

The Nervous System Part -1-



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• • Introduction

- The master controlling and communicating system of the body
- Functions:
 - Maintain body homeostasis
 - Sensory input monitoring stimuli occurring inside and outside the body
 - Integration interpretation of stimuli
 - Motor output response to stimuli

• • Function of the Nervous System



• Central nervous system (CNS)

- Brain and spinal cord
- Integration and command center
- Peripheral nervous system (PNS)
 - Paired spinal and cranial nerves
 - Carries messages to and from the spinal cord and brain







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Peripheral Nervous System (PNS): Two Functional Divisions

- Sensory (afferent) division
 - Carries impulses from skin, skeletal muscles, and joints to the brain
 - Transmits impulses from visceral organs to the brain
- Motor (efferent) division
 - Transmits impulses from the CNS to effector organs (muscle, gland)

Motor Division: Two Main Parts

- Somatic nervous system
 - Conscious control of skeletal muscles
- Autonomic nervous system (ANS)
 - Regulate smooth muscle, cardiac muscle, and glands
 - Divisions sympathetic and parasympathetic



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Histology of Nerve Tissue

• The two principal cell types of the nervous system are:

- Neurons excitable cells that transmit electrical signals
- Supporting cells cells that surround and wrap neurons

Neurons (Nerve Cells)

Structural units of the nervous system

Composed of a body, axon, and dendrites



• • • Neurons (Nerve Cells)



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• • Nerve Cell Body (Soma)

Contains the nucleus and a nucleolusMajor metabolic center





• Armlike extensions from the soma

- Called tracts in the CNS and nerves in the PNS
- There are two types: axons and dendrites



Short diffusely branched processesConduct impulses toward the soma



• • • Axons: Structure

Long axons are called nerve fibersConduct impulses away from the soma



• • • Myelin Sheath

- Whitish, fatty (protein-lipid), segmented sheath around most long axons
- It functions in:
 - Protection of the axon
 - Electrically insulating fibers from one another
 - Increasing the speed of nerve impulse transmission

• • • Supporting Cells: Neuroglia

The supporting cells (neuroglia or glial cells):

- Provide support for neurons
- Insulate neurons
- Guide young neurons to the proper connections
- Promote health and growth

• CNS: Oligodendroglia, astrocytes, ependymal cells, microglia

• PNS: Schwan cells and sattelite cells

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Microglia and Ependymal Cells







STUDE Sensory neuron with Schwann cells and satellite cells

Neuron Classification

• Structural:

- Unipolar
- Bipolar
- Multipolar

• Functional:

- Sensory (afferent)
 - Cell bodies in the ganglia in the PNS
- Motor (efferent)
 - Cell bodies in the CNS
- Interneurons (association neurons)
 - Cell bodies in the CNS, connect motor & sensory neurons

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• • • • CNS: Functional Anatomy of the Brain

Four sections

- Cerebrum
- Diencephalon
- Brain stem
- Cerebellum





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- Largest section
- Two cerebral hemispheres
 - Connected by a thick bundle of nerve fibers called the corpus callosum
 - Longitudinal fissure between hemispheres
- Sulci grooves on surface
- Gyri bumps of brain matter between sulci







- Frontal
 - Motor areas for voluntary body movements
- Parietal
 - Somatosensory interprets sensations
- Temporal
 - Auditory interprets sounds
- Occipital
 - Interprets what a person sees (vision)



Functional Areas of the Cerebral Cortex



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o Cortex

- Outer layer gray matter
- Inner layer white matter



o Ventricles

- Interconnected cavities within the brain
- Filled with CSF



••• *Diencephalon*

• Between the cerebral hemispheres superior to the brain stem

o Thalamus

 Relay station for sensory information going to the cerebral cortex for interpretation

Hypothalamus

 Maintains homeostasis by regulating vital activities





 Connects the cerebrum to the spinal cord

• Midbrain

- Just beneath diencephalon
- Controls both visual and auditory reflexes

o Pons

- Rounded bulge on underside of brain stem
- Regulates respiration

• Medulla oblongata

- Directly connected to spinal cord
- Controls many vital activities, such as heart rate, blood pressure, and breathing





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- Location
 - Inferior to the occipital lobes of the cerebrum
 - Posterior to the pons and medulla oblongata
- Coordinates
 - Complex skeletal muscle contractions that are needed for body movements
 - Control balance and equilibrium





Bones (skull and vertebral column)
Membranes (meninges)
CSF
BBB (blood brain barrier)



• Meninges –protect brain and spinal cord

- Dura mater
 - Tough outer layer
- Arachnoid mater
 - Middle layer
- Pia mater
 - Innermost and most delicate







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••• Cerebrospinal Fluid (CSF)

- Made in choroid plexuses (roofs of ventricles)
- Cushions and nourishes brain
- Hydrocephalus: excessive accumulation





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Circulation of CSF



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Hydrocephalus



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• • • Blood Brain Barrier (BBB)

- Tight junctions between endothelial cells of brain capillaries
- Highly selective transport mechanisms (allows nutrients, O2, CO2
- *Not* a barrier against uncharged and lipid soluble molecules; allows alcohol, nicotine, and some drugs including anesthetics



Cerebrovascular Accidents (Strokes)

- Caused when blood circulation to the brain is blocked and brain tissue dies

- Most commonly caused by blockage of a cerebral artery

- Other causes include compression of the brain by hemorrhage or edema, and atherosclerosis

- Transient ischemic attacks (TIAs) – temporary episodes of reversible cerebral ischemia

- Tissue plasminogen activator (TPA) is the only approved treatment for stroke

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Degenerative Brain Disorders

- Alzheimer's disease a progressive degenerative disease of the brain that results in dementia
- Parkinson's disease degeneration of the dopamine-releasing neurons of the substantia nigra
- Huntington's disease a fatal hereditary disorder caused by accumulation of the protein huntingtin that leads to degeneration of the basal nuclei



- Approximately 17 inches (42 cm) long
- Provides two-way pathway
- Extends from the foramen magnum and ends L1/L2 in adults
- Cauda equina







PNS



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Peripheral Nervous System (PNS)

- Peripheral nervesTwo types:
 - Spinal nerves
 - Cranial nerves



• • • PNS: Spinal nerves

- Peripheral nerves originating from the spinal cord
- o 31 pairs
- Divided into:
 - 8 cervical
 - 12 thoracic
 - 5 lumbar
 - 5 sacral
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- I. Olfactory nerves
 - smell
- II. Optic nerves
 - vision
- III. Oculomotor nerves
 - muscles that move the eyeball, eyelid, and iris
- IV. Trochlear nerves
 - muscles that move the eyeball

V. Trigeminal nerves

- Carry sensory information from the surface of the eye, the scalp, facial skin, the lining of the gums, and the palate
- Also found within the muscles needed for chewing
- VI. Abducens nerves
 - muscles that move the eyeball

VII. Facial nerves

- Found in the muscles of facial expression as well as in the salivary and tear glands
- Also carry sensory information from the tongue

VIII. Vestibulocochlear nerves

 Carry hearing and equilibrium information from the inner ear to the brain

• • • PNS: Cranial Nerves

IX. Glossopharyngeal nerves

- Carry sensory information from the throat and tongue
- Also act in the muscles of the throat
- X. Vagus nerves
 - Carry sensory information from the thoracic and abdominal organs
 - Also found within the muscles in the throat, stomach, intestines, and heart

XI. Accessory nerves

 Found within the muscles of the throat, neck, back, and voice box

XII. Hypoglossal nervesFound within the muscles of the tongue

End of Part -1-



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