of the Schwann cells is a thin layer called the endoneurium, consisting of reticular fibers, scattered fibroblasts, and capillaries. Groups of axons with Schwann cells and endoneurium are bundled together as fascicles by a sleeve of perineurium, containing flat fibrocytes with their edges sealed together by tight junctions. From two to six layers of these unique connective tissue cells regulate diffusion into the fascicle and make up the blood-nerve barrier that helps maintain the fibers' microenvironment. Externally, peripheral nerves have a dense, irregular fibrous coat called the epineurium, which extends deeply to fill the space between fascicles



Peripheral nerves establish communication between centers in the CNS and the sense organs and effectors (muscles, glands, etc). They generally contain both afferent and efferent fibers. Afferent fibers carry information from internal body regions and the environment to the CNS. Efferent fibers carry impulses from the CNS to effector organs commanded by these centers. Nerves possessing only sensory fibers are called sensory nerves; those composed only of fibers carrying impulses to the effectors are called motor nerves. Most nerves have both sensory and motor fibers and are called mixed nerves, usually also with both myelinated and unmyelinated axons.

Ganglia :Ganglia are typically ovoid structures containing neuronal cell bodies and their surrounding glial satellite cells supported by delicate connective tissue and surrounded by a denser capsule. Because they serve as relay stations to transmit nerve impulses, at least one nerve enters and another exits from each ganglion. The direction

of the nerve impulse determines whether the ganglion will be a sensory or an autonomic ganglion.

Sensory ganglia are associated with both cranial nerves (cranial ganglia) and the dorsal roots of the spinal nerves (spinal ganglia). Sensory ganglia are supported by a distinct connective tissue capsule and an internal framework continuous with the connective tissue layers of the nerves. The neurons of these ganglia are pseudounipolar.

Autonomic nerves effect the activity of smooth muscle, the secretion of some glands, heart rate, and many other involuntary activities by which the body maintains a constant internal environment (homeostasis). As indicated earlier autonomic nerves make up the autonomic nervous system. This has two parts: the sympathetic and the parasympathetic divisions..