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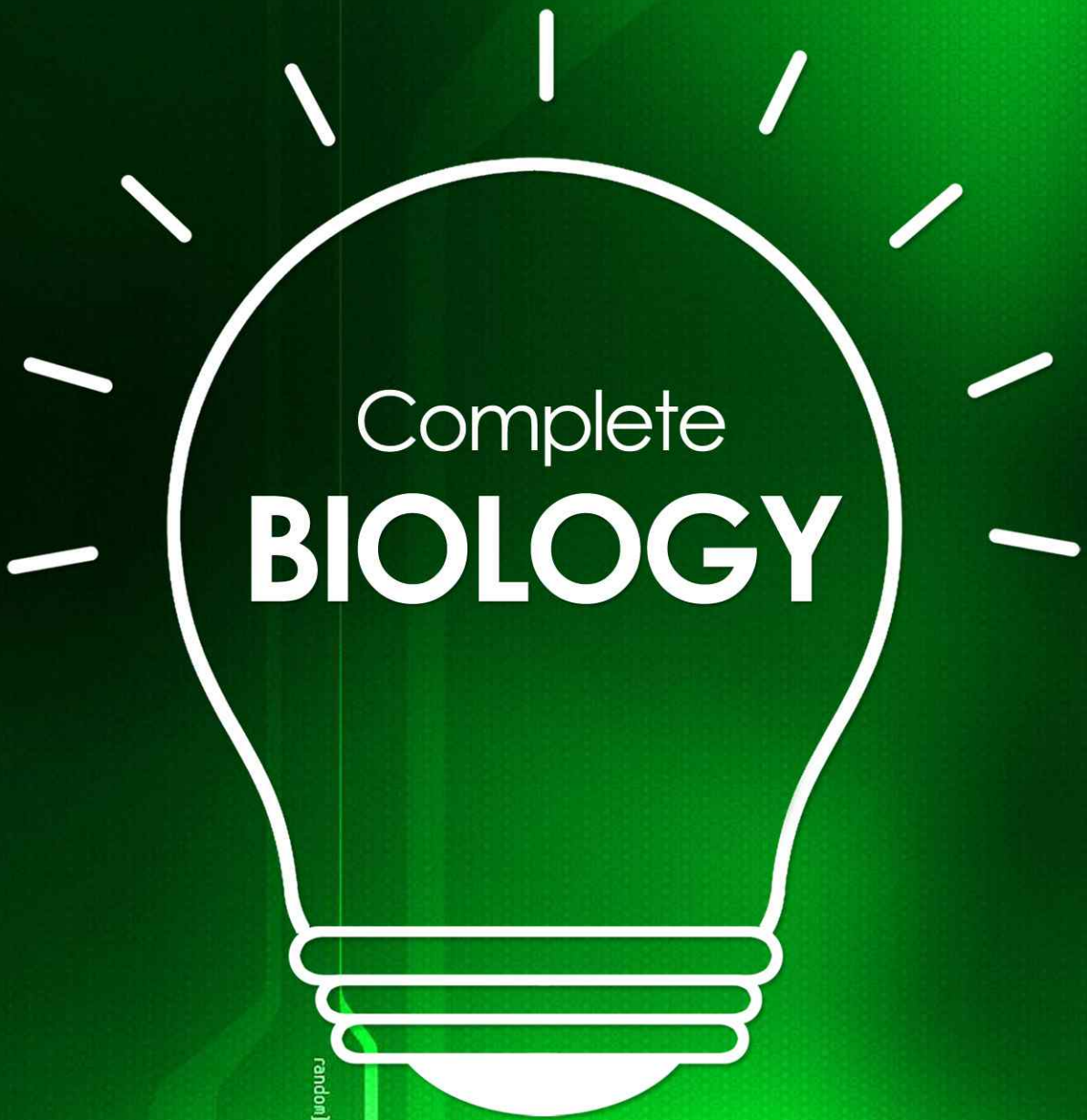

Complete BIOLOGY

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CLASS 11th

Neural Control and Coordination

01. Neural or Nervous System

The system which is responsible for coordination of various activities of different body parts amongst themselves and in response to stimuli of various kinds is called neural system or nervous system.

The basic unit of this system is neuron or nerve cell. Each neuron communicates with thousands of other neurons in a complex information-processing circuit.

02. Central Nervous System

The main parts of central nervous system are brain and spinal cord.

Brain

Brain has following main parts

Outer Coverings or Meninges

Both of them are covered by following three membranes called **meninges** (from outside to inside):

(i) **Outer Duramater :** Thick, tough and collagenous fibrous layers.

(ii) **Middle arachnoid :** Comparatively soft but non-vascularised, also called 'spider web'.

(iii) **Inner piamater :** Highly vascularised and very soft.

Space between dura and arachnoid mater is called **sub-dural space**. Similarly space between piamater and arachnoid-mater is called **sub-arachnoid space**. These spaces are filled with Cerebrospinal Fluid (CSF).

In between the duramater and cranium, one more space is present, which is called **epidural space**.

Cerebrospinal Fluid (CSF)

The fluid present in and around brain and spinal cord is called cerebrospinal fluid. It is secreted by modified ependymal cells of brain which form plexus of cells called **choroid plexus.**

The main functions of CSF are as follows

(i) It absorbs shock or jerk to protect brain and spinal cord.

(ii) It serves as medium for exchange of nutrients and waste products between blood and nervous tissue.

(iii) It serves as endocrine medium for transport of hormones.

Human Brain

It is situated in the cranium or skull. *It contains following parts*

(i) **Forebrain or Prosencephalon**

It is the largest part of the human brain and forms most of the anterior region. *It is further divided into*

(a) **Olfactory lobe or Rhiencephalon**

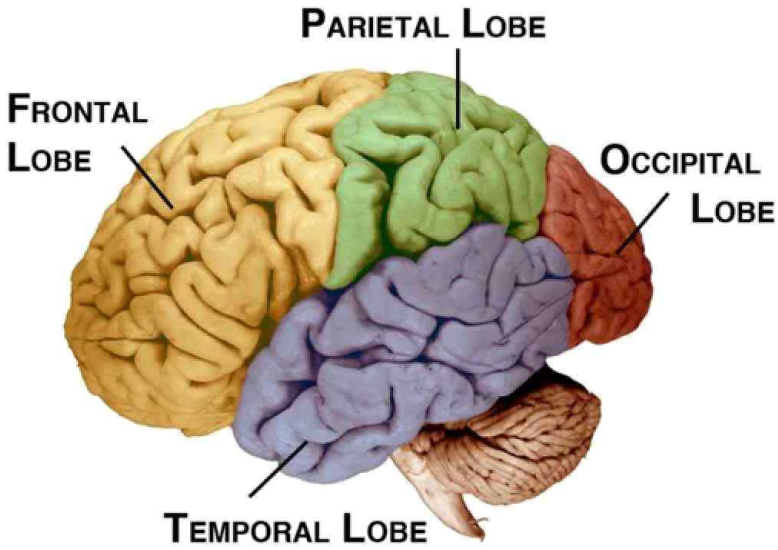
These are paired structures, anterioventral in position and functionally related to smell. Each structure is differentiated into an anterior, swollen part called **olfactory bulb** and posterior, narrow part called **olfactory tract**. It ends in olfactory area of temporal lobe of cerebral hemisphere.

(b) **Cerebrum**

It is the most developed part to human brain. A deep cleft divides the cerebrum longitudinally into two halves namely the left and right cerebral hemispheres. Both of these hemispheres are connected by a nerve fibre band celled **corpus callosum**. It is the characteristic of mammals only.

The specialised functions like intelligence, learning skill, memory, speech, etc. all are attributed to cerebrum. The roof of cortex is called neopallium in mammals and pallium in other vertebrates. *Each of these is further divided into the following five lobes*

- **Frontal lobe :**
  It is present towards forehead and mainly contains prefrontal area, premotor area and motor area. It has a motor area called **Broca's centre**. Which initiates the movement of lips, tongue and larynx to produce speech.
  Frontal lobe is the centre of knowledge, creativity, wisdom, reasoning, judgement, logic, intelligence, creativity, ideas and dreams.
- **Parietal lobe :**
  It is present in the middle and has somato-sensory areas for speech, i.e. Broadman's area. It is also the centre for perception of pain, pressure, taste, touch and temperature.
- **Insular lobe :**
  This lobe is hidden, as it lies deep in the Sylvian fissure.
- **Occipital lobe :**
  It is present in the posterior most region of the brain. it is the area for vision and visual interpretations.
- **Temporal lobe :**
  It is present close to ear. It has olfactory area for smell and auditory area for hearing. It also has Wernicke's area for understanding of speech.



Cerebral hemisphere

On the basis of structure in general the cerebrum of human brain has three parts, i.e. cerebral cortex, basal nuclei of basal ganglion and limbic system.

(i) **Cerebral Cortex :**

In human, it forms about 80% of the total brain mass. it is the portion of grey matter. The white matter portion below it is called sub cortex. The cortex contains folds forming ridges called **gyri** and grooves called as **sulci**.

(ii) **Basal Nuclei or Basal Ganglion :**

Deep within the cerebral hemisphere is a collection of scattered masses or bulges of grey matter.

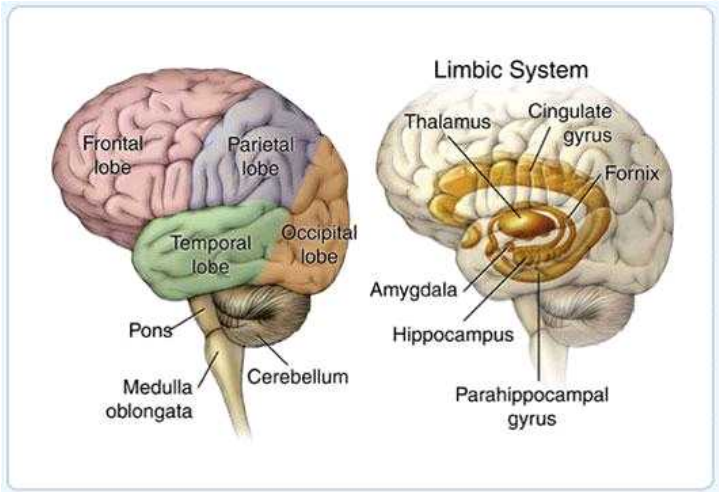
The intermediate layer of cerebral cortex contains specialised, flask-shaped and one of the largest neurons called **Purkinje cells**.

(iii) **Limbic System :**

The medial border of temporal lobe is called limbic system. It is a loop of cortical structures surrounding the corpus callosum and thalamus.

The major components of limbic system are

- **Hippocampus** (shape resembles sea horse) is located inside the temporal lobe and plays a major role in converting short term memory to long term memory. Any damage to this portion may cause Alzheimer's disease. Normal functioning of hippocampus is associated with acetylcholine.
- **Amygdala** (almost –shaped) is associated with the normal emotions.
- **Septal nuclei** or septum is associated with the sexual emotion like sexual arousal, etc.
- **Mammillary bodies** or corpus albicans or corpus mammillare are associated with the olfactory reflexes.
- **Cingulate gyrus** is an arched convolution in the limbic system.



The limbic system

(c) **Diencephalon or Thalaencephalon**

It is the posterioventral part of the forebrain, which is covered by cerebrum. *It consists of three major parts* –thalamus, hypothalamus and epithalamus.

- **Thalamus** It contains an oval mass of grey matter that underlies each cerebral hemisphere. All types of sensory input and other information pass through synapses in the thalamus. It is a centre for sensory and motor signalling and is connected with the limbic system, that's why it is also related to the emotional and memory functions.