

Chapter - 21

Neural Control and Coordination

Points To Remember

Coordination : Process through which two or more organs interact and complement the functions of one another surrounding the brain.

Action potential : A sudden change in the electrical charges in the plasma membrane of a nerve fibre.

Aqueous humour : The thin watery fluid that occupy space between lens and cornea in eye.

Blind spot : A spot on retina which is free from rods and cones and lack the ability for vision.

Cerebrospinal fluid : An alkaline fluid present in between inner two layer of meninges, surrounding the brain and spinal cord.

Cerebellum : A part of hind brain that controls the balance and posture of the body.

Cochlea : A spirally coiled part of internal ear which is responsible for hearing.

Corpus callosum : A curved thick bundle of nerve fibres that joins two cerebral hemisphere.

Depolarisation : A condition when polarity of the plasma membrane of nerve fibre is reversed.

Endolymph : The fluid filled within membranous labyrinth.

Eustachian tube : A tube which connect ear cavity with the pharynx.

Fovea : An area of highest vision on the retina which contain only cones.

Meninges : Three sheets of covering of connective tissue wrapping the brain.

Grey Matter : This shows many convolutions which increase the amount of vital nerve tissue.

Medulla oblongata : Posterior most part of the brain which is continuous with spinal cord and control respiration, heart rate,swallowing,vomiting.

Pons : Thick bundles of fibres on the ventral side of brain below cerebellum.

Foramen magnum : A big aperture in the skull posteriorly through which spinal cord emerges out.

Spinal cord : A tubular structure connected with medulla oblongata of brain and situated in the neural canal of the vertebral column, covered by meninges.

Synaptic cleft : A narrow fluid filled space which separates two membranes of the two neurons at the synapse.

Synaptic vesicles : These are membrane bound vesicles in the axoplasm of the axon terminal and these store neurotransmitter.

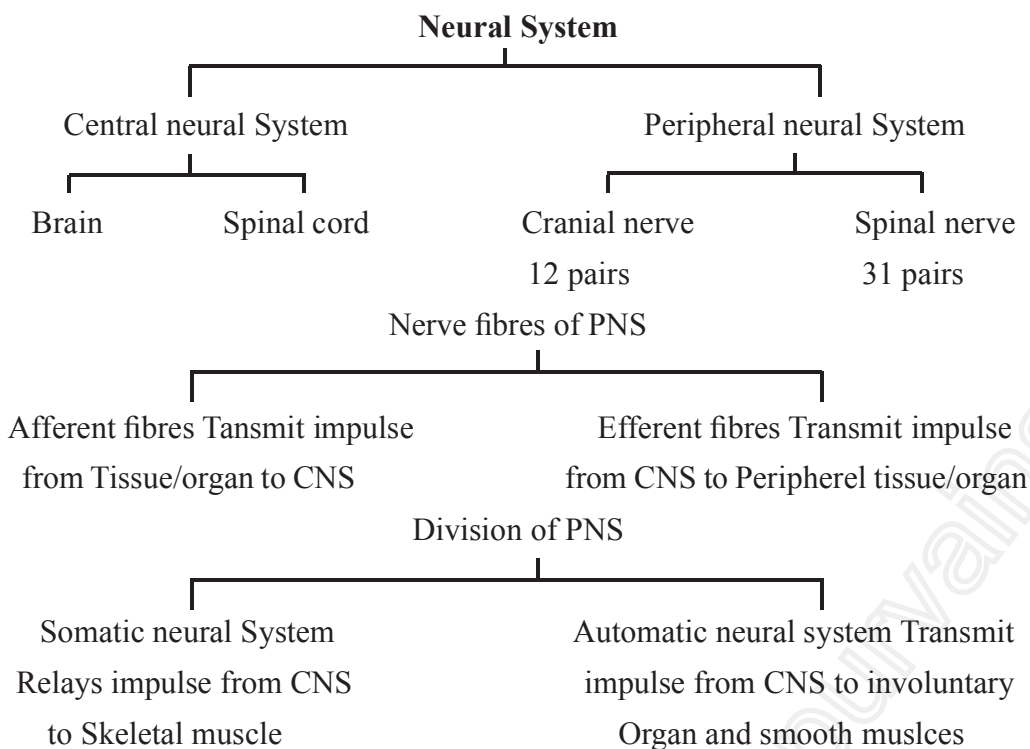
Neurotransmitter : These are chemicals stored in synaptic vesicles, diffuse to reach the membrane of next neuron for its stimulation.

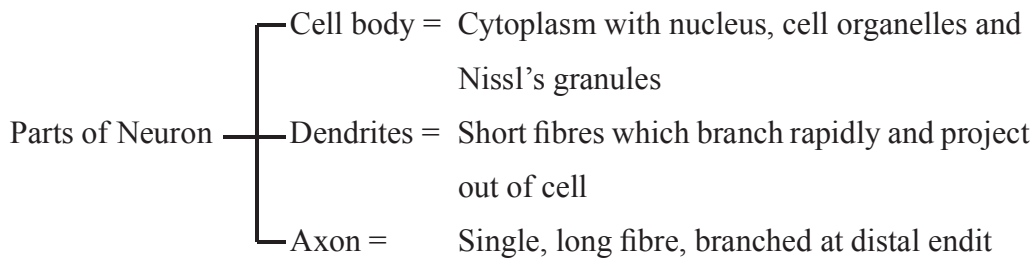
Synapse : A physiological junction between axon of one neuron and dendrite of next neuron.

CNS—Central neural system

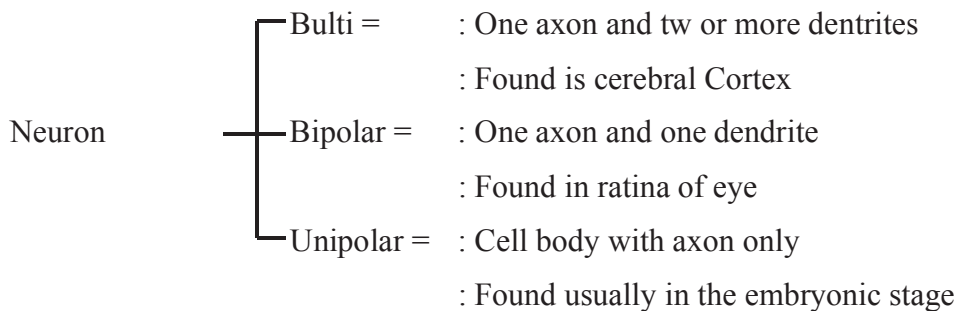
PNS—Peripheral neural system

ANS—Autonomic neural system





(Refer fig. 21.1, page 317, NCERT - Biology, Class-XI)



Conduction of nerve impulse along axon

Polarised membrane/Resting Potential

In resting phase when neuron is not conducting an impulse, the axonal membrane is called polarised. This is due to difference in concentration of ions across the axonal membrane.

At Rest :

- Axoplasm inside the axon contains high conc. of K^+ and low conc. of Na^+ .
- The fluid outside the axon contains low conc. of K^+ and high conc. of Na^+ .

As a result the outer surface of axonal membrane is positively charged and inner surface is negatively charged. The electric potential difference across the resting plasma membrane is called resting potential.

Action Potential : When a nerve fibre is stimulated, the permeability of membrane to Na^+ is greatly increased at the point of stimulus (rapid influx of Na^+) and hence polarity of membrane is reversed and now membrane is said to be depolarised. The electric potential difference across the plasma membrane at that site is called action potential, which is in fact termed as nerve impulse.

Depolarisation is very rapid, so that conduction of nerve impulse along the entire length of axon occurs in fractions of second.



Transmission of Impulses at Synapse

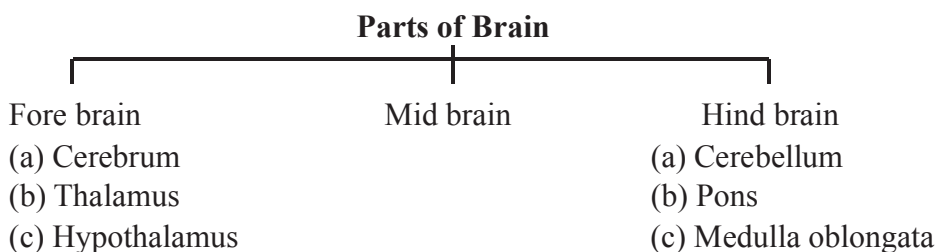
- (i) **At electrical synapses :** Here the membrane of pre and post-synaptic neuron are in very close proximity. Electric current can flow directly from one neuron into other across these synapses, like impulse conduction along a single axon.
- (ii) **At chemical synapses :** Here the membrane of pre and post-synaptic neuron are separated by fluid filled space called synaptic cleft. Neurotransmitter are involved here.

When an impulse arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards membrane and they fuse with the plasma membrane and release their neurotransmitter in the synaptic cleft. These chemicals bind to specific receptors, present on the post-synaptic membrane. Their binding opens ion channels and allow the entry of ion which generate new potential in post synaptic neuron.

Human brain : Human brain is the major portion of central neural system. Which is well protected by the skull.

The brain is surrounded by three cranial meninges—

- (i) Dura mater—outer layer
- (ii) Arachnoid—middle layer
- (iii) Pia mater—Inner layer-remain in contact with brain



Functions of parts of brain :

Cerebrum : Centre of intelligence, memory and imagination, reasoning, judgement, expression of will power.

Thalamus : Acts as relay centre to receive and transmit general sensation of pain, touch and temperature.

Hypothalamus : Centre for regulation of body temperature, urge for eating and drinking.

Midbrain : Responsible to coordinate visual reflexes and auditory reflexes.

Cerebellum : Maintains posture and equilibrium of the body as well as coordinates and regulates voluntary movement.

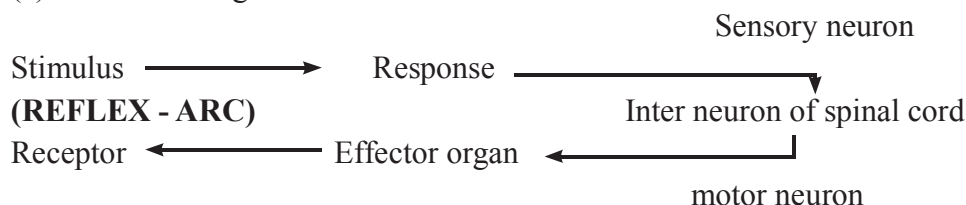
Pons : Relays impulses between medulla oblongata and cerebral hemisphere and between the hemisphere of cerebrum and cerebellum. It also helps to regulate breathing.

Medulla oblongata : Centre that controls heart beat, breathing, swallowing, salivation, sneezing, vomiting and coughing.

Reflex action : It is spontaneous, autonomic and mechanical response to a stimulus that occurs at the level of spinal cord, without involvement of brain.

Reflex arc : The flow of nerve along the specific during reflex action. It consists of—

- (a) A receptor
- (b) An Afferent neuron (sensory neuron)
- (c) An inter neuron
- (d) An efferent neuron (motor neuron)
- (e) An effector organ



Organ of Sight-Eye

Layer	Component	Function
1. External layer	Sclera	Protects and maintain shape of the eye ball
	Cornea	Outermost transparent portion of eye which allows light to enter
2. Middle layer	Choroid	Absorb light and prevent light from being reflected within the eye ball.
	Ciliary body	Holds lens, regulate shape of the lens.
	Iris	Control amount of light entering.
3. Inner layer	Retina	Vision in dim light, colour vision, vision in bright light. Sends the image to brain through optical nerves.

(Refer-Fig. 21.6, Page 323 NCERT-Biology, Class XI)



Organ of Hearing-Ear

Portion of the ear	Component	Function
1. External ear	[Pinna External auditory canal	Collect sound waves Direct sound waves towards ear drum, ear wax prevents the entry of foreign bodies.
2. Middle ear	[Tympanic membrane Ear ossicles Eustachian tube	Acts as resonator that reproduces the vibration of sound. Transmit sound waves to internal ear. Helps in equalising the pressure of either side of ear drum.
3. Internal ear	[Cochlea Vestibular apparatus	Hearing organ. Balancing of body.

(Refer Fig. 21.7, page 325-NCERT-Biology, Class XI)

Questions

Very Short Answer Questions

(1 mark each)

1. Name the fluid present in membranous labyrinth.
2. Name the area of retina where only cones are densely packed.
3. Name the inner most meninges of the brain.
4. To which part of the brain communication and memory are associated ?
5. Name the bundle of fibres that connect two cerebral hemisphere in human being.
6. Name the photo pigment present in the rod cells.
7. Why can impulses flow only in one direction ?
8. Where is hypothalamus located in the brain ?
9. Which cells are responsible for scotopic vision ?

Short Answer Questions-I

(2 marks each)

10. Distinguish between electrical synapses and chemical synapses.
11. What is iris ? Give the function of iris.
12. What is organ of Corti ? Where is it located ?
13. Differentiate between cerebrum and cerebellum.
14. What is synapse ? Name its two types.

15. Fill in the blanks in the different columns A to D :

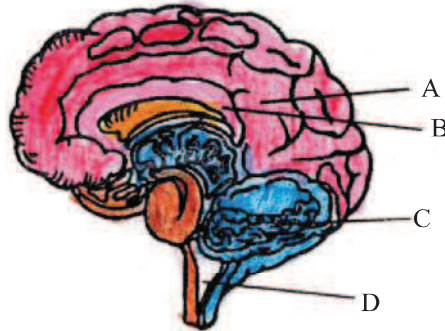
Part/Organ	Function
Pinna(A).....
.....(B).....	Equalise the pressure on either side of ear drum.
Cone cells(C).....
.....(D).....	regulate amount of light to pass into the eye.

16. why are grey matter and white matter contained in human nervous system named so ?

Short Answer Questions-II

(3 marks each)

17. Observe the diagram given right and answer the following questions :



- Label the parts A and B.
- Give the function of C and D.
- Name the layers which wrap this organ.

18. What is a synapse ? How does the nerve impulse cross the chemical synapse ?

19. Give the function of the following :

- Cerebrum
- Hypothalamus
- Mid brain

20. What is meant by reflex action ? Name the components of a reflex arc in correct sequence from receptor upto effector. Support your answer by a diagram.

21. Draw a diagram of V.S. of human eye and label the following :

Iris, Ratina, Cornea, Blind spot, Ciliary body and Vitreous chamber.



Long Answer Questions

(5 mark each)

22. Describe in detail, how conduction of nerve impulse takes place through a nerve fibre.

Answers

Very Short Answers

(1 mark each)

1. Endolymph
2. Fovea
3. Pia mater
4. Cerebrum
5. Corpus callosum
6. Rhodopsin
7. Because each synapse allows impulse to cross it in a single direction.
8. At the base of thalamus.
9. Rods

Short Answers-I

(2 marks each)

10. Refer NCERT text book, Class XI Page no. 319.
11. Refer NCERT Text book, Class XI Page no. 323.
12. Refer NCERT Text book, Class XI Page no. 326.
13. Refer NCERT Text book, Class XI Page no. 321.
14. Junction between two nerves Chemical synapse and electrical synapse
15. (A) To collect sound waves (B) Eustachian tube
(C) Colour vision (D) Iris
16. Refer NCERT book, Page no. 321.

Short Answers-II

(3 marks each)

17. (i) A : Cerebrum
B : Corpus callosum
(ii) C : Balancing of body and maintain posture
D : Vomiting, coughing, breathing, salivation or any other correct answer (anyone).
(iii) Pia mater, arachnoid and dura mater.

18. Refer NCERT Text book, Class XI Page no. 319.
19. Refer NCERT Text book, Class XI Page no. 321.
20. Refer NCERT Text book, Class XI Page no. 322.
21. Refer NCERT Text book, Class XI Page no. 323.

Short Answer

(5 mark)

22. Refer NCERT Text book, Class XI Page no. 317 and 318.

