Diploma in Pharmacy 1st Year
Human Anatomy & Physiology Practical

To study the given model of human urinary system.

Aim:

To study the given model of human central nervous system.

Reference :

Dr. Gupta G.D , Dr. Sharma Shailesh , Dr. Sharma Rahul Kumar , "Practical Manual of Human Anatomy and Physiology" Published by Nirali Prakashan , Pg.No 155 - 158

Theory :

The brain and spinal cord make up the central nervous system. Both of these vital structures are well-protected from harm and injury.

The brain is enclosed within the skull, and the spinal cord is protected by the vertebrae, which create spinal column membrane coverings known as the meninges.

Meninges and Cerebrospinal Fluid (CFS)

Three layers of tissues completely surround the brain and spinal cord Between the skull and the brain, as well as between the vertebral foramina and the spinal cord, are the meninges.

Named from outside inwards they are the:

1) Duramater: This is made up of two layers of dense fibrous tissue. The outer layers cover the inner surface of the skull bones in place of the periosteum, while the inner layer protects the brain.
2) Arachnoid Mater: This is fibrous tissue layer present in between the dura and the pia mater. The subdural space, which contains a tiny quantity of serous fluid, separates it from the duramate, and the subarachnoid space, which contains CSF, separates it from the pia mater.

3) Piamater: This is a thin layer of connective ussue that contains several small blood veins. It obeys to the brain in such a way that it completely covers the convolutions and penetrates each fissure.

Ventricies of the Brain and the CSF

The brain contains four irregularly-shaped cavities or ventricles, containing CSF:

1. Lateral Ventricles: These cavities are located right below the corpus callosum in each of the cerebral hemispheres, one on either side of the median plane.
2. Third Ventricle: They are found in the midline.
3. Fourth Ventricle: The fourth ventricle is located behind the pons and the medulla oblongata, in front of the cerebellum

Cerebrospinal Fluid (CSF)

The choroid plexus secretes CSF into each of the brain's ventricles These are the vascular areas in the living ventricle wall where blood vessels proliferate and are surrounded by ependymal cells. The arachnoid villi are the small diverticula in the arachnoid mater which allow CSF to return into the bloodstream

The difference in pressure on either side of the walls of the arachnoid villi,which operate as one-way valves, determines the passage of CSF from the subarachnoid space to the venus sinuses

Function of CSF

The brain and spinal cord are supported and protected by CSF, which maintains a constant pressure surrounding these essential structures and acts as a cushion or shock absorber between the brain and the skull.

Brain

The brain is a large organ that lies within the skull cavity and weighs roughly 1.4kg,

Parts of the brain are:

1) Cerebrum

2) Hypothalamus, thalamus)diencephalon
3) Midbrain
4) Pons — The brain stem
5) Medulla oblongata
6) Cerebellum

1. **Cerebrum:** It is a part of the brain that accounts for around 2/3 of the total brain mass. It is separated by a fissure-corpus callosum and consists of two hemispheres.

Cerebral Cortex

It is the layer of the brain that is commonly referred to as grey matter since it lacks myelin but has a cell body and synapsis. As the neuron in this area lack the insulation of the white fatty myelin sheath that makes the rest of the brain appears white, the cortex (thin layer of tissue) is grey.

Functions of Cerebral Cortex

Three main activities.

i) Memory, sense of responsibility, thinking, reasoning, moral decision- making, and learning are all mental activities Sensory

ii) perception, which includes the senses of touch, sight,hearing, taste , and smell.

iii) Structural muscle contraction initiation and regulation.

Functional Area of the Cerebral Cortex

i) **Motor Area:**

a) Skeletal muscle is directed through this area. It is located in the frontal lobe, just inside the central sulcus

b) The cell body (betz cell) is pyramidal in shape and initiates skeletal muscle contraction.

c) A nerve fibre (upper motor neuron) from a betz cell travel through the internal capsule to the medulla oblongata.

ii) **Broca's Motor Speech Area**: This is located directly above the lateral sulcus in the frontal lobe and governs the muscle movement

required for speech.

iii) **Sensory Area of the Cerebral Cortex:**

a) **Somato Sensory Area:** This area lies immediately behind the central sulcus. Pain, temperature, pressure, and touch, as well as muscular activity and joint position, are all received (5th cranial nerve)

b) **Auditory (Hearing Area**): It is located directly beneath the lateral sulcus in the temporal lobe The cochlear component of the vestibulocochlear nerve transmits impulses from the inner ear, which the nerve cells receive and interpret (8th cranial nerve).

c) **Olfactory (Smell) Area:** They are found deep within the temporal lobe, this area receives impulses from the nose via the olfactory nerve(1st cranial nerve).

d) **Taste Area:** They are found in the deep levels of the somatosensory area, just above the lateral sulcus.

e) **Visual Area:** The greater part of the occipital lobe is located behind the parieto occipital sulcus.

f) **Association Areas:** These are related to one another as well as other parts of the cerebral cortex.

g) **Premotor Area:** It is found just anterior to the motor region in the frontal lobe. The neurons in this area coordinate movement initiated by the primary motor cortex, allowing learned movement pattems to be repeated.

h) **Prefrontal Area:** It includes the rest of the frontal lobe and extends anteriorly from the premotor region.

i) **Sensory Speech (Wernick's) Area:** It is located next to the pareito-occipital temporal area in the temporal lobe.

j) **Pareito-Occipital Temporal Area:** The majority of the parietal lobe is located behind the somatosensory area.

2. Diencephalon: The cerebrum and the midbrain are connected through it. It consists of several structures situated around the third ventricles, that are:

i) **Thalamus:** It comprises of two masses of grey and white matter, and is situated one on each side of the third ventricle, within the cerebral hemispheres right below the corpus callosum. Sensory receptors on the skin and viscera send information about touch,temperature, and pain to the thalamus, as well as data from the sense organs (special).

ii) **Hypothalamus:** It is a small but vital organ that weighs around 7gm and is made up of several nuclei.

Functions of Hypothalamus

a) Control of ANS

b) Appetite and anxiety

c) Thirst and water balance
d) Body temperature
e) Emotional reaction
f) Sexual behavior
g) Sleeping and waking cycles

3. Brain Stem: The brain stem is mainly divided into three parts:

i. **Mid-Brain:** It is the portion of the brain between the cerebrum and the pons that is located around the cerebral aqueduct. It is made up of nucle and nerve fibre tracts through which the cerebrum is connected with the lower parts of the brain.

ii. **Pons:** It lies in front of the cerebellum, below the midbrain and above the medulla oblongata. It is primarily made up of nerve fibres (white matter) and serves as a link between the cerebellum's two hemispheres.

iii. **Medulla Oblongata:** It is often known as the medulla, is the brain stem's most inner part, stretching from the pons. It is about 2.5cm long and located right in the middle above it.

4. **Cerebellum:** The cerebellum is located behind the pons and just below the cerebrum's posterior half It is involved with voluntary muscular movement. posture, and balance coordination.

Spinal Cord

The spinal cord is an elongated, nearly cylindrical component of the central nervous system that is suspended in the vertebral canal and surrounded by meninges. Above the medulla oblongata, the spinal cord is continuous and runs from the upper border to the lower border sections.

Grey Matter

Grey matter in the spinal cord is organised in the shape of an H, with two posterior, two anterior, and two lateral columns

1) Sensory neurons that receive signals from the body's periphery
2) Lower motor neurons, which send signals to the skeletal muscles.
3) Interneurons, also known as connector neurons, produce spinal reflex ares by connecting sensory and motor neuron at the same or different levels.

White Matter

The spinal cord's white matter is divided into three columns, i.e. anterior,posterior and lateral. Sensory nerve strands rising to the brain, motor nerve fibres descending from the brain, and linking neuron fibres constitute these tracts. Tracts are frequently named according to their points of origin and destination. For example, spinothalamic corticospinal

Result: The given model of central nervous system was studied