

Examrace

Nervous system part 2: Parts and Their Functions for Competitive Exams

Get unlimited access to the best preparation resource for UGC : Get [detailed illustrated notes covering entire syllabus](#): point-by-point for high retention.

Limbic System

- Evolutionarily the structure of limbic system is rather old.
- The limbic system, often referred to as the "emotional brain", is found buried within the cerebrum.
- At the border of the brainstem and cerebral hemispheres it is a doughnut-shaped system of neural structures; associated with emotions e.g. fear and aggression, and drives like hunger and sex; regulates body temperature, blood sugar level and blood pressure.

Structures Within the Limbic System

i. Hippocampus

The hippocampus is the part of the limbic system that is important for memory and learning.

ii. Amygdala

- Two almond-shaped neural clusters in the limbic system that are linked with emotions.
- They are related with aggression and fear.

iii. Hypothalamus

- One of the smallest structures in the brain.
- The neural structure lying below (hypo) the thalamus; Composed of several nuclei. Small bundles of neurons that regulate physiological processes involved in motivated behavior e.g. hunger, thirst, regulation of body temperature.
- Hypothalamus acts as the body's Thermostat.
- Helps govern the endocrine system via the pituitary gland.
- Is linked to emotions.

Homeostasis

Hypothalamus maintains the body's internal equilibrium e.g. looking for food when energy levels are low, causing constriction of the blood vessels when body temperature falls.

Cerebrum

- Largest part of the human brain, associated with higher brain functions such as thought and action.
- Occupies 2/3 of the brain's total mass
- Consists of two symmetrical halves or hemispheres; The right cerebral hemisphere controls the left side of the body and vice versa.
- The hemispheres are connected by Corpus Callosum, a thick mass of nerve fibers.
- Cerebrum regulates the brain's higher cognitive and emotional functions.

Cerebral Cortex

- Coming from the Latin word for "bark", cortex means covering, or sheath; the cortex is a sheet of tissue making up the outer layer of the brain.
- About 1/10 of an inch in thickness, the cortex is composed of some 30 billion nerve cells and 300 trillion synaptic connections.
- It is the body's ultimate control and information-processing center.
- The cerebral cortex is greatly convoluted in humans. These convolutions include:
 - Sulci (singular Sulcus) i.e. small grooves.
 - Gyri (singular Gyrus) i.e. large grooves also called "Fissures".

Grey Matter

- Cerebral cortex mostly consists of glia (glial cells), cell bodies, dendrites and
- Interconnecting neurons; they give the cerebral cortex a grayish brown appearance, commonly known as 'Grey Matter'.

White Matter

- Beneath the cerebral cortex lie millions of axons that connect the neurons of the cerebral cortex to those located elsewhere in the brain.
- The large myelin gives tissue an opaque white appearance known as "White Matter".

Cerebral Lobes

a. Frontal lobe

Associated with motor control and cognitive activities; reasoning, planning, decision making, problem solving, movement and speech (Broca's Area).

b. Parietal lobe

Associated with controlling incoming sensory information; thus affecting movement, orientation, recognition, perception of stimuli.

c. Temporal lobe

Associated with perception and recognition of auditory stimuli, memory & speech. Wernicke's area: concerned with the understanding of language is located here

d. Occipital lobe

Associated with visual processing.

Each lobe controls a different range of activities.

Each hemisphere is vertically divided by the central sulcus, a groove.

The lateral fissure, another groove divides each hemisphere horizontally.

Cranium

The brain is enclosed in the cavity of skull or cranium consisting of eight hard bones; One frontal bone, two parietal bones, two temporal bones, one occipital bone, one sphenoid bone, and one ethmoid bone.

Membranes of the Brain

- Between the surfaces of the brain and the skull, there are three layers of membrane called the meninges, which completely cover the brain and spinal cord.
- These three membranes are:
 - Dura Matter
 - Arachnoid
 - Pia Matter

Cerebrospinal Fluid (CSF)

- The subarachnoid space contains a fluid called cerebrospinal fluid (CSF), a clear, colorless fluid covering the entire surface of central nervous system.
- The total volume of CSF is 125 – 150 ml .
- Total production of CSF is about 400 – 500 ml/day (about 0.36ml/min).
- Association Areas
 - Areas in the cerebral cortex that are not involved in primary motor and sensory functions; rather they are involved in higher mental functions such as learning, remembering, thinking and speaking.
 - Association areas in the Frontal Lobes are concerned with judging and planning;
 - Damage may lead to intact memory but inability to plan out something.

- Personality may also be affected.
- Association areas of other lobes are related to other mental functions; i.e. Temporal Lobe enables us to recognize faces; damage to this area causes inability to identify people (although facial features can be described), and gender and approximate age too.
- Association areas in the posterior lobes are involved in perception and memory. Damage leads to difficulty in perceiving speech.
- Spinal Cord
- Continuation of the Medulla Oblongata.
- The spinal cord is about 45 cm long in men and 43 cm long in women and weighs about 35-40 grams.
- The vertebral column (back bone), encapsulating the spinal cord, is about 70 cm long comprising vertebra in the vertebral column.
- The spinal cord is much shorter than the vertebral column.
- Signals arising in the motor areas of the brain travel back down the cord and leave in the motor neurons.
- The spinal cord also acts as a minor coordinating center responsible for some simple reflexes like the withdrawal reflex.
- Reflex - rapid (and unconscious) response to changes in the internal or external environment, needed to maintain homeostasis
- Reflex arc: the neural pathway over which impulses travel during a reflex. The components of a reflex arc include:
 - Receptor - responds to the stimulus
 - Afferent pathway -- sensory neuron
 - Central Nervous System

Peripheral Nervous System (PNS)

- Consists of the spinal and cranial nerves; these connect the CNS to the rest of the body. PNS connects the body's sensory receptors to the CNS, and the CNS to the muscles and glands.
- The part of the nervous system that includes all parts of the nervous system except the brain and the spinal cord Includes:
 - Somatic Division / Somatic Nervous System/ SNS
 - Autonomic division / Autonomic Nervous System/ ANS

Parts of Peripheral Nervous System

PNS has two important parts

- Skeletal/Somatic Nervous System
 - Controls the voluntary movements of our skeletal muscles.
 - It reports the current state of skeletal muscles and carries instructions back.
 - Controls the voluntary movements of the skeletal muscles.
 - Controls the involuntary movements all over the body; movements of the heart, lungs, stomach, glands and other organs.
- Autonomic Nervous System (ANS)
 - Considered as the “self-governing or self-regulatory mechanism” because of its involuntary operation.
 - Controls the glands and muscles of internal organs e.g. heart, stomach, and glandular activity.
 - A.N.S. has a dual function; i.e. both arousing and calming.
 - **Comprises two sub systems; Sympathetic and parasympathetic nervous systems.**

1. Sympathetic Nervous System (SNS)

- This part of ANS arouses us for defensive action fight or flight.
- If something alarms, endangers, excites, or enrages a person, the sympathetic nervous system accelerates heartbeat, slows digestion, raises the sugar level in blood, dilates the arteries and cools the body through perspiration; makes one alert and ready for action.

2. Parasympathetic Nervous System (PNS)

- When the stressful situation subsides, parasympathetic nervous system begins its activity.
- It produces an effect opposite to that of sympathetic nervous system.
- It conserves energy by decreasing heartbeat, lowering blood pressure, lowering blood sugar and so on.
- In daily life situations, both sympathetic and parasympathetic systems work together to keep us in steady internal state maintaining the homeostasis.
- Studying the Structure and Function of the Brain
- Electroencephalogram (EEG): recording of the electrical signals being transmitted within the brain, through electrodes attached to the skull.

- **Computerized Axial Tomography (CAT):** a computer constructs an image of the brain by combining thousands of separate X-rays taken from slightly different angles.
- **Magnetic Resonance Imaging (MRI):** the scan produces a powerful magnetic field to provide a computer generated, detailed image of the structure of the brain.
- **Super Conducting Quantum Interference Device (SQUID):** a scan sensitive to minute changes in the magnetic field occurring when neurons are firing.
- **Positron Emission Tomography (PET):** a scan showing biochemical activity within the brain at any given moment.

Endocrine System

Endocrine system is a collection of glands that produce hormones that regulate body's growth, metabolism, and sexual development and function.

The hormones are released into the bloodstream and transported to tissues and organs throughout the body.

Although there are eight major endocrine glands scattered throughout the body, they are still considered to be one system because they have similar functions, similar mechanisms of influence, and many important interrelationships.

- Endocrine glands are known as the “Managers of Human Body”.
- Endocrine system is the system in which a number of glands secrete numerous hormones directly into the blood stream which regulate:
 - Body’s growth
 - Metabolism
 - Sexual development and functions, and
 - Other vital functions of the body
 - Endocrine glands are ductless glands that secrete their hormones directly into the bloodstream.
 - Hormones act as chemical messenger controlling various functions, reaching to the tissues and other vital organs of the body.

Pineal Gland

- The pineal gland, also known as pineal body, is found in the brain stem.
- It is small and cone-shaped in structure

Main Function

- Affects reproductive development

- Daily physiologic/ biological cycles

Pituitary Gland

- Size and shape
- It is a small gland___ diameter of about 1 centimeter or size of a pea.
- Location
- It is connected with the hypothalamus by a slender stalk and also surrounded by bone.
- Secretes a number of different hormones that influence/affect various other endocrine glands.
- There are two distinguishable regions in the gland that have different secretions and functions:

a. The anterior lobe

- Growth Hormone: Protein that regulates and also stimulates the:
- Growth of bones,
- Muscles, and other organs of the body by promoting protein synthesis.
- The effect of this hormone is important and very much apparent because it affects height.

Growth Hormonal Problems

- Dwarfism

If there is very little or no secretion of this hormone in a child, then the child may become a pituitary dwarf___ small in stature.

- Gigantism
 - If there is too much secretion of this hormone in the body, then there is exaggerated bone growth in a person and the person become exceptionally tall or a giant.
 - This rare condition is usually caused by a pituitary tumor and can be treated by removing the tumor.
 - When the pituitary gland fails to produce adequate amounts of growth hormone, a child's growth in height is impaired/ disturbed.
 - Hypoglycemia (low blood sugar) may also occur in children who have deficiency of this growth hormone ___ affects particularly infants and young children with this condition.
- Thyroid-stimulating hormone: Affects the glandular cells of the thyroid so that it secretes thyroid hormone. The thyroid gland become enlarged and secretes too much thyroid hormone if there is hyper secretion of thyroid- stimulating hormone.

- Adrenocorticotrophic hormone: Cortical hormones especially cortisol are secreted when it reacts with the receptor cells in the cortex of the adrenal gland.
- Gonadotropic hormones: Regulate the development, growth, and function of gonads and ovaries by reacting along with receptor cells present in these organs.
- Prolactin Hormone: Helps in promoting the development of glandular tissues in the female breasts during pregnancy and as a result stimulates milk production after the birth of the infant.

b. Hormones of the Posterior Lobe

These hormones are:

i. Antidiuretic hormone

- Helps in the reabsorption of water by the kidney tubules___ as a result of which less amount of water is lost from the body as urine.
- This system/ mechanism conserve water for the body.

ii. Oxytocin

- Helps in the contraction of smooth muscles in the walls of the uterus.
- It also stimulates the ejection of milk from the lactating breast.

3. Hypothalamus

- Part of the central nervous system that is involved in controlling and activating involuntary functions of the body such as,
- Hormonal system
- Other body functions as well___ regulating sleep and stimulating appetite

Developed by: [Mindsprite Solutions](#)