SAMPLE CONTENT

Precise

BIOLOGY

Vol. II

BASED ON NEW PAPER PATTERN

Std. XII Science

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Precise

BIOLOGY (Vol. II)

Std. XII Sci.

Salient Features

- Written as per Latest Board Paper Pattern
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions
- Includes relevant board questions from March 2009 to March 2022
- Includes selective questions from NCERT textbook for practice
- Marks provided to the Questions as per relevant weightage wherever deemed necessary
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PREFACE

Precise Biology Vol. II, Std. XII Sci. is intended for every Maharashtra State Board aspirant of Std. XII, Science. The scope, sequence, and level of the book are designed to match the new textbook issued by the Maharashtra State board.

Biological systems are the supreme complex chemical systems on Earth, and their functions are both controlled and determined by the principles/laws of chemistry and physics.

We understand that Board Examinations can be daunting and the stress of cracking the examination can often leave students struggling to make sense of the curriculum. Relevant questions of Board Examination from March 2009 to March 2022 are provided so that students would get an idea about the types of questions that are asked in Board Examinations.

With the examination in focus, the ***Precise Series*** has been specifically designed to make preparation easier, by providing a methodical and organized perspective of the curriculum, thus greatly improving the chances of scoring well.

In order to make sure that students fully grasp the nub of the subject, it is important to present such concepts meaningfully and in an easy to read format. In this vein, the Precise Biology book has been crafted to provide an ***exam-centric approach*** to the curriculum, while ***retaining the essence*** of the subject. Each chapter is thus structured to provide a conceptual foundation.

The scope of the book also offers a plethora of Multiple Choice Questions (MCQs) in order to familiarize the students with the pattern of competitive examinations.

We believe that the study of Biology helps in the understanding of many fascinating and important phenomena. In this vein, we have put an effort to relate Biology to real-world events in order to show students that Biology is a vibrant, constantly evolving science that has relevance in our modern world. We hope this book becomes a valuable tool for you and helps you to understand the concepts of Biology.

Publisher

Edition: Fifth

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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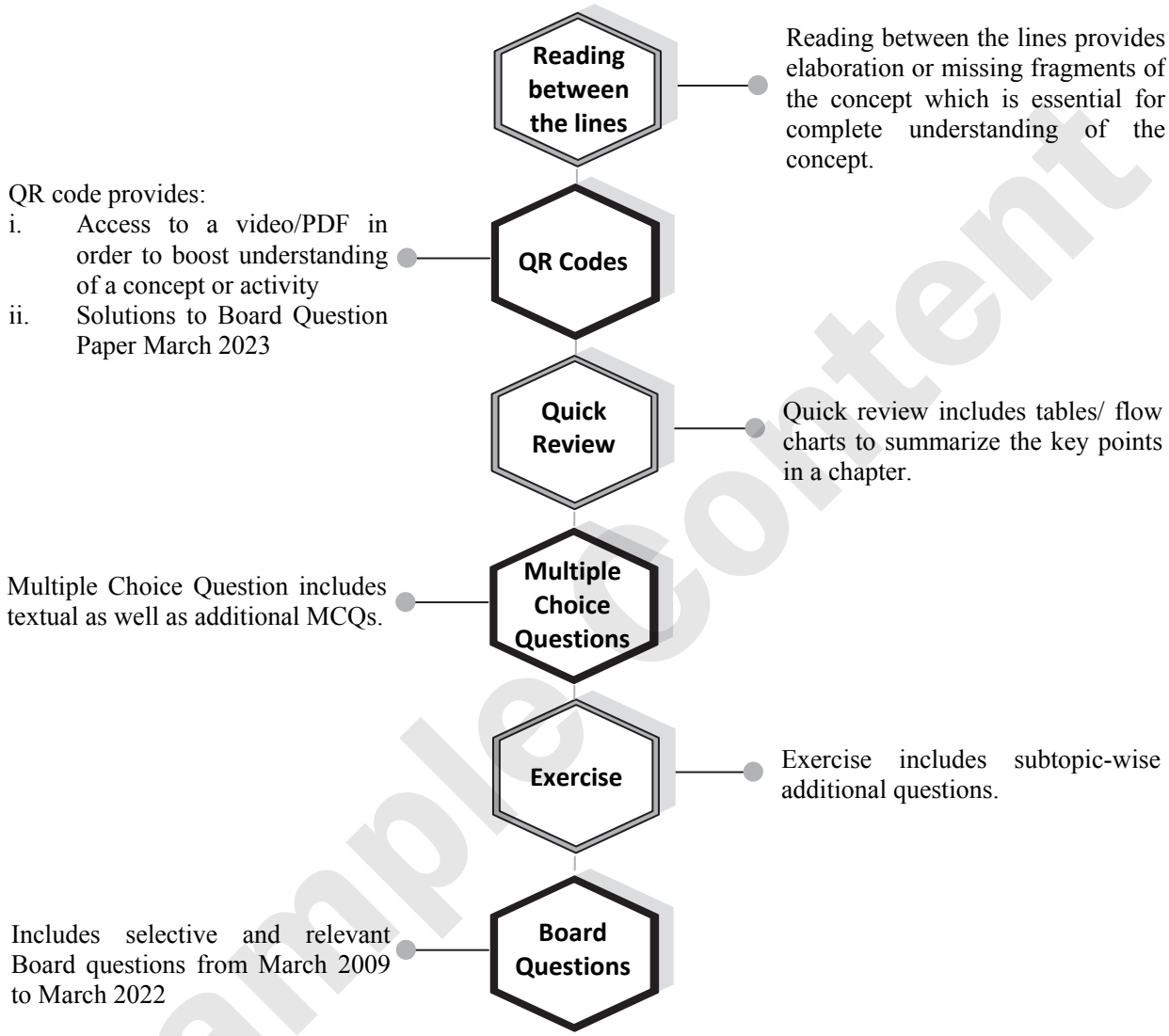
KEY FEATURES



PAPER PATTERN

- There will be one single theroy paper of 70 Marks and practical examination of 30 Marks in Biology.
- Duration of theory paper will be 3 hours.

Section A: **(18 Marks)**

This section will contain Multiple Choice Questions and Very Short Answer(VSA) type of questions.
There will be 10 MCQs and 8 VSA type of questions, each carrying **One** mark.
Students will have to attempt all the questions.

Section B: **(16 Marks)**

This section will contain 12 Short Answer (SA-I) type of questions, each carrying **Two** marks.
Students will have to attempt any 8 questions.

Section C: **(24 Marks)**

This section will contain 12 Short Answer (SA-II) type of questions, each carrying **Three** marks.
Students will have to attempt any 8 questions.

Section D: **(12 Marks)**

This section will contain 5 Long Answer (LA) type of questions, each carrying **Four** marks.
Students will have to attempt any 3 questions.

Distribution of Marks According to the Type of Questions

Type of Questions		
MCQ	1 Mark each	10 Marks
VSA	1 Mark each	8 Marks
SA - I	2 Marks each	16 Marks
SA - II	3 Marks each	24 Marks
LA	4 Marks each	12 Marks

CONTENTS

Chapter No.	Chapter Name	Marks without option	Marks with option	Page No.
9.	Control and Coordination	8	11	1
10.	Human Health and Diseases	3	4	44
11.	Enhancement of Food Production	4	6	72
12.	Biotechnology	5	7	102
13.	Organisms and Populations	3	4	123
14.	Ecosystems and Energy Flow	3	4	139
15.	Biodiversity, Conservation and Environmental Issues	3	4	154
	Board Question Paper: March 2023 (Solution in PDF format through QR code)			175

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note: 1. * mark represents Textual question.

2. 🔔 symbol represents textual questions that need external reference for an answer.

3. Questions from NCERT textbook are represented with tag [NCERT].

4. Chapters 1 to 8 are a part of Precise Biology Vol. I, Std. XII (Sci.)

Scan the adjacent QR Code to know more about our ***"Model Question Papers with solutions"*** book for Std. XII (Sci.) and Gear up yourself to score more in the XII Board Examination.

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9 Control and Co-ordination

Contents and Concepts

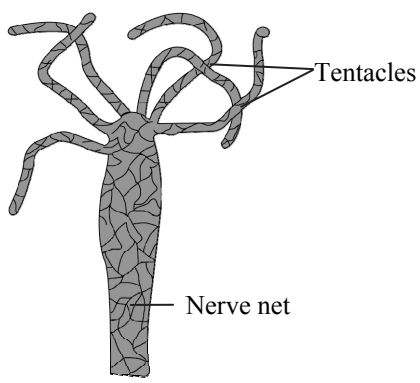
9.1 Nervous Co-ordination in Lower Animals
9.2 Neural Tissue
9.3 Synapse
9.4 Transmission of Nerve Impulse
9.5 Human Nervous System
9.6 Sensory Receptors
9.7 Disorders of Nervous System
9.8 Chemical Co-ordination
9.9 Endocrine System
9.10 Major Endocrine Glands

9.1 Nervous Co-ordination in Lower Animals

Q.1. Describe the nervous system in *Hydra*. Sketch and label the nerve net in *Hydra*. **[3 Marks]**

Ans:

i. *Hydra* (Cnidarian) shows diffused type of nervous system. It is the most primitive nervous system.
ii. Nervous system of *Hydra* consists of the **sensory cells** and the **nerve cells** (neurons) along with their fibres.
iii. The nerve cells are distributed throughout the body and inter-connected to each other by synapses between their fibres to form the **nerve net**.
iv. There are two nerve nets in the mesoglea of *Hydra*, one connected towards the epidermis and the other towards the gastro-dermis.
v. *Hydra* lacks specialized sense organs however, it has sensory cells scattered in the body wall and tentacles.
vi. The nerve cells have fibres but there are no sensory and motor nerves.
vii. In *Hydra*, the nerve impulses show no polarity or direction. This is because the sensory cells are activated at any point and from this point the impulse can be carried throughout the body in any direction, thus causing movements of the body or tentacles. **e.g.** Catching of prey during feeding.

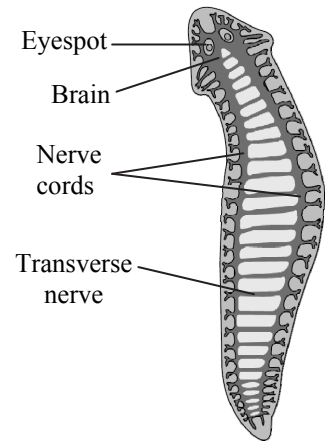


Nerve net in *Hydra*

Q.2. Comment on nervous system in *Planaria*. **[3 Marks]**

Ans:

i. *Planaria* (flatworm) belongs to phylum Platyhelminthes. It is among the most primitive animals which have developed central nervous system (CNS).
ii. The central nervous system of *Planaria* consists of **cerebral** or **cephalic ganglion** appearing like an inverted U shaped brain and **ventral nerve** cords (VNC) or long nerve cords.
iii. Cerebral ganglia lie in the anterior or head region. Each ganglion gives rise to nine branches towards the outer side.
iv. A pair of ventral nerve cords arises ventrally from below the ganglia. They are interconnected to each other in a ladder like manner by transfer nerve or commissure.
vi. The peripheral nerve plexus arise laterally from ventral nerve cord.
vii. The peripheral nervous system (PNS) includes sensory cells arranged in lateral cords in the body. Also, single sensory cells are scattered in the body.
viii. A pair of photosensory structures - eyes is present on the dorsal side of brain.



Ladder type nervous system in Flatworms e.g. *Planaria*

9.2 Neural Tissue

***Q.3. Match the organism with the type of nervous system found in them.** **[2 Marks]**

	Column I		Column II
i.	Neurons	a.	Earthworm
ii.	Ladder type	b.	*Hydra*
iii.	Ganglion	c.	Flatworm
iv.	Nerve net	d.	Human

Ans: i – d, ii – c, iii – a, iv – b

Q.4. Write a note on neural tissues. **[2/ 3 Marks]**

Ans:

i. The neural tissue consists of nerve cells or neurons and the neuroglia or glial cells.

ii. Outside the CNS, a nerve is a bundle of axons while inside the CNS it refers to tract.

iii. Nerves along with nervous organs constitute the nervous system of the higher animals and bring about control and coordination of various activities of the body.

iv. The types of nerves are sensory, motor or mixed (both sensory and motor fibres). The nerves arising from the cytons of the CNS travel throughout the body transmitting the nerves impulses to or from the CNS.

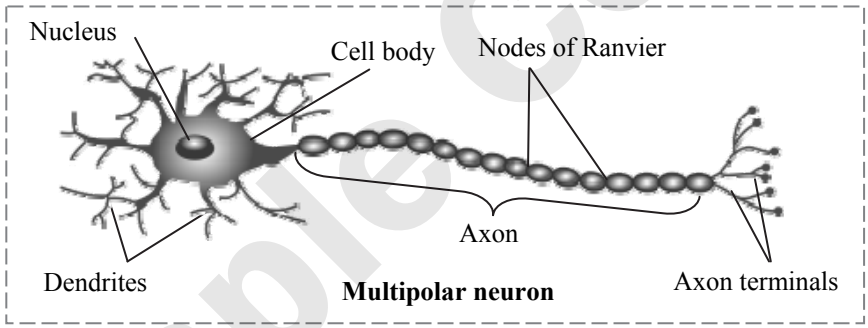
v. The receptors carry the sensory inputs towards the central nervous system. Central nervous system interprets the inputs carried to the CNS and then through the motor commands, the response is sent out.

Q.5. Name the structural and functional unit of nervous system. **[1 Mark]**

Ans: Neurons or nerve cells are the structural and functional units of the nervous system.

Q.6. Describe briefly the structure of multipolar neuron. **[3/4 Marks]**

Ans:



Multipolar neuron

i. Multipolar neuron has three parts - cyton or cell body, dendrons and axon.

a. Cyton:

1. It has a distinct central nucleus with a nucleolus and neuroplasm.
2. The cytoplasm of cyton contains neurofibrils, Nissl's granules and other cell organelles.
3. **Neurofibrils** play an important role in transmission of nerve impulse.
4. **Nissl's granules** are riboprotein components. They play an important role in the synthesis of the enzyme required for formation of the neurotransmitter.
5. The **cytons** are generally found inside the brain, spinal cord (CNS) and in the ganglia. The small groups of cytons inside the white matter of brain are called **basal nuclei**.

b. Dendrons:

1. These are small conical processes that arise from the cyton.
2. These are highly branched into fine dendrites.
3. Dendrons contain Nissl's granules and neurofibrils
4. They transmit messages towards the cyton.

c. Axon:

1. It is a single long, usually unbranched process arising from the cyton at the **axon hillock** (part of the cell body of a neuron that connects to the axon).
2. It consists of a bundle of neurofibrils, but lack Nissl's granules.
3. The axons carry the messages away from the cytons.

4. The axons may give out lateral branches called **collaterals**. The terminal branches of axon gives out branches called **telodendrons**.
5. The terminal branches attach to a muscle, gland, skin or telodendrites of another neuron.

ii. The connective tissue covering around the nerve fascicule is called **endoneurium**. Few nerve fascicles with endoneurium are surrounded by connective tissue, called **perineurium** and a still large bundle of nerves is covered on the outer side by **epineurium**. Blood is supplied to all the nerves to provide oxygen and nutrients.

iii. The interconnection between two neurons or neuron with motor organ is called **synapse**. It is usually **axo dendronic** or may be **axo-axonic, axo-somatic** or **dendro-dendronic.**

Q.7. Distinguish between medullated nerve fibre and non medullated nerve fibre. [2 Marks]

Ans:

	Medullated nerves	Non medullated nerves
i.	Nerves (bundle of axons) are covered by both medullary sheath and neurilemma.	Nerves (bundle of axons) are covered only by neurilemma.
ii.	Conduction of impulse in medullated nerves is 50 times faster than in non-medullated nerves.	Conduction of impulse in non-medullated nerve is slower than medullated nerves.
iii.	In medullated nerves, the insulating fatty myelin sheath prevents flow of ions between the axoplasm and extra cellular fluid.	They lack myelin sheath; hence the flow of ions cannot be prevented due to myelin sheath.
iv.	Saltatory conduction occurs through this nerve fibre.	Saltatory conduction does not occur through this nerve fibre.

Q.8. Write a short note on neuroglia. [2 Marks]

Ans:

i. Neuroglial cells are much greater in number than the neurons.

ii. The different types of neuroglial cells are oligodendrocytes, microglia or brain macrophages, astrocytes, satellite cells, ependymal cells and Schwann cells.

iii. These are supporting cells of the central nervous system and peripheral nervous system.

iv. Most of the supporting cells of the nervous system are derived from ectoderm.

Q.9. Describe the different types of neuroglial cells and their functions. [4 Marks]

Ans: Different types of neuroglial cells are as follows:

For diagram: *Refer Q.11*

i. Oligodendrocytes: They are found in central nervous system. These cells have few branches. Oligodendrocytes mainly form myelin sheath around the central axons, which form the white matter of CNS.

ii. Microglia or brain macrophages: These are small sized cells found in CNS with few branches. They are derived from monocytes and act as macrophages. They reach the site of injury, dead neurons and cell debris in the CNS. They mediate immune response in the CNS.

iii. Astrocytes: These are star shaped and the most abundant glial cells of CNS. They have varied roles in the brain, secretion and absorption of neural transmitter and maintenance of blood-brain barrier (BBB). They regulate the transmission of electrical impulses with the brain.

iv. Ependymal cells: They are found in CNS. These cells form single layer of squamous or columnar cells, often ciliated epithelial cells lining the ventricles or brain cavities and central canal of spinal cord. They are mainly responsible for production and probably also for circulation of CSF in brain ventricles and central canal.

v. Schwann cells: These are the most abundant glial cells of PNS. They produce myelin sheath around medullated nerves of PNS

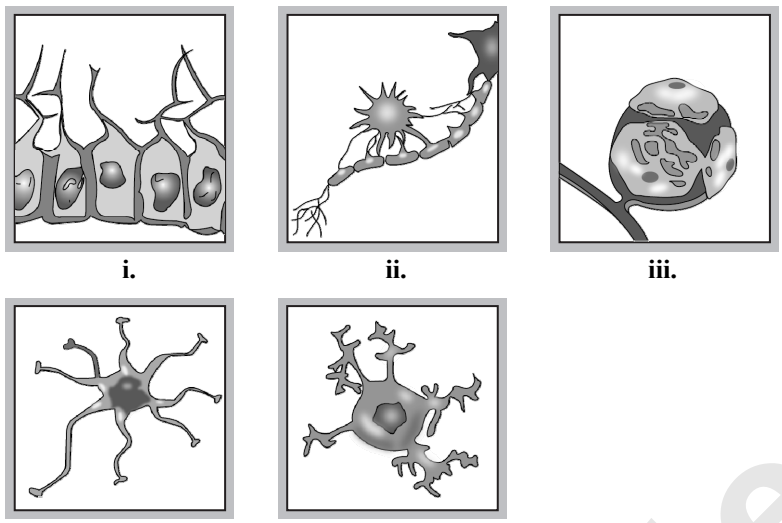
vi. Satellite cells: These cells are found in PNS. They support the functions of neurons.

[Note: *Ependymal cells are cuboidal to columnar cells arranged in single layer and possess microvilli and cilia.]*

Q.10. Give the significance of myelin sheath. [1 Mark]

Ans: Myelin sheath is an insulating sheath made up of protein and fatty substances which allows quick transmission of electrical impulses

Q.11. Identify the types of neuroglial cells (i-v). **[4 Marks]**



Types of Neuroglial cells

Ans: i. Ependymal cells ii. Oligodendrocytes iii. Satellite cells
iv. Astrocytes v. Microglia

Q.12. Differentiate between Neurons and Neuroglia. **[2 Marks]**

Ans:

	Neurons	Neuroglia
i.	Neurons transmit electrical signals that initiate action potential.	Neuroglia are supporting cells of nervous system.
ii.	Less in number as compared to neuroglia.	Far greater in number than the neurons.
iii.	They are also known as nerve cells.	They are also known as glial cells.

***Q.13. Complete the table.** **[2/ 3 Marks]**

Location	Cell type	Function
PNS	_____	Produce myelin sheath
PNS	Satellite cells	_____
_____	Oligodendrocytes	Form myelin sheath around the central axon
CNS	_____	Phagocytose pathogens
CNS	_____	Form the epithelial lining of brain cavities and central canal

Ans:

Location	Cell type	Function
PNS	**Schwann cells**	Produce myelin sheath
PNS	Satellite cells	**Support the function of neurons**
CNS	Oligodendrocytes	Form myelin sheath around the central axon
CNS	**Microglia or brain macrophages**	Phagocytose pathogens
CNS	**Ependymal cells**	Form the epithelial lining of brain cavities and central canal

Q.14. *List the properties of the nerve fibres. **[2/ 3 Marks]**

OR

Explain the properties of nerve fibres. **[Mar 22] [3 Marks]**

Ans:

i. **Excitability/Irritability:** Nerve fibres have polarized membrane, thus they have the ability to perceive stimulus and enter into a state of activity.

ii. **Conductivity:** It is ability of nerve to transmit impulses along the whole length of axon.

iii. **Stimulus:** It is any detectable, physical, chemical, electrical change in the external or internal environment which brings about excitation in a nerve/muscle/organ/organism. A stimulus must have a minimum intensity called **threshold stimulus,** in order to be effective. **Subliminal** (weak) stimulus will have no effect while **supraliminal** (strong) stimulus will produce the same degree of impulse as the threshold stimulus.

iv. **Summation effect:** A single subliminal stimulus will have no effect but when many such weak stimuli are given again and again they may produce an impulse due to summation of effects.

v. **All or none law:** The nerve will either conduct the impulse along its entire length or will not conduct the impulse at all. This occurs in case of subliminal or weak stimulus.

vi. **Refractory period**: It is the time interval (about millisecond) during which a nerve fails to respond to a second stimulus even if it is strong.

vii. **Synaptic delay:** The impulse takes about 0.3 to 0.5 milliseconds to cross a synapse. It is required for release of neurotransmitter from the axon terminal and excitation in the dendron of the next neuron.

viii. **Synaptic fatigue:** The transmission of nerve impulse across the synapse stops temporarily due to depletion of the neurotransmitter.

ix. **Velocity:** The rate of transmission of impulse is higher in long and thick nerves. It is higher in homeotherms than in poikilotherms. The velocity of transmission is higher in voluntary fibres (100 - 120 m/s in man) as compared to autonomic or involuntary nerves (10-20 m/s). In medullated nerve fibre, the velocity of transmission is higher as impulse has to jump from one node of Ranvier to the next.

9.3 Synapse

Q.15. Define the following terms: **[1 Mark Each]**

i. Pre-synaptic neuron

Ans: The neuron carrying an impulse to the synapse is called the pre-synaptic neuron.

ii. Post synaptic neuron.

Ans: The neuron receiving input at the synapse is the post synaptic neuron.

iii. Synaptic cleft

Ans: The intercellular space between two nerve cells.

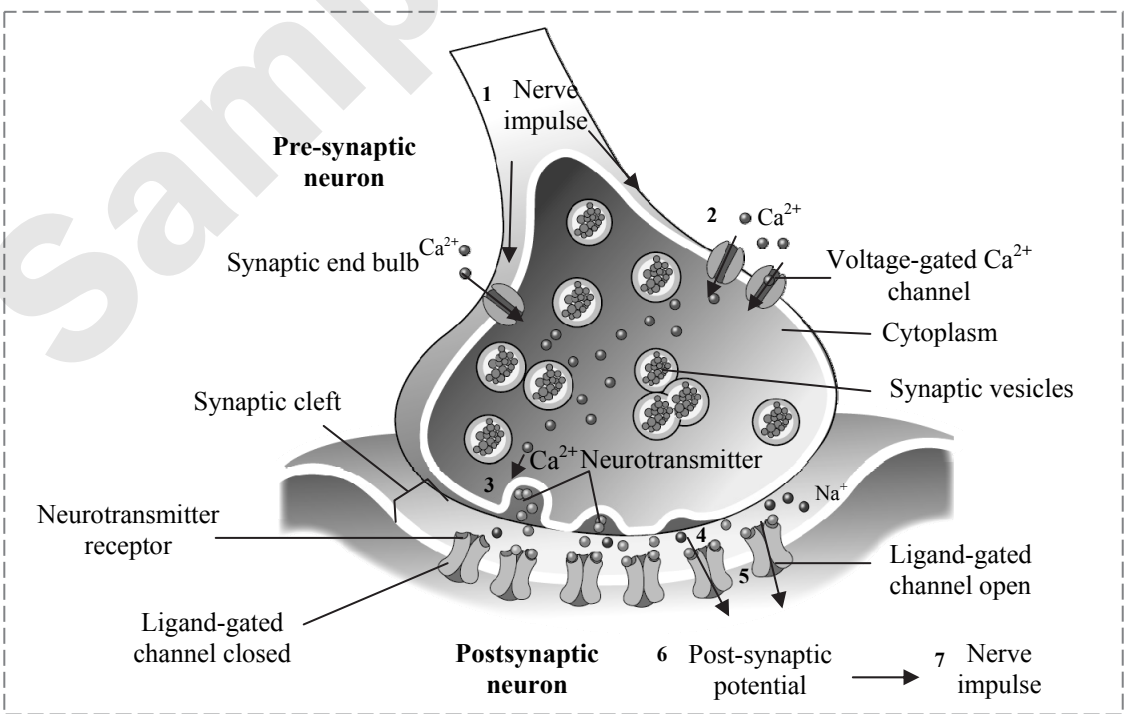
Q.16. What is the width of synaptic cleft? **[1 Mark]**

Ans: The width of the synaptic cleft is about 20 – 30 nm.

Q.17. What is synaptic transmission? **[1 Mark]**

Ans: The process by which the impulse from the pre-synaptic neuron is conducted to the post-synaptic neuron or cell is called synaptic transmission. It is a one way process carried out by neurotransmission.

***Q.18. Answer the questions after observing the diagram given below.**



i. What do the synaptic vesicles contain? **[1 Mark]**

Ans: Synaptic vesicles contain neurotransmitter molecules.

ii. What process is used to release the neurotransmitter? **[1 Mark]**

Ans: Neurotransmitter is released by the process of exocytosis.

iii. What should be the reason for the next impulse to be conducted? **[2/ 3 Marks]**

Ans:

a. When a neuron receives an impulse, it passes it to the next neuron. The impulse travels along the axon of the pre-synaptic neuron to the axon terminal.

b. Pre-synaptic neurons or axons have synaptic knobs at their ends or terminals. These synaptic knobs have synaptic vesicles which contain neurotransmitter molecules.

c. When the impulse reaches a synaptic knob, Ca^{+} channels open and Ca^{+} ions diffuse inward from the extracellular fluid.

d. This causes release of neurotransmitters which bind to the receptors of the post synaptic cell.

e. The neurotransmitter is destroyed by the enzyme cholinesterase. A new impulse/ next impulse is generated and conducted to the synaptic gap.

iv. Will the impulse be carried by postsynaptic membrane even if one pre-synaptic neuron is there? **[1/ 2 Marks]**

Ans: Yes,

a. A pre synaptic neuron when receives an impulse, releases a neurotransmitter into synaptic cleft which is required to cross the gap between axon terminal and next neuron.

b. For further transmission of impulse, a pre-synaptic neuron is required that initiates the release of neurotransmitters that facilitate the movement of impulses across synapses.

v. Can you name the channel responsible for their transmission? **[1 Mark]**

Ans: Ligand gated ion channel is responsible for the transmission of impulse.

Q.19. Write a note on synapse and elaborate on its types. **[2/ 3 Marks]**

Ans:

i. **Synaps**e is a junction between two nerve cells with a minute gap (synaptic cleft) in between them which allows transmission of impulse by a neurotransmitter bridge.

ii. It is point where the neurons communicate with one another.

iii. A **synaptic cleft** or a small intercellular space lies in between two cells having a width about 20-30 nm between them.

iv. Electrical synapse and chemical synapse are the two types of synapses:

a. Electrical synapse: In this type of synapse, the gap between the neighbouring neurons is narrow. The synapse between such closed neurons is mechanical.
An electrical conductive link is formed between the pre and post synaptic neurons. At the gap junction, the two cells are within almost 3.8 nm distance of each other. Transmission across the gap is faster but depends on the connection located at the gap junctions between the two neurons.
Electrical synapses are found in parts of body which require producing fastest response**. e.g.** Defence reflexes. They may be unidirectional or bidirectional (allows transmission of impulses in either direction).

b. Chemical synapse: These are specialized junctions through which the cells of the neural system send chemical signals to other neurons and to non-neuronal parts like gland and muscles. The synaptic gap in chemical synapse is 20-40 nm which is larger than that in electrical synapse. A chemical synapse between a motor neuron and a muscle cell is called a **Neuromuscular Junction**.
There are three components of a typical chemical synapse:

1. The pre-synaptic terminal (mostly axonic terminal)
2. The synaptic membrane of the post synaptic cell (usually on the dendrite of the next neuron/gland cell/ muscle)
3. The post synaptic neuron.

Q.20. Can you tell? *(Textbook page no. 189)*

Explain how is impulse transmitted through a synapse? **[2/ 3 Marks]**

Ans:

i. Chemical synapse between a motor neuron and a muscle cell is called a neuromuscular junction. It has three components - the pre-synaptic terminal (mostly axonic terminal), the synaptic membrane of the post synaptic cell (usually on the dendrite of the next neuron/gland cell/ muscle) and the post synaptic neuron.

ii. The impulse travels along the axon of the pre-synaptic neuron to the axon terminal. Pre-synaptic neurons have several synaptic knobs at their ends. These synaptic knobs have synaptic vesicles that contain neurotransmitter molecules.

iii. When an impulse reaches the synaptic knob, voltage sensitive Ca^{++} channels open and the Ca^{++} ions diffuse inward from the extracellular fluid.

iv. Increase in level of calcium ion concentration inside the cells initiates a series of events that fuse synaptic vesicles with the cell membrane of pre-synaptic neuron, where the neurotransmitters are released by exocytosis.

v. The released neurotransmitters bind to the receptors of the post-synaptic cell. The action of a neurotransmitter is either excitatory (turning a process on) or inhibitory (turning a process off) depending on the nature of the neurotransmitter involved.

vi. Once the impulse is transmitted across the synapse, the enzyme like cholinesterase destroys the neurotransmitter. The next impulse can now be formed.

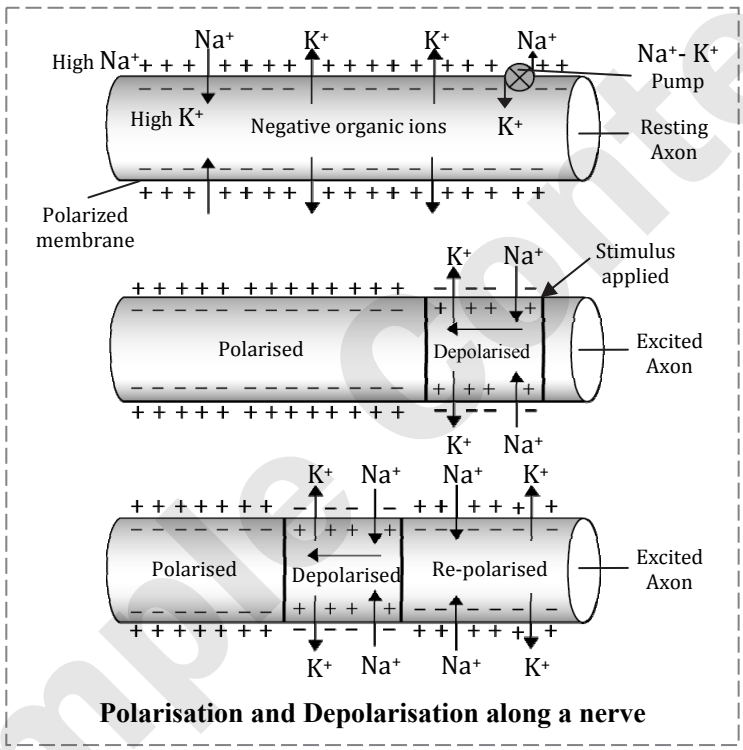
9.4 Transmission of Nerve Impulse

Q.21. Explain the process of transmission of nerve impulse. [4 Marks]

OR

What are the main steps of generation of nerve impulse? Explain in brief.

Ans:



Polarisation and Depolarisation along a nerve

i. The transmission of the nerve impulse along the long nerve fibre/ axon tube is a result of electrical changes across the neuronal membrane during conduction of an impulse.

ii. Each neuron has a charged cellular membrane with a voltage which is different on the outer and inner side of the membrane.

iii. The resting nerve remains in a polarised state by maintaining an excess of Na^+ on the outer side, whereas on the inner side there is an excess of K^+ along with large negatively charge protein molecules and nucleic acid.

iv. Application of stimulus on the resting nerve results in the increased permeability of the membrane to Na^+. Na^+ rush into the axon from the extracellular fluid (ECF) and bring about depolarisation.

v. The membrane potential changes from -70 mV (resting potential) to about +30 mV to +60 mV (action potential).

vi. Depolarisation is now triggered in the next part while the initial part itself starts undergoing repolarisation.

vii. After a short interval (refractory period), the large number of Na^+ on the inside causes a drop in permeability of membrane to Na^+ and simultaneously increasing the permeability to K^+ by opening the K^+ voltage gates and slowly closing the Na^+ gates. This is known as repolarisation.

viii. The K^+ ions diffuse out of the axon and the axoplasm inside of the membrane becomes negatively charged as compared to the ECF which becomes positively charged.

ix. The process of producing a wave of stimulation, causing depolarisation and repolarisation is repeated continuously upto the end of the axon terminal. This is a self-propagating process.

[Note: Scan the given Q. R. Code in *Quill - The Padhai App* to get conceptual clarity of transmission of nerve impulse with the aid of a relevant video.**]**

Q.22. Write a note on sodium potassium pump? [2 Marks]

Ans:

i. The ionic gradient across the resting plasma membrane is maintained by the sodium potassium pump.

ii. Sodium potassium pump gets operated when Na^+ gates are closed and K^+ gates are open as the permeability of the membrane for Na^+ decreases and that for K^+ increases.

iii. It actively transports 3 Na^+ outwards for 2 K^+ into the cell.

iv. It is an electrogenic pump.

***Q.23. Explain the process of conduction of nerve impulses up to development of action potential. [3 Marks]**

Ans: *Refer Q. 21 (i-v)*

Q.24. Transport pumps and gated ion channels can operate only in the nodes of Ranvier of medullated nerve fibres. Give reason. [2 Marks]

Ans:

i. Medullated nerve fibres have the insulating fatty myelin sheath.

ii. This myelin sheath prevents the flow of ions between the axoplasm and the extracellular fluid.
Thus, the transport pumps and ion gated channel operate only in the region where the myelin sheath is absent. i.e. nodes of Ranvier.

Q.25. What is saltatory conduction? [1 Mark]

Ans:

i. Saltatory conduction is the rapid passage of action potential along myelinated nerves from one node of Ranvier to the other.

ii. It occurs at the rate of 120 m/s.

9.5 Human Nervous System

Q.26. Explain the human nervous system. [3/ 4 Marks]

Ans: Nervous system in humans is well developed and complex.
It is classified into three parts: Central nervous system (CNS), Peripheral nervous system (PNS) and autonomic nervous system (ANS).

i. **Central Nervous System:** It consists of brain and spinal cord. It lies along the mid dorsal axis. Brain is enclosed within the brain box/cranium of the skull, whereas the spinal cord occupies the vertebral canal of the vertebral column.

ii. **Peripheral Nervous System (PNS):** It connects central nervous system to the different parts of the body having receptors and effectors. Depending on the connection to the CNS, the peripheral nerves are classified into afferent nerves and efferent nerves.
Efferent nerve fibres transmit sensory impulses from the tissues or organs to the CNS whereas afferent nerve fibres transmit regulatory or motor impulses from the CNS to the various peripheral tissues and organ.

iii. **Autonomous Nervous System (ANS):** It transmits impulses from CNS to the involuntary organs and smooth muscles of the body. ANS consists of peripheral nerves that regulate the activities of involuntary organs like cardiac muscles, smooth muscles, glands etc. In this, impulses are conducted from the Central Nervous system by an axon that synapses with an autonomous ganglion which is known as pre ganglionic neuron. The second neuron in this ganglionic pathway has an axon that extends from the autonomic ganglion to an effector organ and is known as postganglionic neuron. Autonomic nervous system consists of sympathetic and parasympathetic nervous system.

[Note:** According to the recent studies, ANS is included in PNS. PNS is divided into somatic nervous system and autonomic nervous system. The somatic nervous system relays impulses from CNS to the skeletal or voluntary muscles of the body.**]

Q.27. Describe the divisions of autonomic nervous system. [3/ 4 Marks]

Ans:

i. **Sympathetic Nervous System (SNS):**

a. It is also called thoraco-lumbar outflow.

b. It originates in the thoracic and lumbar region of spinal cord (T1 to L3) and consists of 22 pairs of sympathetic ganglia which lie on a pair of sympathetic cords on lateral sides of the spinal cord.

c. The pre-ganglionic nerve fibres are short and post ganglionic nerve fibres are long.
d. **Adrenaline** and **Nor-adrenaline** are produced at the terminal of postganglionic nerve fibres at the effector organ; hence it is also called adrenergic fibres.
e. Sympathetic nervous system controls body activities during emergencies (fight or flight response). It has excitatory and stimulating effect on most organs of the body except on the digestive and the excretory organs.

ii. Parasympathetic Nervous System:

a. It is also called cranio-sacral outflow.
b. Parasympathetic nervous system consists of the branches from the cranial (III, VII, IX, X) nerves, sacral (II, III) and spinal (IV) nerves. It consists of ganglia which are very close or within the wall of the effector organs.
c. The pre-ganglionic nerves are long and post-ganglionic nerves are short.
d. **Acetylcholine** is produced at the terminal end of postganglionic nerve at the effector organ, hence these are also called **cholinergic fibres**.
e. Parasympathetic nervous system is antagonistic to sympathetic nervous system. It brings all activities which are stimulated by the sympathetic system back to normal. Hence, it is also called housekeeping system.
f. It has an inhibitory effect on most organs. However, the activities like those associated with digestion, peristalsis and micturition, which are inhibited by sympathetic system, are thus accelerated by the parasympathetic system.

***Q.28. Krishna was going to school and on the way he saw a major bus accident. His heart beat increased and hands and feet become cold. Name the part of the nervous system that had a role to play in this reaction. [1 Mark]**

Ans: Sympathetic nervous system controls body activities during fight, fright or flight situations. It activates the release of hormones adrenaline and nor-adrenaline due to which the heart beat increases, hands and feet become cold.

***[Note:** The given textual question is included under Long Answer Questions in exercise but this question might be asked in Short Answer Questions. Hence, students are required to answer the question on the basis of marks allotted.]*

***Q 29. Distinguish between the sympathetic and parasympathetic nervous system on the basis of the effect they have on: i. Heart beat ii. Urinary Bladder [2 Marks]**

Ans:

	Sympathetic nervous system	Parasympathetic nervous system
Heart beat	Increases	Decreases
Urinary bladder	Inhibits bladder contraction	Stimulates bladder contraction

Q.30. Complete the table. [2 Marks]

Organ/ Region	Sympathetic nervous system	Parasympathetic nervous system
Arterial blood pressure	_____	_____
Blood vessels	_____	_____
Pupil of eye	_____	_____
Gastrointestinal movements	_____	_____
Bronchi	_____	_____

Ans:

Organ/ Region	Sympathetic nervous system	Parasympathetic nervous system
Arterial blood pressure	**Increases**	**Decreases**
Blood vessels	**Constricts**	**Dilates**
Pupil of eye	**Dilates**	**Constricts**
Gastrointestinal movements	**Retards peristalsis**	**Accelerates peristalsis**
Bronchi	**Constricts**	**Dilates**
Bile secretion	**Inhibits**	**Stimulates**
Secretion of adrenaline and nor adrenaline	**Stimulates**	**Inhibits**

Q.31. Enlist the meninges of human brain. [2 Marks]

Ans: Meninges are the protective membranes surrounding the brain and spinal cord. They are as follows:

i. Dura mater: It is the outermost tough, non-vascular, thick and fibrous meninx and is attached to the inner side of the cranium. Sub-dural space present between dura mater and arachnoid mater is filled with serous fluid

ii. Arachnoid mater: It is the middle, thin and non-vascular layer of connective tissue having web like appearance. Sub-arachnoid space is present between arachnoid mater and pia mater is filled with Cerebrospinal fluid (CSF).

iii. Pia mater: It is the innermost delicate, highly vascular membrane. It lies in close contact with the CNS.

***Q.32. Rakesh got hurt on his head when he fell down from his motorbike. Which inner membranes must have protected his brain? What other roles do they have to play? [2 Marks]**

Ans:

i. When Rakesh fell down from his motor bike the inner membranes called meninges protected his brain from injury.

ii. These meninges form a protective covering around the brain and spinal cord. They act as a shock absorber.

Q.33. What is cerebrospinal fluid? Enlist its functions. [3 Marks]

Ans:

i. Cerebrospinal fluid (CSF) is lymph like extra cellular fluid, secreted by the choroid plexuses of pia mater and ependymal cells lining the ventricles of brain and central canal of spinal cord.

ii. CSF is drained from brain to the outside into the blood stream by the three openings in the roof of medulla oblongata.

iii. CSF is slightly alkaline fluid with a specific gravity of 1.005.

iv. A total of 100 -120 cc of CSF is present in and around the CNS.

v. CSF is continuously generated by the ependymal cells lining the ventricles and central canal and simultaneoulsy drained out of the brain into the blood stream.

Functions of CSF:

i. The meninges and CSF act as a shock absorber and protect the brain and spinal cord from mechanical injuries.

ii. It also maintains constant pressure inside cranium.

iii. It helps in exchange of nutrients and wastes between blood and brain tissue.

iv. It helps in the supply of oxygen to the brain.

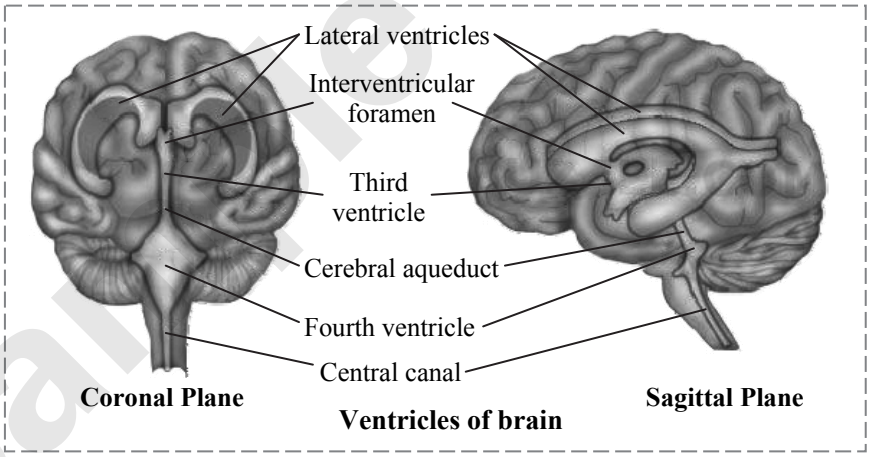
v. It protects the brain from desiccation.

Q.34. Sketch and label the diagram of ventricles of brain. [3 Marks]

OR

Sketch and label the diagram of brain to show ventricles in coronal plane. [July 22]

Ans:



Ventricles of brain

Q.35. Answer the following questions:

i. What is encephalology? [1 Mark]

Ans: The study of all aspects of brain is called encephalology

ii. Name the cavity which is continuation of IVth ventricle. [July 22]

Ans: Cavity of medulla.

Q.36. Describe the structure of forebrain. [3/ 4 Marks]

Ans: Forebrain consists of olfactory lobes, cerebrum and diencephalon.

i. Olfactory lobes (Rhinencephalon): These are highly reduced in human brain and covered by cerebrum from all sides except ventral. Each lobe consists of an olfactory peduncle and olfactory bulb.

ii. Cerebrum (Telencephalon):

a. It is a largest part of the brain, constituting about 85 % of total brain.

b. It is divided into right and left cerebral hemispheres by means of a deep median, long fissure. The two hemispheres are internally connected to each other by **corpus callosum**.

c. The outer surface of cerebrum is called **cerebral cortex,** which has outer thin region composed of grey matter and the deep inner part is **cerebral medulla**, which is composed of white matter.
d. The surface of each cerebral hemisphere is greatly folded by many convolutions or **gyri** and grooves called **sulc**i. These greatly increase total surface area for accommodation of the vast number of nerve cells.
e. Each cerebral hemisphere is further divided into four main lobes by three deep sulci:
1. **Parieto-occipital sulcus**: It separates the parietal lobe from occipital lobe.
2. The lateral or **Sylvian sulcus**: It demarcates the temporal lobe from the frontal and parietal lobes.
3. **Central sulcus**: It separates the frontal lobe from parietal lobe.
Since, these three sulci are not complete; the lobes are not clearly demarcated from each other. A fifth **median lobe** called insula or insular cortex is folded deep within the lateral sulcus.
f. The grey matter of cerebral cortex mainly consists of cell bodies of billions of neurons along with no medulated fibres and dendrons. The white matter mainly has axons of myelinated nerves.

iii. Diencephalon: It is the part of the forebrain that contains epithalamus, thalamus and hypothalamus. It lies below the corpus callosum and above the midbrain. It encloses a single cavity called third ventricle / diocoel which communicates with the two lateral ventricles of cerebrum through a narrow opening called **foramen of Monro**.

Q.37. Can you tell? *(Textbook page no 195)*
The functions of forebrain. **[2 Marks]**

Ans:
i. The forebrain plays an important role in processing of information related to cognitive activities, sensory and associative functions and voluntary motor activities.
ii. **Parts of forebrain and their function:**
a. Cerebrum: Sensory integration, control voluntary movements, speech and abstract thoughts
b. Thalamus: Relay centre between medulla and the cerebrum
c. Hypothalamus: *Refer Q.39 (iii)*

Q.38. Write a note on corpus callosum. **[2 Marks]**

Ans:
i. The two cerebral hemispheres are internally connected to each other by a thick band of nerve fibres called **corpus callosum**.
ii. Corpus callosum is typically seen in mammalian brain.
iii. It is the largest commissure of the brain.
iv. It has an anterior and posterior fold called **genu** and **splenium** respectively.

Q.39. Describe the parts of diencephalon in detail. Add a note on functions of hypothalamus. [4 Marks]
Ans: Diencephalon contains the epithalamus, thalamus and hypothalamus
i. Epithalamus:
a. It is the thin non-nervous roof of the diencephalon. It is fused anteriorly with the pia mater to form the anterior choroid plexus.
b. It is connected to pineal gland through a pineal stalk from its dorsal wall.
ii. Thalamus:
a. It is formed by lateral thick walls of diencephalon. Thalami mainly contain grey matter.
b. The **habenculor commissure** connects two thalami. Different parts of the brain are interconnected by the RAS (Reticular Activating System) through the thalami.
c. It is called relay centre as it transmits all sensory impulses except those of olfactory (smell) to the cerebrum.
d. The narrow cavity of diencephalon is called 3rd ventricle or **diocoel**. It connects anteriorly to the two lateral ventricles by a single opening called **Foramen of Monro** and posteriorly to the 4th ventricle or metacoel through a narrow duct of **Sylvius** or **iter**.
iii. Hypothalamus:
a. It is ectodermal in origin.
b. It forms the floor of the diencephalon.
c. It is richly supplied with blood vessels (Hypothalamo-hypophyseal portal vein) and helps in feedback mechanism for hormonal control. It maintains homeostasis, internal equilibrium of the body and involuntary behaviour control.
d. The hypothalamus also contains hypothalamic nuclei in its white matter with neuro-secretory cells involved in the production of hormones.

e. The hypothalamus is a link between the nervous and the endocrine system.
f. A complex neuronal circuit called the **limbic system** is formed by the hypothalamus, amygdala, parts of epithalamus and thalamus, hippocampus and other areas. It appears to be responsible for emotional reactions, motivational drives and memory.
g. The floor of the hypothalamus continues as a downward projection called **hypophyseal stalk** or **infundibulum** which connects it to the hypophysis (pituitary gland) both physically and functionally by secretion of neurotransmitters.
h. The inferior surface of hypothalamus also bears the **optic chiasma** (crossing of the two optic nerves) and a pair of mammillary bodies (unique to mammalian brain and responsible for recollective memory).

Functions of hypothalamus:

a. It regulates heart rate, respiration, blood pressure (B.P.), body temperature, water and electrolyte balance.
b. It has centres for hunger, thirst, sleep, fatigue, satiety centre, secretion of glands of stomach and intestine. It also produces neurohormones that stimulate the pituitary gland.
c. Major function of hypothalamus is maintaining homeostasis.
d. It controls the secretory activity of pituitary gland by releasing and inhibiting hormones.

Q.40. What are basal ganglia? **[2 Marks]**

Ans:

i. Basal ganglia or basal nuclei are grey masses present within the white matter or lying on the lateral sides of thalamus.
ii. The basal ganglia or nuclei of cerebrum receive neurotransmitters from various parts.
iii. They help the cortex in the execution of activities at the subconscious level**. e.g.** Writing slow or rapid typing.
iv. The largest basal nucleus known as corpus striatum, is located at the floor of cerebrum.

Q.41. Describe the functional areas of cerebrum. **[3 Marks]**

Ans: Cerebrum shows all three types of areas – sensory, motor and association area.

Following are the functional areas of cerebrum:

i. **Frontal lobes:** They have motor area which controls voluntary motor activities or movements of muscles. The centre for expression of emotions, intelligence, will power, memory, personality areas are located in the frontal lobe**.**

The **premotor area** is higher centre for involuntary movements and autonomous nervous system. **Association area** is for coordination between sensation and movements.

Broca's area /motor speech area is the motor speech area and translates thoughts into speech and controls movement of tongue, lips and vocal cords.

ii. **Parietal lobes:** They are mainly for somaesthetic sensation of pain, pressure, temperature, tastes (gustatoreceptor).

iii. **Temporal lobes:** It contains centres for smell (olfactory), hearing (auditory), speech and emotions.

iv. **Occipital lobes:** They have visual area mainly for sense of vision.

Wernicke's area or intelligence centre is the area of contact between temporal, parietal and occipital lobes It is the sensory speech area responsible for understanding and formulating written and spoken language.

[Note: Scan the given Q. R. Code in *Quill - The Padhai App* to get conceptual clarity with the aid of a relevant video.**]**

Q.42. Can you tell? *(Textbook page no. 195)*

About the midbrain. **[2/ 3 Marks]**

Ans:

i. Midbrain is located between diencephalon and the pons varolli.
ii. It contains the cerebral aqueduct or iter that connects the third and fourth ventricles.
iii. The **corpora quadrigemina** are four rounded elevations on the dorsal surface of the mid brain. The two superior colliculi are involved in visual reflexes and the two inferior colliculi are relay centres for auditory reflexes that operate when it is necessary to move the head to hear sounds more distinctly.
iv. The mid brain also contains on its inferior surface two thick fibrous tracks called cerebral peduncles or **crura cerebri**.
v. The tracts of ascending and descending nerve fibres from RAS (Renin Angiotensin system) connect the cerebrum and mid brain.
vi. Near the centre of the mid brain is a mass of grey matter scattered within the white matter. It is called the **red nucleus.** It plays an important role in controlling posture and muscle tone, modifying some motor activities and motor coordination.

***Q.43. What is the function of red nucleus?** **[1 Mark]**

Ans: *Refer Q.42(vi)*

***Q.44. What is the importance of corpora quadrigemina?** **[1 Mark]**

Ans: *Refer Q.42(iii)*

Q.45. Describe hind brain and give its functions. **[4 Marks]**

Ans: The posterior region of the brain is called hind brain. It consists of pons varolli, cerebellum and medulla oblongata.

i. Pons varolli:

a. It appears as a rounded bulge on the underside of the brain stem and contains a cross band of nerve fibres connecting cerebrum, cerebellar lobes, medulla oblongata and spinal cord.

b. It also contains several nuclei.

ii. Cerebellum:

a. It is the second largest part of the brain and consists of two lateral hemispheres and a central vermis.

b. It is composed of white matter with a thin layer of grey matter, the cortex.

c. The white matter intermixes with the grey matter and shows a tree-like pattern called **arbor vitae.**

d. The surface of cerebellum shows convolutions (gyri and sulci) a number of nuclei lie deep within each lateral or cerebellar hemisphere.

e. Over 30 million neurons lie in the cortex.

f. Three pairs of myelinated nerve bundles called cerebullar penduncles connect cerebellum to the other parts of CNS.

g. **Functions:**

1. It is an important centre which maintains equilibrium of body, posture, balancing orientation, moderation of voluntary movements, maintenance of muscle tone.
2. It is a regulatory centre for neuromuscular activities and controls the rapid activities like walking, running, speaking etc.
3. All activities of cerebellum are involuntary (though may involve learning in early stages).

iii. Medulla oblongata:

a. It is the posterior conical part of the brain and continues as the spinal cord.

b. It has inner grey matter and outer white matter.

c. Its roof has the posterior choroid plexes for secretion of CSF.

d. The posterior choroid plexes also shows three openings - a pair of lateral foramen of Luschka and a median foramen of Magendie.

e. **Functions:**

1. It controls involuntary vital functions like heart beat, respiration, vasomotor activities and peristalsis.
2. It also controls non vital reflex activities like coughing, swallowing, sneezing, vomiting, yawning, etc.

[Note: Scan the given Q. R. Code in *Quill - The Padhai App* to get conceptual clarity with the aid of a relevant video.**]**

Q.46. What does brain stem consist of? **[1 Mark]**

Ans: Brain stem consists of mid brain, pons and medulla**.**

***Q.47. What does the cerebellum of brain control?** **[1 Mark]**

Ans: *Refer Q.45 (ii)*

***Q.48. Give reason - Injury to medulla oblongata may prove fatal.** **[2 Marks]**

Ans:

i. Medulla oblongata is a part of brain stem.

ii. It controls involuntary vital functions like heartbeat, respiration, vasomotor activities and peristalsis.

iii. It also controls non vital reflex activities like coughing, sneezing, swallowing, vomiting, yawning etc.

iv. Thus, damage or injury to medulla oblongata may disrupt these vital functions.

Therefore, injury to medulla oblongata may prove fatal.

Q.49. Can you tell? *(Textbook page no. 195)*

Distinguish between Cerebrum and Cerebellum. **[2 Marks]**

Ans:

No.	Cerebrum	Cerebellum
i.	It is the largest part of the brain	It is the second largest part of the brain.
ii.	Cerebrum is the part of forebrain.	Cerebellum is the part of hindbrain.
iii.	The cerebrum co-ordinates the functions of the sensory and motor areas.	It is an important centre which maintains body equilibrium, posture, balancing orientation, moderation of voluntary movements, etc.
iv.	It has less number of neurons as compared to cerebellum.	It has more number of neurons as compared to cerebrum.

Q.50. Match the Columns: **[2 Marks Each]**

i.

	Column I		Column II
a.	Prosencephalon	1.	Midbrain
b.	Mesencephalon	2.	Hindbrain
c.	Rhombencephalon	3.	Forebrain

ii.

	Column I (Functional areas of cerebrum)		Column II (Functions)
a.	Association area	1.	Co-ordination between sensation and movements
b.	Broca's area	2.	Responsible for understanding and formulating written and spoken language
c.	Wernicke's area	3.	Translates the thoughts into speech

Ans:

i. a – 3, b – 1, c – 2 ii. a – 1, b – 3, c – 2

Q.51. Explain the structure and functions of spinal cord. **[4 Marks]**

Ans:

i. Spinal cord is the part of central nervous system and forms the lower extension of the medulla oblongata of the brain.
ii. It is covered and protected by bony covering and membranes.
iii. It lies within the neural canal of the vertebral column and is surrounded by three meninges - dura mater, arachnoid mater and pia mater.
iv. The Cerebro Spinal Fluid (CSF) forms a fluid cushion around the spinal cord and within it inside the central canal.
v. The spinal cord externally appears as long cylindrical rod. Its length is 42-45 cm and 2 - 2.5 cm broad. It is broadest at its anterior end.
vi. Spinal cord gradually tapers into **conus medullaris** (L1 to L2) and posteriorly continues as a thread-like filum terminale.
vii. Spinal cord shows two swellings along its length called cervical and lumbar swelling.
viii. From the lateral sides of the spinal cord, 31 pairs of spinal nerves arise. These nerves are concentrated in the region of cervical and lumbar swelling and around the conus medullaris.
ix. The bunch of nerves in the hind part of the spinal cord, along with the filum terminale, appears like a horse's tail, thus it is known as **cauda equina**.

Functions of spinal cord:

a. The spinal cord is the main centre for the most reflex actions.
b. It provides pathway for conduction of sensory and motor impulses to and from the brain.
c. It provides nervous connection to many parts of the body.

Q.52. Describe the T.S. of spinal cord. **[Oct 15] [3 Marks]**

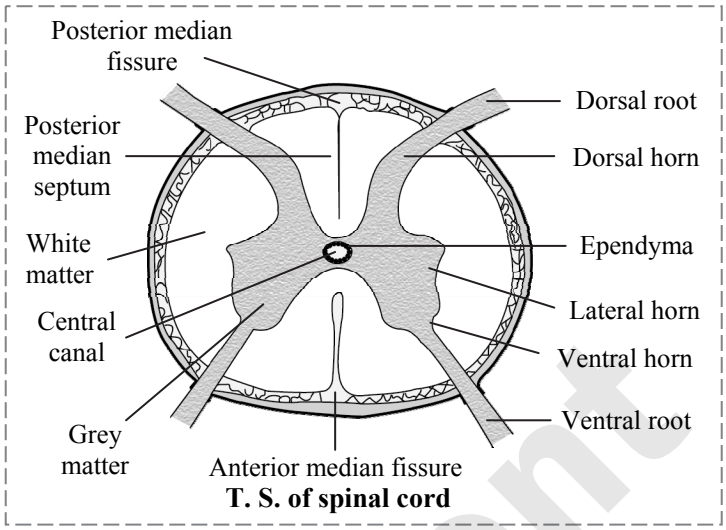
Ans:

i. The spinal cord is dorso-ventrally flattened due to the presence of deep, narrow posterior fissure and shallow, broad anterior fissure. The fissures divide the spinal cord incompletely into a right and left side.
ii. The fissures divide the grey matter into six horns, namely dorsal, lateral and ventral horns while the white matter is divisible into 6 columns or funiculi, namely dorsal, lateral and ventral funiculi.
iii. The H-shaped or butterfly shaped grey matter is on the inner side, while the white matter is on the outer side.
iv. The dorsal and ventral horns extend out of the spinal cord as dorsal root and ventral root of spinal cord respectively.

v. The dorsal root is connected to the dorsal root ganglion (lies just outside and lateral to the spinal cord). It has an aggregation/collection of unipolar sensory neurons.

vi. A central canal can be seen in the centre.

vii. The association or inter-neurons lie inside the grey matter. They receive signal from the sensory nerve, integrate it and direct the response towards the motor neurons lying towards the ventral horn. The lateral horns have neurons of autonomic nervous system (ANS). The nerves arising from these neurons emerge out from the ventral root of spinal nerve.



T. S. of spinal cord

viii. The white matter consists mainly of bundles of myelinated nerve fibre called ascending and descending tracts. The ascending tracts conduct sensory impulses from spinal cord to the brain and these lie in the dorsal column/funiculi. The descending tracts conduct motor impulses from brain to the lateral and ventral funiculi of spinal cord.

Q.53. Write a note on Peripheral Nervous System. [2/ 3 Marks]

Ans:

i. The peripheral nervous system connects the central nervous system (brain and spinal cord) to the different parts of the body having receptors and effectors.

ii. For location: *Refer Q.26(ii)*

iii. Depending on the connection to the CNS, the peripheral nerves are classified into two main types – Cranial nerves and Spinal nerves.

iv. Cranial nerves originate from or terminate into the brain. These nerves develop from the brain, in all amniotes (reptiles, birds and mammals). Spinal nerves originate from the spinal cord. They are mixed nerves and provide two-way connection between spinal cord and of the upper and lower limbs, neck and trunk.

v. There are 12 pairs of cranial nerves and 31 pairs of spinal nerves. Cranial nerves are classified as sensory (I, II, VIII), motor (III, IV, VI, XI, XII) and mixed (V, VII, IX, X) nerves, according to their functions.

Q.54. Distinguish between Cranial Nerves and Spinal Nerves. [2 Marks]

Ans:

	Cranial nerves	Spinal nerves
i.	These nerves originate from or terminate into the brain.	These nerves originate from the spinal cord.
ii.	There are 12 pairs of cranial nerves.	There are 31 pairs of spinal nerves.
iii.	They are sensory, mixed or motor nerves.	They are mixed nerves
iv.	They are classified based on their origin.	They are classified based on the location from which they branch i.e. C1 – C8, T1 – T12, L1- L5, S1 – S5, Co1

Q.55. Write an account of cranial nerves and spinal nerves. [4 Marks]

Ans: Cranial nerves:

These nerves arise from or terminate into the brain.

There are 12 pairs of cranial nerves in man as shown in the table given below:

No.	Name	Origin	Organs Innervated	Type	Functions
I	Olfactory	Olfactory bulb	Epithelium of nose	Sensory	Smell
II	Optic	Side of diencephalon	Retina of eye	Sensory	Vision
III	Occulomotor	Floor of mid brain	Eye muscles (4 of 6 eye muscles)	Motor	Movement of eye ball.
IV	Pathetic	Floor of midbrain	Eye muscles (1 of 6 eye muscles, forehead scalp)	Motor	Rotation and movement of eye ball.

V	Trigeminal (Largest cranial nerve) (Dentist's nerve) a. Ophthalmic b. Maxillary c. Mandibular	Ventral side of pons	- Nasal cavity, upper eyelids, forehead, scalp, conjunctiva, lacrimal gland, scalp Mucosa of nose, palate, upper teeth, upper lip, lower eyelid, parts of pharynx Lower teeth, skin over mandible cheek, side of head in front ear, muscles of mastication	Mixed Sensory Sensory Mixed	Sensation of skin touch, taste, jaw movement
VI	Abducens (Smallest cranial nerve)		Muscles of eye ball, lateral rectus muscle	Motor	Movement of eye
VII	Facial (bearing geniculate ganglion)		facial, scalp and neck muscles, lacrimal, sublingual, submandibular, nasal and palatine glands	Mixed	Facial expressions, Movement of neck, secretion of tears, taste, salivary secretion
VIII	Auditory (Vestibulocochlear) a. Vestibular b. Cochlear		Internal ear	Sensory	Hearing and equilibrium
IX	Glosso-pharyngeal	Side of medulla oblongata	Pharynx, tongue, salivary glands	Mixed	Taste, salivation and swallowing
X	Vagus (Pneumogastric) Only nerve that passes into the body and innervates internal organs, has maximum number of branches and longest distribution	Side of medulla oblongata	Larynx, trachea, pharynx, alimentary canal, heart, lungs, pancreas, blood vessels	Mixed	Visceral sensations and visceral movements like breathing cardiac, slowing, gastric and pancreatic secretion, gastrointestinal hormones
XI	Spinal accessory	Side of medulla oblongata	Neck and shoulder muscles, reflexes of thoracic and abdominal viscera, larynx, pharynx	Motor	Movements of pharynx, larynx, neck and shoulder
XII	Hypoglossal	Side of medulla oblongata	Muscles of tongue	Motor	Movement of tongue

Spinal nerves:

These nerves arise from spinal cord and are of mixed type in nature.

There are 31 pairs of spinal nerves as shown in the table given below:

No.	Group	No. of Pairs	Region of origin from vertebral column
i.	Cervical	8 (C1-C8)	Neck
ii.	Thoracic	12(T1-T12)	Thorax
iii.	Lumbar	5(L1-L5)	Abdomen
iv.	Sacral	5(S1-S5)	Pelvis
v.	Coccygeal	1(Co1)	Coccyx

Q.56. Match the following. **[2/ 3 Marks]**

	Column I (Cranial nerves)		Column II (Origin of Cranial nerves)		Column III (Functions of cranial nerves)
i.	Occulomotor	a.	Side of medulla oblongata	1.	**Visceral sensation and visceral movements**
ii.	Vagus	b.	Floor of midbrain	2.	**Smell**
iii.	Olfactory	c.	Ventral side of Pons	3.	**Sensation of touch**
iv.	Trigeminal	d.	Olfactory bulb	4.	**Movement of eyeball**

Ans: (i – b – 4), (ii – a – 1), (iii – d – 2), (iv – c – 3)

Q.57. Answer the following questions:

i. Give the names of III, V, IX and XII cranial nerves. **[2 Marks]**

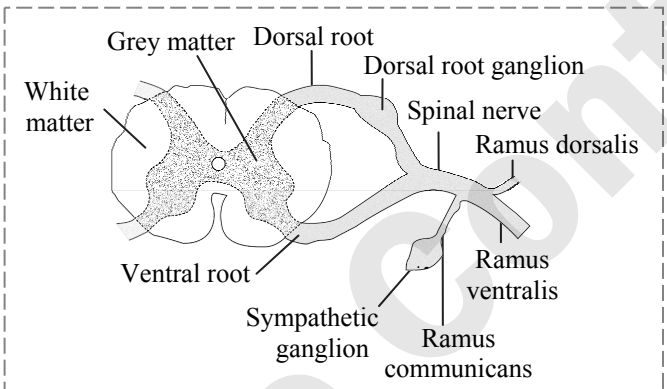
Ans: *Refer Q.55.*

ii. State the other name for Dentist's nerve. **[July 22] [1 Mark]**

Ans: Other name for Dentist's nerve: Trigeminal nerve.

Q.58. With the help of a neat labelled diagram, explain the formation of spinal nerves. **[3/ 4 Marks]**

Ans:



Formation of Spinal Nerve

i. Each spinal nerve is formed inside the neural canal of vertebral column by two roots - the posterior or dorsal sensory root and anterior or ventral root.

ii. Anterior root receives the sensory nerve from the dorsal root ganglion (cell bodies of sensory neurons are located in the ganglion), while the anterior/ventral root gives out the motor nerve.

iii. The dorsal sensory and the ventral motor nerves together form the mixed spinal nerve. It emerges out from both sides of the spinal cord through the inter-vertebral foramen.

iv. Spinal nerves emerging from vertebral column immediately divide into three branches, namely ramus dorsalis, ramus ventralis, and ramus communicans.

- **a. Ramus dorsalis:** from skin and to muscles of dorsal side
- **b. Ramus ventralis:** the largest of the three, supplies the organs and muscles on lateral and anterior side.
- **c. Ramus communicans:** the smallest of the three and given out from 1st thoracic up to 3rd lumbar (L3) spinal nerve. It joins the sympathetic ganglia.

Reflex action

Q.59.Define reflex action and reflex arc. **[2 Marks]**

Ans:

i. Reflex action is a sudden, spontaneous automatic, involuntary response to stimulus. The response to stimulus is said to be involuntary as it is carried out without any conscious effort by the brain.

ii. The path along which the reflex action is carried out is called reflex arc.

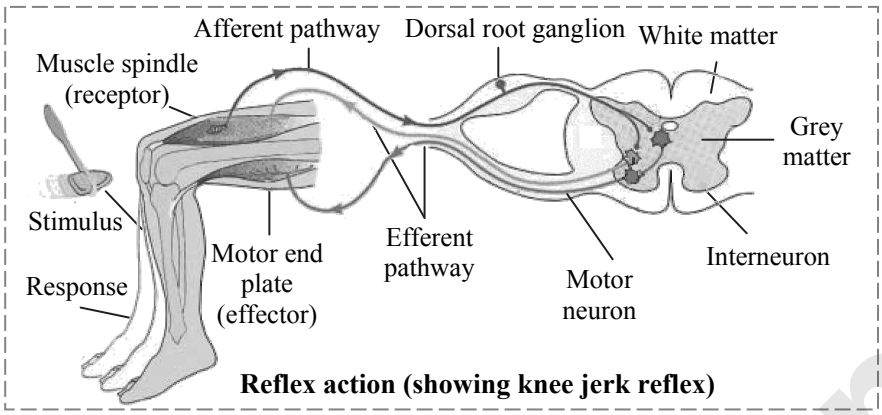
***Q.60. Explain the Reflex Pathway with the help of a neat labelled diagram.** **[4 Marks]**

Ans:

i. The reflex pathway comprises of at least one afferent neuron (receptor) and one efferent (effector or excitor) neuron appropriately arranged in a series.

ii. The afferent neuron receives signal from a sensory organ and transmits the impulse via a dorsal nerve root into the CNS (at the level of spinal cord).

iii. The efferent neuron then carries signals from CNS to the effector. The stimulus and response thus forms a reflex arc as shown below in the knee jerk reflex.



Reflex action (showing knee jerk reflex)

Q.61. Explain the types of reflex action. **[3 Marks]**

Ans: Different type of reflex actions:

i. On the basis of control over the actions -

a. Cranial reflexes: They are carried out by brain. These are slow action response.
e.g. Watering of mouth on sight or smell of good food.

b. Spinal reflexes: They are carried out through spinal cord. These are quick acting response.
e.g. Withdrawal of leg while stepping on something hot or pointed.

ii. Based on previous experiences -

a. Unconditional reflexes: These do not require any previous experience
e.g. Sneezing, coughing, yawning, hiccupping.

b. Conditional reflexes: These actions are based on previous experience. Initially these actions are voluntary when learning is being done; later after perfection they become involuntary.
These were first studied by E. Pavlov on salivation in dog (at the sight and sound of bell)
e.g. Swimming, dancing, cycling, etc.

iii. According to number of synapses involved -

a. Simple monosynaptic: It involves only sensory and motor neurons.
e.g. Knee jerk reflex

b. Complex polysynaptic reflexes: It involves sensory neurons, inter-neurons and motor neurons.
e.g. Cycling, swimming, etc.

9.6 Sensory receptors

Q.62. Define receptors. Enlist different types of receptors. **[3 Marks]**

Ans: Sensory receptors are some specialized structures in the body to receive the various stimuli from the external or internal environment.
Receptors are classified on the basis of their location, function and their sensitivity to specific stimuli.

i. Exteroceptors:
They receive stimuli directly from the external environment.
Various types of exteroceptors are given below:

No.	Type	Location	Function
a.	Mechanoreceptors	Skin	Sensitive to mechanical stimuli like touch, pain, pressure, deep pressure, etc.
b.	Thermoreceptors	Skin	Receives sensory stimuli for heat (caloreceptors) and cold
c.	Chemoreceptors 1.Gustatoreceptors 2.Olfactory receptors	Taste buds of tongue Olfactory epithelium of Nose	Sensitive to taste of sweet, salt, sour, bitter and umami Sensitive to about 10,000 different smells
d.	Statoreceptors	Internal ear-semicircular canals	Receptors for maintaining balance and equilibrium
e.	Photoreceptors	Retina of the eye	Receives sensory stimuli for vision
f.	Phonoreceptors	Internal organ – Organ of corti	Sound reception

ii. Interoceptors: They receive stimuli coming from within the body.
Various types of interoceptors are given below:

No.	Type	Location	Function
a.	Proprioceptors	Joints, muscles and tendons	Detect changes in the movements of joints, tendons and muscles; pain, tension and sensitive to vibrations
b.	Enteroceptors	From internal body organs	Sensitive to stimuli coming from internal organs like hunger, thirst, pain, osmotic change
c.	Baroreceptors (These are also considered as mechanoreceptors, receiving signals from internal organ)	Present in walls of atria, venae cavae, aortic arch, carotid sinus	Sensitive to changes in blood pressure so as to restore homeostasis through vasodilation or vasoconstriction

***Q.63. How does tongue detect the sensation of taste? [1 Mark]**
Ans: Tongue detects the sensation of taste due to gustatoreceptors.

Q.64. Give the role of statoreceptors. [1 Mark]
Ans: *Refer Q.62 (i-d)*

Q.65. Where are baroreceptors located? [1 Mark]
Ans: *Refer Q.62 (ii-c)*

Sense organs

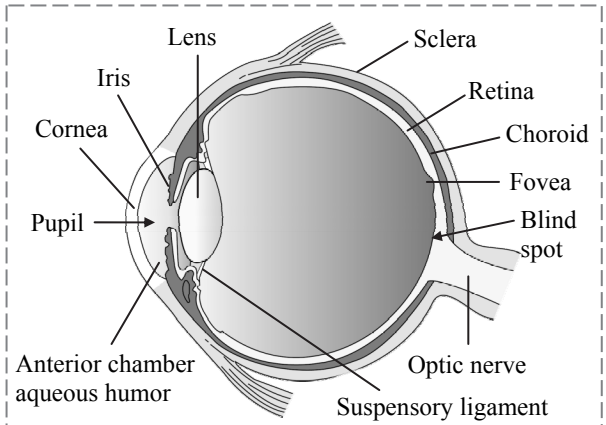
Q.66. Describe the different parts of human eye. [4 Marks]
Ans: Eyes are a pair of sensory organs of vision. They are protected by bones, eyebrows, upper and lower eyelids with eyelashes and the lacrimal / tear glands. Movement of the eyeball within the orbit is controlled by 6 sets of muscles.
Each human eyeball is nearly spherical and formed of three layers: Sclera, choroid and retina

i. Sclera/ Sclerotic:
a. It is the outermost layer made of dense fibro-elastic connective tissue with collagen fibres. The sclera is provided with blood vessels.
b. It provides attachment to the eyeball muscles.
c. The anterior thick, transparent part of sclera is **cornea**. It is slightly bulged out for focussing light on the retina.
d. Cornea is nourished by aqueous humour and also by lacrimal secretion. It lacks blood vessels.
e. The exposed part of sclera and the entire cornea are covered by a transparent membranous covering called **conjunctiva**.

ii. Choroid/ Uvea: It is the middle, vascular and pigmented layer. It is not a complete layer and can be divided into 3 regions – Choroid proper, ciliary body and iris

a. The choroid proper:
1. It lines the sclera. It is pigmented and thus it prevents internal reflection. The blood vessels of choroid provide nutrition and oxygen to the retina.

b. Ciliary body:
1. It is a thick, muscular, ring like structure at the junction of choroid and iris. Its epithelium secretes **aqueous humor**.
2. Attached to the ciliary body are suspensory ligaments which hold the lens. The ligaments and muscles of the **ciliary body** help in the adjustment of the size of lens.



Eye

c. Iris:
1. At the junction of the sclera and cornea, the vascular part of choroid sharply bends into the cavity of eyeball, forming a thin and coloured partition called **iris**. It is perforated in the middle by an aperture called **pupil**.
2. Smooth muscles of the iris help in regulating the size of pupil depending on the intensity of light entering the eyeball. The pigment in the iris determines the colour of the eye.

3. **Lens** is a transparent, elastic, biconvex structure. It is suspended in the eyeball by the suspensory ligaments. Lens make fine adjustments to bring a sharp focus on retina.
4. The lens and suspensory ligaments divide the cavity of the eyeball into a small anterior aqueous chamber, filled with a clear watery fluid aqueous humor and a posterior large vitreous chamber, filled with a jelly like **vitreous humor**. It maintains shape of the eyeball and maintains pressure for keeping the lens in position

iii. Retina:

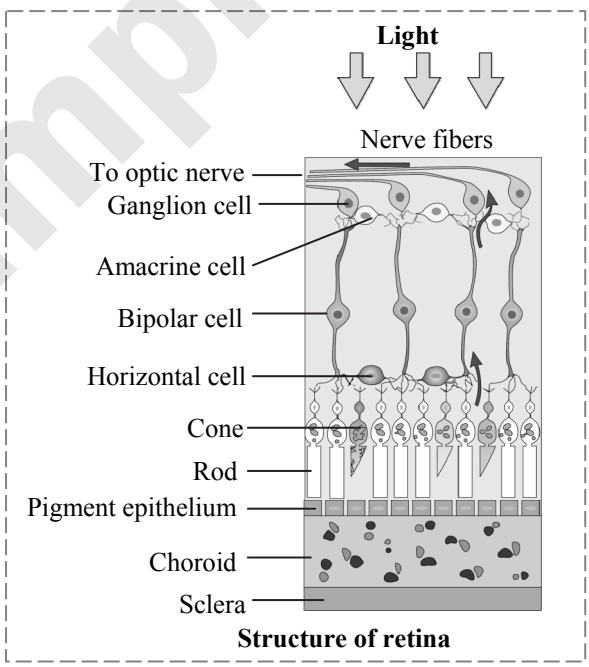
a. It is the innermost, delicate, non-vascular light sensitive layer.
b. It has 2 regions - Single layer of pigmented non sensory part lining the iris and ciliary body, sensory part lining the choroid.
c. It has an outer pigmented part and an inner nervous part.
d. The inner nervous part is transparent and made of 3 layers - outer photosensitive layer made of rod and cone cells, middle layer of bipolar nerve cells and inner layer of ganglion cells.
e. The nerve fibres from the basal end of the ganglion cells collectively form the optic nerve.
f. The **blind spot** is an area diagonally opposite to the lens. It is the area of retina from where the optic nerve and blood vessels leave the eyeball. There are no rod and cone cells in this region. An area, lateral to the and above the blind spot is called yellow area or **macula lutea**. At its centre, is a depression called **fovea centralis**. It has maximum density of cone cells and is the point with sharpest vision.
g. The rod and cone cells lie deep in the retina, so that light has to pass through the ganglion and bipolar cells before reaching them.
h. Retina contains **photoreceptor cells:** These are of two types - Rod cells and cone cells.They contain light sensitive proteins termed as photopigments.
i. The cones are responsible for daylight (photopic) vision and colour vision. While the rods function in dim light (Scotopic) vision. The purple red protein called **rhodopsin** is present in the rods which is vitamin A derivative.
j. The cones are of three types, which contain their own characteristic photo-pigments that respond to red, green and blue lights. Various combinations of these cones and their photopigments produce sensation of different colours. The sensation of white light is produced due to the simultaneous equal stimulation of these three types of cones

Q.67. What is a blind spot? **[1 Mark]**

Ans: *Refer Q.66 (iii –f)*

Q.68. Describe the structure of retina with the help of neat and labelled diagram. **[2/3 Marks]**

Ans: *For explanation*: *Refer Q.66 (iii)*



Structure of retina

Q.69. What is the accommodation power of the lens? **[1 Mark]**

Ans: The ability of the lens by which the light rays from far and near objects is focussed on the retina is called accommodation power of lens.

Q.70. Where is the highest density of cone cells in the retina? **[1 Mark]**
Ans: The highest density of cone cells is in the fovea centralis of the retina.

Q.71. Write a note on photoreceptor cells. **[2 Marks]**
Ans: *Refer Q.66(iii-h, i and j)*

Q.72. Name the protein present in the rods of retina. **[1 Mark]**
Ans: Rhodopsin

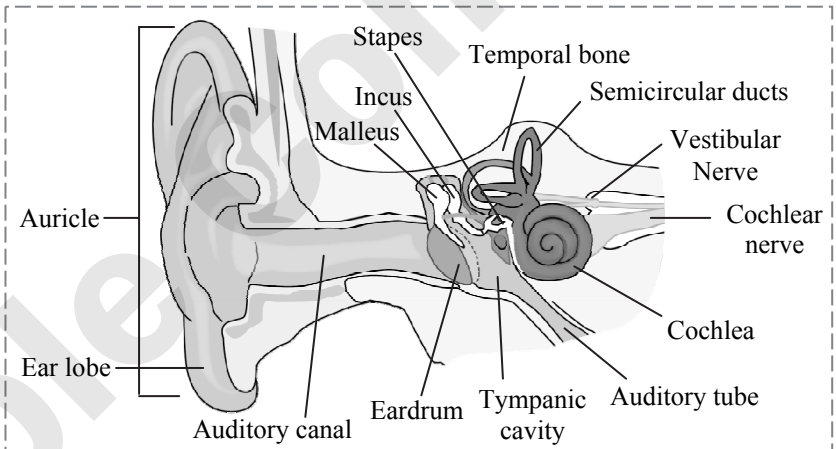
Q.73. Give a brief account of mechanism of vision. **[2/ 3 Marks]**
Ans:
i. The retina adapts changes when light rays fall on it.
ii. The light rays fall on the photoreceptor cells (rods and cones) breaking up of light sensitive pigments by specific wavelength of light.
iii. This causes stimulation of rods and cones which generate nerve impulse in the bipolar nerve cells.
iv. The nerve impulse is transmitted to ganglion cells. The nerve impulses in the axon of ganglion cells converge and leave via. the optic nerves.
v. The optic nerves transmit the nerve impulses to the brain (visual cortex area)
vi. The nerve impulses are analyzed in the brain and the image is formed on the retina.

Q.74. Describe the structure of human ear. **[4 Marks]**
Ans: The human ear is called stato-acoustic organ and it has two functions - hearing and body equilibrium.
The ear is made up of three parts: External ear, middle ear and inner ear.

i. External ear: It consists of ear pinna, auditory canal and tympanic membrane.

a. Ear pinna: In humans, the ear pinna is an immovable part, supported by elastic cartilage structure. It leads into an auditory canal. The pinna collects and sends the sound waves into the auditory canal.

b. Auditory canal: The auditory canal ends at the ear drum. It transfers the sound waves to the ear drum. There are very fine hair and wax secreting sebaceous glands in the skin of pinna and auditory canal.



Structure of human ear

c. Tympanic membrane: It is a delicate, membranous structure which transmits the sound waves to the middle ear. It is formed of connective tissues covered with skin on the outside and mucous membrane on the inside.

ii. Middle ear: It consists of chain of three ear ossicles called Malleus (hammer), Incus (anvil) and Stapes (stirrup-the smallest bone). On receiving the vibrations from the tympanic membrane, the ear ossicles amplify the vibrations and transfer these to the cochlea.
A short **Eustachian tube** connects the middle ear to the pharynx. It equalizes air pressure on both sides of the ear drum.

iii. Internal ear: It consists of the labyrinth and vestibular apparatus.

a. Labyrinth:
1. It consists of bony labyrinth and membranous labyrinth, filled with perilymph and endolymph respectively.
2. The coiled portion of the labyrinth is cochlea.
3. **The cochlea** contains three fluid filled chambers separated by **Reissner's membrane** and **basilar membrane**.
The upper chamber towards vestibuli is called **scala vestibuli** and the bottom chamber **scala tympani**. The middle chamber is the **scala media**. It is filled with endolymph while scala vestibuli and scala tympani are filled with perilymph.
4. The **organ of Corti** is a pea sized structure located on basilar membrane (floor of scala media). It acts as transducer, converting the sound vibrations into nerve impulses. It has a sensory epithelium over the basilar membrane, which is in contact with a gelatinous tectorial membrane.
5. The sensory cells have sensory hair on their free end so also called hair cell. Supporting cells are present in between the rows of hair cells.

6. Hair cells have long stiff microvilli called stereocilia on their apical surfaces. Above these stereocilia, is a jelly like membrane called **tectorial membrane.**

b. Vestibular apparatus:

1. It is composed of three **semi-circular canals** filled with endolymph and the **utriculo-saccular region** with the otolith organ.
2. All three semi-circular canals lie in different planes at right angle to each other.
3. The base of each of the canal has an ampulla in which there is a sensory spot called crista. The **cristae** help in maintaining equilibrium.
4. The vestibule has two sensory spots - macula of **saccule** and macula of **utricle** consisting of hair cells and supporting cells.
5. The tips of the hair and cilium project into a thick gelatinous sheath otolithic membrane, within this membrane minute particle made of $CaCO_3$ and protein otoliths or otoconia are secreted.
6. The macula and crista are the receptors sensitive to the position of the head with respect to gravity. The three semicircular canals are arranged in such a way that the movement in any plane can be detected by these cells and the balance and posture of the body is maintained.
7. Receptors for dynamic balance lie in the cristae of ampullae while for static/linear balance lie in the maculae of utriculus and sacculus.

***Q.75. Name the three ossicles of the middle ear.** **[1 Mark]**

Ans: *Refer Q.74 (ii)*

Q.76. How does the inner ear control the body balance? **[1 Mark]**

Ans: *Refer Q.74 (iii-b)*

***Q.77. Draw the neat labelled diagrams of.**

i. Human ear **[2/ 3 Marks]**

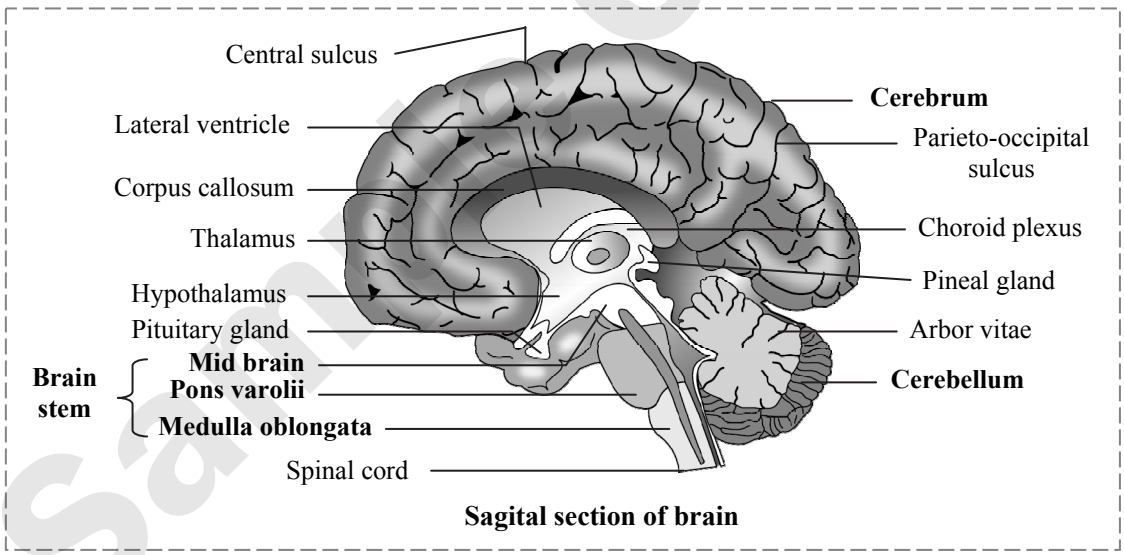
Ans: *Refer Q.74 (Diagram)*

ii. Sectional view of human eye **[2/ 3 Marks]**

Ans: *Refer Q.66 (Diagram)*

iii. L. S. of human brain **[2/ 3 Marks]**

Ans:



Sagital section of brain

iv. Multipolar Neuron **[2/ 3 Marks]**

Ans: *Refer Q.6 (Diagram)*

9.7 Disorders of Nervous System

Q.78. Write a note on psychological disorders. **[2 Marks]**

Ans:

i. Psychological disorders are commonly called mental disorders.

ii. These are a wide range of conditions that affect the mood, thinking or behaviour of an individual. These affect multiple areas of life and create distress for the person suffering from it.

iii. Some of the major categories of psychological disorders are - Intellectual disability (formerly known as mental retardation), Autism spectrum disorder, bipolar disorder, depression, anxiety disorder, ADHD (Attention Deficit Hyperactivity Disorder) and stress related disorders.

Q.79. Elaborate on the following disorders of nervous system. **[3 Marks]**

i. Parkinson's disease

Ans: a. Degeneration of dopamine-producing neurons in the CNS causes Parkinson's disease.
b. The symptoms develop gradually over the years.
c. Symptoms are tremors, stiffness and difficulty in walking, balance and co-ordination.

ii. Alzheimer's disease

Ans: a. It is the most common form of dementia.
b. Its incidence increases with the age, showing the loss of cognitive functioning - thinking, and remembering, reasoning and behavioural abilities to such an extent that it interferes with the person's daily life and activities.
c. It occurs due to loss of cholinergic and other neurons in the CNS, accumulation of amyloid proteins.
d. There is no cure for Alzheimer's, but treatment slows down the progression of the disease and may improve the quality of life.

9.8 Chemical Co-ordination

Q.80. State the types of chemical signals. **[2/ 3 Marks]**

Ans: The cells and organisms communicate with each other through chemical signals. There are four types of chemical signals:

i. Autocrines: Cells release secretion to stimulate itself.
ii. Paracrines: Cells release secretion to stimulate neighbouring cells.
iii. Endocrines: Cells release secretion to stimulate distant cells.
iv. Pheromones: Organs release secretions to stimulate other organism.

Q.81. Give an account on pheromones. **[3 Marks]**

Ans:

i. Pheromones are the chemicals that operate between members of the same species. They are also known as social hormones.
ii. These are commonly also called sex attractants or external hormones.
iii. Pheromones are volatile substances produced and discharged by an organism, which induces a physiological response in other organisms of the same species.
iv. Some pheromones enhance the chance of mating between the sexes. These are called signaling pheromones used to induce a behavioral response.
v. Pheromones are produced by many species of insects. Social insects such as ants make use of signaling pheromones to locate food sources and warn of danger.
vi. Worker bees are females maintained in a sterile state by the pheromone called anti-queen factor produced by queen. The factor spreads among the workers preventing maturation of the ovaries of workers as long as the queen is present in the bee hive. Increase in colony size results in dilution of pheromones and second queen may develop.

9.9 Endocrine System

Q.82.Write a note on endocrine system. **[2 Marks]**

Ans:

i. In higher animals, in addition to nervous system there is need of chemical coordination. The chemical coordination is carried out by secretions of endocrine (ductless) glands.
ii. This chemical coordination system is also called the endocrine system.
iii. The endocrine system controls body activities by means of chemical messengers called hormones.
iv. These hormones are released directly into the blood and are carried all over the body via. blood. However, the message is relayed only to the target organs which are stimulated to carry out specific processes which include activities like growth and development.

Q.83.Describe the chemical nature of hormones. **[2 Marks]**

Ans:

i. Amines: These are simple amines. Catecholamines secreted by adrenal medulla, epinephrine and non-epinephrine and melatonin from pineal gland. Some are modified from amino acids. **e.g**. Thyroxine.
ii. Peptide hormones: These hormones consist of long or short chains of amino acids. **e.g.** Hormones of hypothalamus oxytocin, ADH, GnRH.

iii. **Protein hormone:** Insulin, glucagon TSH, FSH, LTH, GH, relaxin.
iv. **Fatty acid derivatives:** Prostaglandin
v. **Steroid hormones:** These hormones are lipid soluble and derived from cholesterol and other steroids. Action of these hormones is concerned with long lasting responses. **e.g.** Oestrogen, testosterone, aldosterone.
vi . **Gas:** NO (Nitric Oxide)

Q.84.Can you tell? *(Textbook page no. 211)*
State properties of hormones. **[2 Marks]**

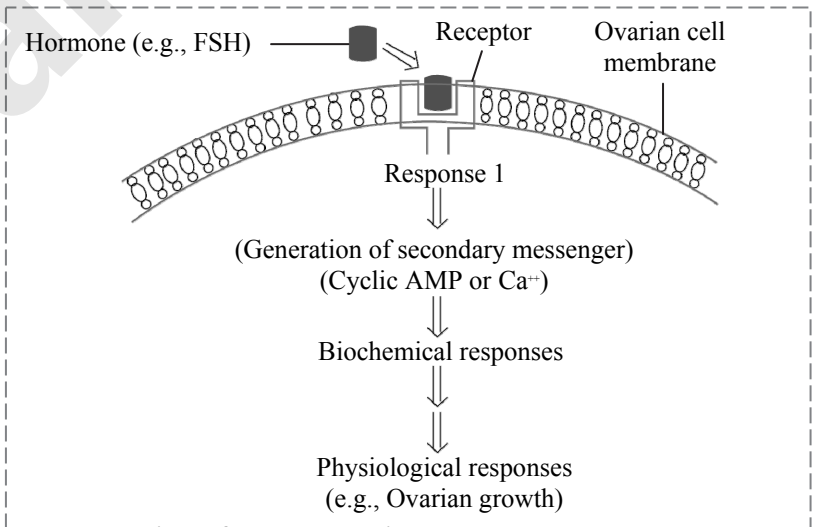
Ans: Common properties of hormones:
i. Hormones act as chemical messengers and are effective in low concentration
ii. Hormones can function as regulators that inhibit or stimulate or modify specific processes.
iii. Some hormones interact with receptors present on plasma membrane of target cells where as some enter the nucleus to interact with genes.
iv. Hyper-secretion or Hypo-secretion of hormones leads to various disorders.
v. Hormones are metabolised after their function, thus cannot be reused.
vi. Hormone secretion is regulated by positive or negative feedback mechanism.

Q.85.Explain the mechanism of hormone action. **[4 Marks]**

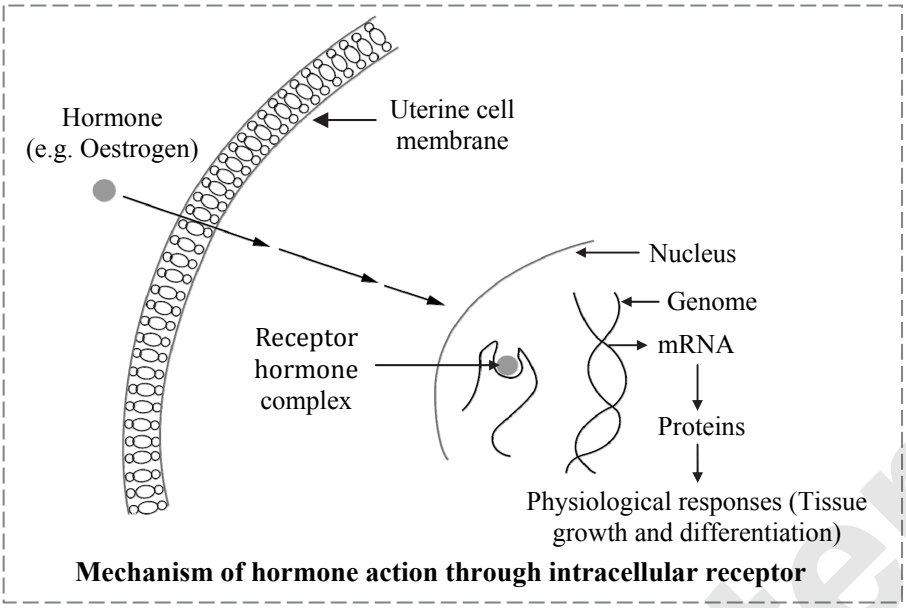
Ans: Hormones are released in very minute quantities. They produce their effect on the target cells by binding to hormone receptors, which are present on the cell membrane (i.e. membrane receptors) or may be intracellular receptors.

i. Mode of hormone action through membrane receptors:
a. Hormones like catecholamines, peptide and polypeptide hormones are not lipid soluble and they cannot enter their target cells through plasma membrane. These non-steroid water soluble hormones interact with surface receptor and initiate metabolic activity.
b. Molecules of amino acids derivatives, peptide hormones bind to specific receptor molecules located on the plasma membrane.
c. The hormone receptor complex causes the release of an enzyme **adenylate cyclase** from the receptor site. This enzyme forms cyclic AMP from ATP of the cell.
d. cAMP activates enzymatic actions. The hormone acts as the first messenger and the cAMP acts as the second messenger.
e. Some other secondary messengers are Ca^{++}, cGMP and IP_3 (Inositol triphosphate), etc.

ii. Mode of action through intracellular receptors:
a. Steroid and thyroid hormones are lipid soluble and can easily pass through plasma membrane of the target cell into the cytoplasm.
b. In the cytoplasm, they bind to specific intra-cellular receptors proteins forming a hormone – receptor complex that enters the nucleus.
c. The hormone receptor complex binds to a specific regulatory site of DNA, in the nucleus.
d. The activated genes transcribe mRNA which directs protein synthesis and enzymes in the cytoplasm.
e. The action of lipid soluble hormones is slow but long lasting,



Mechanism of hormone action through membrane receptor



Mechanism of hormone action through intracellular receptor

***Q.86. Explain action of steroid hormones and proteinous hormones.** **[2 Marks]**
Ans: *Refer Q.85*

***Q.87. Name the type of hormones binding to DNA and alter gene expression.** **[1 Mark]**
Ans: Steroids
[Note:** Steroid hormone receptors are proteins that have a binding site for a particular steroid molecule. Their response elements are DNA sequences that are bound by the complex of the steroid bound to its receptor.**]

9.10 Major Endocrine Glands

Hypothalamus

Q.88.State the hormones secreted by hypothalamus and their functions. **[3/ 4 Marks]**
Ans: Hypothalamus secretes the following hormones:

i. ADH: Anti Diuretic Hormone (ADH) or Vasopressin.
Functions:
It increases reabsorption of water in distal convoluted tubules and collecting ducts of kidney tubules.
It regulates the balance of body fluids by reducing the output of urine.
It increases blood pressure by causing vasoconstriction.

ii. Oxytocin:
Functions:
It stimulates contraction of uterus during parturition. It stimulates ejection or release of milk thus, it is also known as birth hormone or milk ejecting hormone.

iii. Prolactin inhibiting hormone: It inhibits the release of prolactin from anterior pituitary.
iv. Gonadotropin releasing hormone: It stimulates pituitary to secrete gonadotropins.
v. Thyrotropin releasing hormone: It stimulates the release of TSH by anterior pituitary gland.
vi. Corticotrophin releasing hormone: It stimulates the release of ACTH by the anterior pituitary gland.

[Note:** The hormone secreted by hypothalamus that stimulates the release of ACTH is corticotrophin releasing hormone (CRH)**]

Q.89. Write a note on Hyposecretion of ADH. **[2 Marks]**
Ans:
i. Hyposecretion of ADH causes diabetes mellitus.
ii. It reduces water reabsorption and increases urine output.
iii. Ordinarily, urine contains no glucose. However, diabetes mellitus is associated with abnormally high levels of sugar (glucose) in the blood. Elevated levels of blood glucose (hyperglycemia) lead to spillage of glucose into the urine.
iv. This condition causes excessive micturition or polyuria, polydipsia (increased thirst), etc.

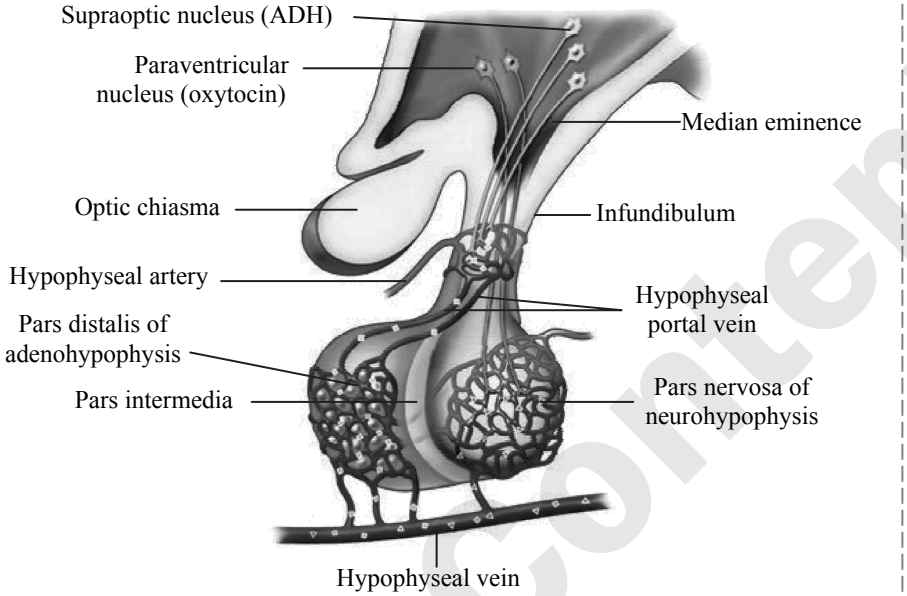
***Q.90. Give symptoms of the disease caused by hyposecretion of ADH.** **[1 Mark]**
Ans: *Refer Q.89 (iv)*

Pituitary gland

Q.91. Write an account of location and structure of pituitary gland with the help of neat and labelled diagram. [3/ 4 Marks]

Ans: Pituitary gland: It is the smallest pea sized, reddish green coloured gland that controls almost all other endocrine glands.

i. Location: It is located just below the hypothalamus and is attached to it by a stalk called **infundibulum** or hypophyseal stalk. Pituitary gland remains lodged in a bony depression called **sella turcica** of the sphenoid bone. The connection of Rathke's pouch with pituitary gland is lost in embryo.



Pituitary gland

ii. Structure: The pituitary gland shows two lobes called anterior lobe (adenohypophysis) and posterior lobe (neurohypophysis).

a. Adenohypophysis:

1. It develops from the roof of buccal cavity as an outgrowth called as Rathke's pouch. It grows upwards towards the brain**.**
2. It is the larger lobe of pituitary gland. It is a highly cellular and vascular part of pituitary gland. It contains various types of epitheloid secretory cells, acidophils, basophils, chromatophores.
3. It is further divided into three parts - Pars distalis, pars tuberalis and pars intermedia.
4. **Pars intermedia** is poorly developed in human beings. It is a small reduced part lying in the cleft between the anterior and posterior lobe. It secretes Melanocyte Stimulating Hormone (MSH) in some lower vertebrates. **MSH** stimulates the dispersion of melanin granules in melanocytes and is responsible for skin pigmentation.

b. Neurohypophysis:

1. The neurohypophysis grows as a downward extension of hypothalamus.
2. Neurohypophysis is connected directly to the hypothalamus by axon fibres.
3. It is composed of three parts - Pars nervosa/ neural lobe, infundibulum and median eminence.
   The pars nervosa acts as storage area for the secretions of hypothalamus. It stores and releases the hormones - oxytocin and vasopressin.

***Q.92. Where is the pituitary gland located? Enlist the hormones secreted by anterior pituitary. [3/ 4 Marks]**

Ans: Pituitary gland located just below the hypothalamus.

Hormones secreted by anterior pituitary:

i. Somatotropic Hormone (STH) / Somatotropin / Growth Hormone (GH):
Secretion of GH is high till puberty later its secretion becomes low. However, it is continuously secreted throughout life for repair and replacement of body tissue or cells.

Functions:

a. It stimulates growth of the body and development of all tissues.
b. It accelerates protein synthesis and cell division.
c. It stimulates the release of growth hormone.

ii. Thyroid Stimulating Hormone (TSH) / Thyrotropin:
Function:
It stimulates thyroid gland to produce hormone thyroxine.

iii. Adrenocorticotropic Hormone (ACTH) / Adrenocorticotropin:
Functions:
a. It stimulates adrenal cortex to produce its hormones.
b. It maintains functioning of adrenal cortex.

iv. Prolactin / Luteotropin/ Mammotropin:
Secretion of this hormone is regulated by PIF (Prolactin inhibiting factor) of hypothalamus.
Functions:
a. Activates the growth of mammary glands during pregnancy (mammotropin).
b. Stimulates milk production and secretion of milk (lactogenic) by mammary gland after child birth.

v. Gonadotropins:
a. Follicle Stimulating Hormone (FSH):
In **males**, it stimulates the development of seminiferous tubules.
In **females**, it stimulates the growth of ovarian follicles.

[Note:** FSH acts on Sertoli cells to stimulate spermatogenesis in testis**]

b. Luteinizing hormone (LH):
LH induces the ruptured follicles to develop into corpus luteum and for production of progesterone
FSH and LH are responsible for stimulation of ovaries to produce oestrogen.

c. ICSH: In males, it stimulates the testes to produce the androgen called testosterone. Testosterone is responsible for development of secondary sexual characters.

[Note:** Luteinizing hormone (LH) is also known as Interstitial cell stimulating hormone (ICSH)**]

***Q.93. What is adenohypophysis? Name the hormones secreted by it. [2 Marks]**
Ans: *Refer Q.91(ii – a) and 92*

Q.94. Which hormone is responsible for lactation or secretion of milk by alveoli? [1 Mark]
Ans: Prolactin

***Q.95. What is the cause of abnormal elongation of long bones of arms and legs and of lower jaw? [1 Mark]**
Ans: Excessive secretion of Growth Hormone causes abnormal elongation of long bones of arms and legs and of lower jaw.

Q.96. Describe the hormones of neurohypophysis. [3 Marks]
Ans: **Posterior pituitary (Neurohypophysis)** does not secrete any hormone, but stores and releases the hormones secreted by hypothalamus as and when required. These hormones are ADH and oxytocin.
Refer Q.88 (i, ii) and 91(ii-b)

Q.97. Pituitary gland was earlier known as master endocrine gland. Justify. [1 Mark]
Ans: Pituitary gland controls functions of other endocrine glands hence, it was earlier known as master endocrine gland.

***Q.98. Explain the role of hypothalamus and pituitary as a coordinated unit in maintaining homeostasis. [3 Marks]**

Ans:
i. Hypothalamus controls the secretory activity of pituitary gland (anterior pituitary) by producing, releasing and inhibiting hormones.
ii. Anterior pituitary and intermediate lobes are connected to the hypothalamus through hypophyseal portal system. Various hormones secreted by hypothalamus reach the pituitary gland through the hypophyseal portal system.
iii. The portal vein collects blood from various parts of hypothalamus and opens into anterior lobe of pituitary. From the pituitary, the vein finally carries the blood into the superior vena cava. It helps in feedback mechanism for hormonal control.
iv. Also, negative feedback mechanism takes place in the form of hormones released by the target glands decrease the secretion of pituitary gland.
v. In such negative feedback mechanism, the secretion of ACTH, TSH and gonadotropins (FSH and LH) decreases when their target gland hormones levels rise.
e.g. Adrenocorticotropic hormone (ACTH) stimulates the cortex of the adrenal gland to secrete glucocorticoids, mainly cortisol. In turn, an elevated blood level of cortisol decreases secretion of both corticotropin and corticotropin-releasing hormone (CRH) by suppressing the activity of the anterior pituitary corticotrophs and neurosecretory cells.

Q.99. Write a note on hypophyseal portal system. [2 Marks]
Ans: *Refer Q.98 (ii, iiii)*

Q.100. Describe the disorders caused due to hypo and hypo secretion of growth hormone. **[2 Marks]**

Ans:

i. Hypersecretion of Growth hormone:

a. Gigantism: In childhood, hypersecretion of GH leads to gigantism. It is a condition of overgrowth wherein an individual attains abnormal height.

b. Acromegaly: In middle aged adults, hypersecretion of GH leads to acromegaly. It causes disproportionate growth causing disfigurement and enlargement of bones of nose, lower jaw, hands, fingers and feet.

ii. Hyposecretion of Growth hormone:

Pituitary dwarfism: It is the condition which results due to hyposecretion of GH in childhood. It causes retardation of physical growth.

Pineal gland

Q.101. Give an account of pineal gland and enlist the functions of hormone secreted by it. **[2/ 3 Marks]**

Ans:

i. The pineal gland is given off from the roof of diencephalon and is located between the two cerebral hemispheres.

ii. The pineal gland is sensitive to the biochemical signals of light.

iii. It secretes a hormone called melatonin also known as sleep hormone.

iv. Melatonin is derived from tryptophan.

v. **Functions:**

a. It plays a very important role in the regulation of biological clock (**e.g.** 24-hour diurnal rhythm) of our body.

b. It helps in maintaining the normal rhythm of sleep-wake cycle and also influences body temperature, metabolism and reproductive cycles.

***Q.102. Name the hormone secreted by the pineal gland.** **[1 Mark]**

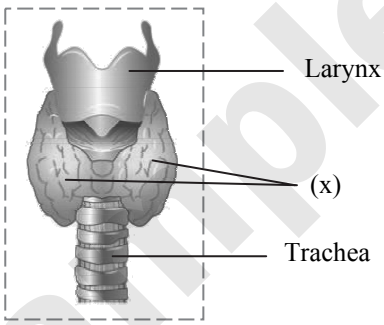
Ans: Melatonin

Thyroid gland

Q.103. Name the largest endocrine gland. **[1 Mark]**

Ans: Thyroid gland

Q.104. Identify the gland (x) and mention its location. **[2 Marks]**



Ans:

i. The gland (x) given in the picture is thyroid gland.

ii. It is situated in front of the trachea just below the larynx.

Q.105. With the help of a suitable diagram, describe the T.S. of thyroid gland. **[3 Marks]**

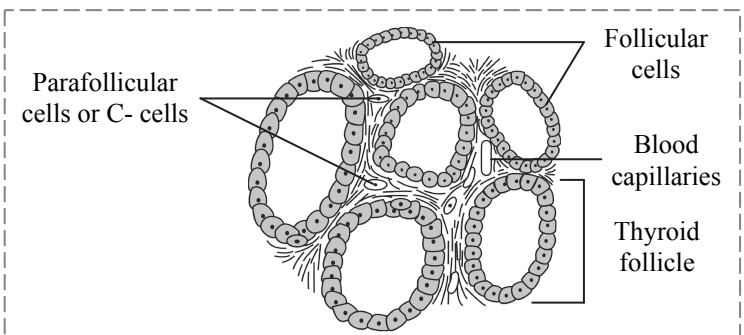
Ans:

i. The thyroid lobes are composed of round follicles held together by inter-follicular connective tissue called stroma.

ii. The stroma contains blood capillaries and small group of parafollicular cell or 'C' cells (clear cells).

iii. Thyroid follicles are composed of cuboidal epithelium which rest on a basement membrane and is filled with a gelatinous colloid.

iv. The parafollicular cells or 'C' cells produce calcitonin hormone.



T.S of Thyroid gland

Q.106. Write an account of hormones secreted by thyroid gland. **[3 Marks]**

Ans:

i. Thyroid gland is stimulated to secrete its hormones by thyroid stimulating hormone (TSH).
The two hormones secreted by the follicular cells are Thyroxine/tetra iodothyronine/ T_4 (four atoms of iodine) and Triiodothyronine or T_3 (three atoms of iodine).

ii. Thyroxine is synthesized by attaching iodine to amino acid tyrosine by enzymatic action. The amino acid tyrosine molecule binds to iodine to produce **Monoiodothyronine** (T_1) or 2 atoms of iodine to produce **Diodothyronine** (T_2). T_1 and T_2 molecules bind end to end to make colloidal mass inside the follicle. They are further metabolised to prepare T_3 and T_4.

iii. Triidothyronine or T_3 is also secreted in small quantity. It is physiologically more active. Thyroid gland is the only gland that stores its hormones. T_3 and T_4 hormones are stored before secretion and are regulated by thyrotropin of pituitary gland by negative feed back mechanism.

iv. **Functions of thyroid hormones:**
   a. Thyroxine regulates the basal metabolic rate of body. It also regulates metabolism by stimulating protein synthesis and promotes growth of body tissues. It helps in thermoregulation by increasing heat production. It increases action of neuro transmitters- adrenaline and nor adrenaline. It also supports the process of RBC production and maintenance of water and electrolyte balance. It also regulates reproductive cycles in females.
   b. The hormone calcitonin regulates calcium metabolism.

Q.107. Describe the role of calcitonin in regulating calcium phosphorous level of blood. **[2 Marks]**

Ans:

i. The secretion of calcitonin is under the feedback control of calcium concentration in plasma.

ii. Calcitonin is secreted when concentration of calcium rises in the blood.

iii. It lowers the concentration of calcium and phosphorus in the plasma by decreasing their release from the bones and accelerating the uptake of calcium and phosphorous by the bones.

Q.108. Name the only endocrine gland that stores its hormones. **[2 Marks]**

Ans: Thyroid gland

Q.109. Can you tell? *(Textbook page no. 211)*

Describe neurohormonal regulation of pituitary and thyroid gland? **[2/ 3 Marks]**

Ans:

i. Hypothalamus controls the secretory activity of anterior pituitary, which in turn regulates other endocrine glands. The hypothalamic hormones act as a link between the nervous and endocrine system. The hypothalamic hormones reach the anterior pituitary through the hypophyseal portal system

ii. The neurosecretory cells of hypothalamus secrete the hormone Thyrotropin Releasing Hormone (TRH) into the portal system, which stimulates the anterior pituitary to release of Thyroid stimulating hormone (TSH) which in turn stimulates the thyroid gland to release thyroid hormones.

iii. Low levels of T_3 and T_4 or low metabolic rate stimulate the secretion of TRH into the hypophyseal portal system which stimulates the anterior pituitary to secrete TSH. This in turn stimulates the thyroid gland to release the hormone thyroxine.

iv. Hypothalamus and pituitary are the target organs of thyroxine. The hormone thyroxine acts on these glands and inhibit the secretion of the hormones TRH and TSH respectively.

v. This negative feedback mechanism helps in maintaining homeostasis.

Q.110. Describe in detail the disorders of thyroid gland. **[3/ 4 Marks]**

Ans: Disorders of thyroid gland are caused due to hypersecretion and hyposecretion of thyroid hormones.

i. **Hypersecretion of thyroid hormones:** It is caused by increase in the levels of thyroid hormones. This increases metabolic rate, sensitivity, sweating, flushing, rapid respiration, bulging of eye balls, and affects various physiological activities.
Graves' disease: Hyperthyroidism in adults results in this disorder. It is characterised by protruding eyeballs, increased BMR and weight loss. Increased BMR produces a range of effect like increased heartbeat, increased B.P., higher body temperature, nervousness, irritability and tremor of fingers.

***[Note:** Graves' disease is also called as exopthalmic goitre.]*

ii. **Hyposecretion of thyroid hormone:** It is caused by deficiency of thyroid hormones or removal of thyroid gland (Thyroidectomy).
   a. Cretinism: It is caused due to deficiency of thyroid hormones in infants. A cretin (individual suffering from cretinism) has reduced BMR and low oxidation. They are short statured because the skeleton fails to grow. They are mentally retarded, show stunted growth and delayed puberty. They show dry skin, thick tongue, prolonged neonatal jaundice, lethargy and constipation.
   This can be treated by early administration of thyroid hormones.

b. Myxoedema: It is caused due to the deficiency of thyroid hormones in adults. It is characterised by a peculiar thickening and puffiness of skin and subcutaneous tissue particularly of the face and extremities. Patient lacks alertness, intelligence. The patient suffers from slow heart rate, low B.P., low body temperature (feels cold) and stunted sexual development.

c. Simple goitre: It is iodine deficiency goitre. Iodine is required for synthesis of thyroid hormone and if there is deficiency of iodine in the diet, it causes enlargement of thyroid gland leading to simple goitre. This disease is common in hilly areas. Addition of iodine to table salt prevents this disease. The size of the thyroid gland is increased but total output of thyroxine is decreased.

iii. Hyposecretion of thyroid hormones in pregnant females causes defective development and maturation of growing baby.

Q.111. Distinguish between hyperthyroidism and hypothyroidism. [Mar 22] [2 Marks]

Ans:

	Hyperthyroidism	Hypothyroidism
i.	Caused by increase in the levels of thyroid hormones.	Caused by deficiency of thyroid hormones or removal of thyroid gland.
ii.	Hyperthyroidism leads to increase in metabolic rate.	Hypothyroidism leads to decrease in metabolic rate.
iii.	Leads to increase in BMR.	Leads to decrease in BMR.
iv.	Increases blood pressure and heart rate.	Decreases blood pressure and heart rate.
v.	Hyperthyroidism leads to increase in body temperature.	Hypothyroidism leads to decrease in body temperature.
vi.	It causes Graves' disease.	It causes simple goiter.

***Q.112. Which are the 2 types of goitre? What are their causes? [2 Marks]**

Ans: *Refer Q.110 (i, ii – c)*

[Note:** This textual question has been modified for better understanding of the students.**]

***Q.113. While holding a tea cup Mr. Kothari's hands rattle. Which disorder he may be suffering from and what is the reason for this? [1 Mark]**

Ans:

i. Mr. Kothari may be suffering from Graves' disease.

ii. It is caused due to increased levels of thyroid hormone or hyperthyroidism.

***Q.114. Describe in brief an account of disorders of the thyroid. [3/ 4 Marks]**

Ans: *Refer Q.110*

***Q.115. An adult patient suffers from low heart rate, low metabolic rate and low body temperature. He also lacks alertness, intelligence and initiative. What can be this disease? What can be its cause and care? [2 Marks]**

Ans:

i. The patient may be suffering from myxoedema.

ii. It is caused due the deficiency of thyroid hormones (hypothyroidism) in adults.

iii. Care: Patients should take prescribed medications regularly and eat food rich in iodine.

***Q.116. What will be the effect of thyroid gland atrophy on the human body? [2 Marks]**

Ans: Thyroid gland atrophy causes hypothyroidism.
For effects of thyroid gland atrophy on human body: *Refer Q.110 (ii)*

Parathyroid gland

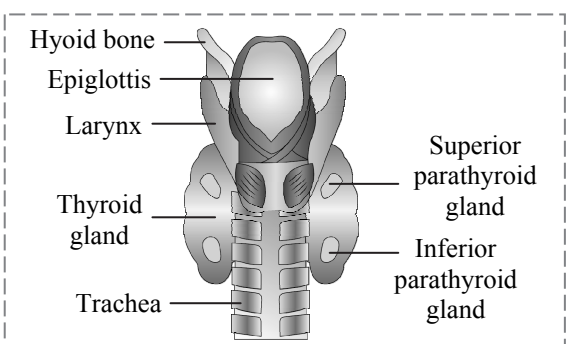
Q.117. Describe the morphology of parathyroid glands. [2 Marks]

Ans:

i. Parathyroid gland is situated on the posterior surface of the lobes of thyroid gland.

ii. These are four in number and named as superior and inferior parathyroid glands.

iii. The cells of parathyroid glands are arranged in a compact mass.



Parathyroid gland

Q.118. Name the hormone produced by parathyroid gland. **[1 Mark]**

Ans: Parathyroid gland secretes a peptide hormone called parathormone (PTH)/ Collip's hormone.

Q.119. Give the role of parathormone. **[1/ 2 Marks]**

Ans:

i. Parathormone increases Ca^{++} level in the blood.
ii. It regulates calcium and phosphate balance between blood and other tissues.
iii. It draws calcium from bones and increases calcium absorption in digestive tract.
iv. It reduces calcium loss through urine.

Q.120. Can you tell? *(Textbook page no. 214)*

How does fall and rise in blood calcium stimulate secretion of parathyroids? **[2 Marks]**

Ans:

i. Secretion of parathyroids (parathormone) is under feedback control of blood calcium level.
ii. When blood calcium level falls, the parathyroids secrete the hormone parathormone. Release of parathormone increases blood calcium level. It draws calcium from bones increases calcium absorption in the digestive tract and reduces loss of calcium in the urine.
iii. When blood calcium level rises, the secretion of parathyroid is inhibited. The hormone calcitonin is secreted when blood calcium level rises. It lowers concentration of calcium in the blood by decreasing their release from the bones and accelerating the uptake of calcium by the bones.
iv. Parathoromone and calcitonin regulate the calcium balance between blood and other tissues.

Q.121. Give an account on hypo and hypersecretion of parathormone. **[2 Marks]**

Ans:

i. Hyposecretion of parathormone (hormone secreted by parathyroid gland):
Parathyroid tetany or hypocalcemic tetany: Lowered secretion of parathormone lowers blood calcium level. This increases excitability of nerves and muscles causing muscle twitch and spasms. This is known as parathyroid tetany or hypocalcemic tetany.

ii. Hypersecretion of parathormone:
Osteoporosis: Increased secretion of parathormone increases blood calcium level as demineralization of bones (absorption of calcium from bones) occurs. This results in softening, bending and fracture of bone. This is known as osteoporosis. It is common in women who have reached menopause.

Thymus Gland

Q.122. Describe the thymus gland. Add a note on the functions of the hormone secreted by thymus gland. **[2/ 3 Marks]**

Ans:

i. Thymus gland is located in the upper part of the thorax on the dorsal side of the heart.
ii. It is soft, pinkish, bilobed mass of lymphoid tissue.
iii. It is a prominent gland at birth but gets gradually atrophied in the adult, so it is called temporary gland.
iv. **Functions of hormone thymosins (hormone secreted by thymus gland):**
   a. Thymus plays an important role in development of immunity as it is involved in maturation of T lymphocytes.
   b. Thymosin promotes production of antibodies by providing humoral immunity.

***Q.123. Which endocrine gland plays important role in improving immunity?** **[1 Mark]**

Ans: Thymus gland

Adrenal glands/ suprarenal glands

Q.124. Where are the adrenal glands located in the body? **[1 Mark]**

Ans: Adrenal glands are located above each kidney and are hence called suprarenals. They are located on the upper border of kidneys.

Q.125. Name the two distinct regions of adrenal gland. Explain the regions and the hormones secreted in detail. **[4 Marks]**

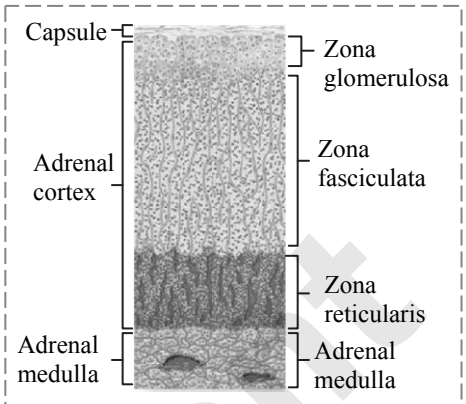
Ans: The two distinct regions of adrenal gland are adrenal cortex and adrenal medulla

i. Adrenal cortex: It is derived from embryonic mesoderm. Adrenal cortex secretes many hormones together called corticoids. It is differentiated into three concentric regions.

a. Outer thin zona glomerulosa:
It secretes mineralocorticoids. They are released for regulating sodium and potassium ion concentration. They regulate salt-water balance, blood volume and blood pressure.
Aldosterone (salt retaining hormone) is the main mineralocorticoid. It balances Na-K levels.

b. Middle thick zona fasciculata: It is responsible for secretion of glucocorticoids like cortisol. It regulates metabolism of carbohydrates, proteins and lipids. **Cortisol** is an important glucocorticoid. It is responsible for increase in blood glucose level. It is also immunosuppressive. It suppresses the synthesis of antibodies so; it is used in treatment of allergy.
It prepares animals to face emergencies in nature.

c. Inner thin zona reticularis: It is responsible for production of sex corticoids (gonadocorticoids).
In males, they are involved in development and maintenance of external sex characters. Excess sex corticoids in female causes adrenal virilism and hirsutism (excess hair on face) while in males it causes gynaecomastia i.e. enlarged breast. Androgens and estradiols are the produced by the adrenal cortex.



Histology of Adrenal gland

ii. Adrenal medulla: It develops from ectoderm. It secretes two hormones adrenaline (epinephrine) and noradrenaline (norepinephrine). Adrenaline is also known as emergency hormone, also called 3F hormone – (fight, flight and fright). Noradrenaline regulates the blood pressure under normal condition. It also acts as vasoconstrictor.

Q.126. Name the hormone which is known as emergency hormone. **[1 Mark]**

Ans: Adrenaline

***Q.127. Describe in brief, an account of disorders of adrenal gland.** **[2 Marks]**

Ans: Disorders of adrenal gland:

i. Addison's disease: It is caused due to hypersecretion of glucocorticoids (hormone secreted adrenal cortex). It is characterized by low blood sugar, low Na^+ and high K^+ concentration in plasma, increased loss of Na^+ and water in urine. It leads to weight loss, weakness, nausea, vomiting and diarrhoea.

ii. Cushing's disease: It is caused due to Hyposecretion of mineralocorticoids (hormone secreted by adrenal cortex)
It leads to high blood sugar level, excretion of glucose in urine, rise in Na^+ level in blood, high blood pressure, obesity and wasting of limb muscles.

Q.128. Explain how the adrenal medulla and sympathetic nervous system function as a closely integrated system. **[3 Marks]**

Ans:

i. Adrenal medulla is the inner region of the adrenal gland. It is the modified sympathetic ganglion of the autonomic nervous system (ANS).
ii. The chromaffin cells of adrenal medulla secrete hormones rather than releasing a neurotransmitter. These cells are innervated by sympathetic pre-ganglionic neurons of the autonomous nervous system (ANS).
iii. The autonomous nervous exerts direct control over the chromaffin cells, thus the hormones – adrenaline and nor adrenaline can be released quickly into the blood.
iv. The impulses from hypothalamus stimulate sympathetic pre-ganglionic neurons which in turn stimulate the chromaffin cells to secrete adrenaline to nor-adrenaline.
v. The fight-or-flight response is initiated by nerve impulses from the hypothalamus to the sympathetic nervous system, including adrenal medulla. This response rapidly increases circulation, promotes ATP production, and decreases non-essential activities.

Thus, adrenal medulla and sympathetic nervous system function as closely integrated manner.

Pancreas

Q.129. Pancreas is a dual gland – Explain. **[2 Marks]**

OR

Can you tell? *(Textbook page no. 216)*

Pancreas is both exocrine as well as endocrine gland. Give reason.

Ans: Pancreas is a dual gland because

i. Major part of the pancreas consists of clusters of glandular cells called acini or lobules which are exocrine in function.
ii. Among exocrine cells, there are patches of endocrine cells called Islets of Langerhans.
iii. Pancreas has both the cells, exocrine as well as endocrine.

Hence, it is called as heterocrine or dual gland.

Q.130. *Name the secretion of alpha, beta and delta cells of islets of Langerhans. Explain their role. [3 Marks]

OR

Describe in detail the types of cells of Islets of Langerhans and the role of hormones secreted.

Ans: Islets of Langerhans are endocrine cells of pancreas. They are four types of cells in Islets of Langerhans which have endocrine role i.e. they secrete hormones.

i. **Alpha cells (α cells):** They constitute 20% of Islets of Langerhans. They secrete hormone glucagon. Glucagon stimulates glycogenolysis (breakdown of glycogen) in liver which causes hyperglycemia.

ii. **Beta cells (β cells):** They constitute 70% of Islets of Langerhans. They secrete insulin which stimulates glycogenesis (formation of glycogen) in liver and muscles. Insulin causes hypoglycemia by increasing uptake of glucose by cells.

iii. **Delta cells (δ cells):** They constitute 10% of Islets of Langerhans. These cells secrete somatostatin which inhibits the secretion of insulin and glucagon. It also lowers the gastric secretions, motility and absorption in digestive tract. Somatostatin inhibits the release of growth hormone.

iv. **PP cells or F cells:** These cells secrete pancreatic polypeptide (PP) and inhibit the release of pancreatic juice.

***Q.131. Describe the endocrine role of islets of Langerhans. [2/ 3 Marks]**

Ans: *Refer Q.130*

Q.132. Describe the disorder related to hyposecretion of pancreas. [3 Marks]

Ans: Hyposecretion of pancreas causes diabetes mellitus.

i. It is the most common metabolic endocrine disorder of pancreas.

ii. The under activity of Beta cells results in reduced secretion of insulin due to which blood glucose level increases.

iii. In children, such a condition is called insulin dependent diabetes mellitus/ Type I (IDDM).

iv. The other form of diabetes is Non-insulin dependent diabetes mellitus/ Type II (NIDDM) which is caused due to failure of insulin to facilitate the movement of glucose into cells.

v. In both disorders, blood glucose level increases. Some of the glucose is excreted in urine. It also causes excessive urination and dehydration of body tissues.

vi. Degradation of fats increases formation of ketone bodies (ketosis). Administration of insulin lowers blood glucose level.

Q.133. Describe the hormones secreted by the ovary and its functions. [2/ 3 Marks]

Ans: Ovaries secrete the following hormones:

i. **Progesterone:** It is secreted by corpus luteum of the ovary after ovulation. It is essential for thickening of uterine endometrium, thus preparing the uterus for implantation of fertilized ovum. It is responsible for development of mammary glands during pregnancy. It inhibits uterine contractions during pregnancy.

ii. **Oestrogen:** It is secreted by developing follicles. Estradiol is the main oestrogen. It is responsible for development of secondary sexual characters in females.

iii. **Relaxin:** It is secreted by the corpus luteum of the ovary at the end of gestation period. It relaxes the cervix of the pregnant female and the ligaments of pelvic girdle to ease out the birth process.

iv. **Inhibin:** It is secreted by the corpus luteum. Inhibin inhibits the FSH and GnRH production.

***Q.134. Name the hormone which is anti-abortion hormone. [1 Mark]**

Ans: Progesterone

***Q.135. Name the ovarian hormones and give their functions. [1 Mark]**

Ans: *Refer Q.133*

Q.136. Name the group of hormones secreted by testis and its functions. [2 Marks]

Ans: The group of hormones secreted by testis are androgens such as **testosterone**.

Functions of androgens:

i. It is also responsible for appearance of secondary sexual characters such as facial and pubic hair, deepening of voice, broadening of shoulders, male aggressiveness, etc.

ii. It involves in development of testis.

Q.137. Name the cells that secrete the hormone testosterone. [1 Mark]

Ans: Testosterone is secreted from interstitial cells or Leydig cells by the influence of luteinising hormone (LH).

***Q.138. Mention the function of testosterone. [1 Mark]**

Ans: *Refer Q.136*

Diffuse endocrine glands

Q.139. State the hormones secreted by placenta. **[2 Marks]**

Ans: It is the intimate connection between foetus and uterine wall of the mother for physiological exchange of the material.

i. During pregnancy, placenta secretes hormones such as oestrogen, progesterone, hCG (Human Chorionic Gonadotropin) and Human Placental Lactogen.

ii. The presence of hCG in urine indicates pregnancy.

iii. These hormones check the contraction of uterine muscles and also maintain the thickness of uterine endometrium. Thus, they help in maintaining pregnancy.

***Q.140. Name an organ which acts as temporary endocrine gland.** **[1 Mark]**

Ans: Placenta

Hormones of gastrointestinal tract

Q.141. Can you tell? *(Textbook page no. 216)*

Enlist hormones secreted by GI tract and state their role. **[2 Marks]**

Ans: In the gastrointestinal mucosa, certain cells are endocrine in function. These cells produce hormones which play vital role in digestive processes and flow of digestive juices

i. **Gastrin:** It stimulates gastric glands to produce gastric juice.

ii. **Secretin:** It is responsible for secretion of pancreatic juice and bile from presence and liver.

iii. **Cholecystokinin CCK/ Pancreozymin PZ:** This hormone stimulates the pancreas to release its enzymes and also stimulates gall bladder to release bile.

iv. **Enterogastrone /Gastric inhibitory peptide (GIP):** It slows gastric contractions and inhibits the secretion of gastric juice.

***Q.142. State the site of production and function of Secretin, Gastrin and Cholecystokinin.** **[3 Marks]**

Ans:

i. **Site of production:** Secretin, gastrin and cholecystokinin are secreted in the gastrointestinal tract

ii. **Functions:**

Secretin: It is responsible for secretion of pancreatic juice from pancreas and bile from liver.

Gastrin: It stimulates gastric glands to produce gastric juice.

Cholecystokin in CCK/ Pancreozymin PZ: It stimulates the pancreas to release enzymes and also stimulates gall bladder to release bile.

Q.143. Can you tell? *(Textbook page no. 216)*

Mention the role of heart and kidney in hormone secretion. **[3 Marks]**

Ans: Role of heart and kidney in hormone secretion:

i. **Kidney:** It produces renin, erythropoietin and calcitriol (calcitriol is the active form of vitamin cholecalciferol (D3).

ii. **Heart: Atrial natriuretic hormone /ANF:** Increases sodium excretion by kidneys and reduces blood pressure.

Q.144. What is hormone therapy? Where it can be applied? **[2 Marks]**

Ans:

i. Hormone therapy/ HT is the use of hormones in medical treatment.

ii. HT is applied in pregnancy, menopause, osteoporosis, growth hormone deficiency, insulin resistance, cancer, etc.

***Q.145. Write the names of hormones and the glands secreting them for the regulation of following functions.** **[4 Marks]**

Ans:

Functions	Hormones	Glands
Growth of thyroid and secretion of thyroxine	TSH (Thyroid stimulating hormone)	Pituitary
Helps in relaxing pubic ligaments to facilitate easy birth of young ones.	Relaxin	Ovaries
Stimulate intestinal glands to secrete intestinal juice	Cholecystokinin	Gastrointestinal tract
Controls calcium level in the blood	Calcitonin, Parathormone	Thyroid , parathyroid respectively
Controls tubular absorption of water in kidneys	ADH/ Vasopressin	Hypothalamus
Sodium and potassium ion metabolism	Aldosterone (mineralocorticoid)	Adrenal cortex

Basal Metabolic rate	Thyroxine	Thyroid
Uterine contraction	Oxytocin	Hypothalamus
Heart beat and blood pressure	Adrenaline, nor adrenaline	Adrenal medulla
Secretion of growth hormone	Somatotropin	Pituitary
Maturation of Graafian follicle	LH (Luteinizing hormone)	Pituitary

Q.146. Give example(s) of: **[1 Mark Each]**

i. Hyperglycemic hormone and hypoglycemic hormone.
ii. Hypercalcemic hormone.
iii. Gonadotropic hormones.
iv. Progestational hormone.
v. Blood pressure lowering hormone.
vi. Androgens and estrogens. **[NCERT]**

Ans:

i. Glucagon and insulin
ii. Parathormone (PTH)
iii. FSH and LH/ICSH
iv. Progesterone
v. Atrial natriuretic factor (ANF)
vi. Testosterone and Estradiol

Q.147. Write short notes on the functions of the following hormones: **[1/ 2 Mark(s) Each]**

i. Parathyroid hormone (PTH)
ii. Thyroid hormones
iii. Thymosins
iv. Insulin and glucagon
v. Estrogens
vi. Androgens **[NCERT]**

Ans:

No.	Hormone	Function/s
i.	PTH	Parathormone increases Ca^{++} level in the blood. It regulates calcium and phosphate balance between blood and other tissues. It draws calcium from bones and increases calcium absorption in digestive tract. It reduces calcium loss through urine.
ii.	Thyroid hormones a. Thyroxine b. Calcitonin	Thyroxine regulates the basal metabolic rate of body. It also regulates metabolism by stimulating protein synthesis and promotes growth of body tissues. It helps in thermoregulation by increasing heat production. It increases action of neuro transmitters- adrenaline and nor adrenaline. It also supports the process of RBC production and maintenance of water and electrolyte balance. It also regulates reproductive cycles in females. It also regulates reproductive cycles in females. The hormone calcitonin regulates calcium metabolism.
iii.	Thymosin	Promotes production of antibodies by providing humoral immunity
iv.	a. Insulin b. Glucagon	Decreases sugar level in blood by stimulating glycogenesis in liver and muscle cells; increasing the utilization of glucose prevents gluconeogenesis. Increases sugar level in blood by stimulating glycogenolysis in liver cells and gluconeogenesis.
v.	Estrogen	It is responsible for development of secondary sexual characters in females.
vi.	Androgens (e.g. Testosterone)	It is also responsible for appearance of secondary sexual characters such as facial and pubic hair, deepening of voice, broadening of shoulders, male aggressiveness, etc. It involves in development of testis.

Q.148. Name the following: **[1 Mark Each]**

i. The outermost meninges.
Ans: Dura mater

ii. The largest part of the brain.
Ans: Cerebrum

iii. Part of the Central Nervous System which acts as a master clock of the body.
Ans: Hypothalamus of forebrain

iv. These structures form limbic system.
Ans: Hypothalamus, amygdala, parts of epithalamus and thalamus

v. The III cranial nerve.
Ans: Occulomotor

vi. The receptors that is sensitive to mechanical stimuli like touch, pain.
Ans: Mechanoreceptors

vii. Fluid in the eye that fills the space between the lens and cornea.
Ans: Aqueous humor

viii. Sensory cells in the eye specialized for colour vision.
Ans: Cones

ix. The coiled portion of the labyrinth.
Ans: Cochlea

x. The parts of adenohypophysis
Ans: Pars distalis, pars intermedia and pars tuberalis

xi. The hormone that maintains 24-hour diurnal rhythm of the body.
Ans: Melatonin

xii. The hormone which inhibits the FSH and GnRH secretion.
Ans: Inhibin

xiii. The hormones secreted in the kidney.
Ans: Renin, calcitriol and erythropoietin

xiv. Name the region of retina where rods and cones are absent. **[Mar 20]**
Ans: Blind spot

Q.149. Fill in the blanks. **[1 Mark Each]**

i. The resting potential of axon is _____.
Ans: −70mV

ii. Sodium potassium pump pumps out $3Na^+$ ions for every _____ ions that are pumped into the cell.
Ans: 2 Na^+

iii. Brain is enclosed within the _____ of skull.
Ans: Cranium

iv. The cerebral hemispheres are connected by a band of nerve fibres called _____.
Ans: Corpus callosum

v. _____ is the part of forebrain that contains epithalamus, thalamus and hypothalamus.
Ans: Diencephalon

vi. The four rounded elevations on the dorsal surface of the midbrain are _____.
Ans: Corpora quadrigemina

vii. The outermost layer of wall of eyeball is _____.
Ans: Sclera

viii. _____ connects the middle ear to the pharynx.
Ans: Eustachian tube

ix. Graves's disease is cause due to hyper secretion of _____.
Ans: Thyroid gland/ thyroid hormone

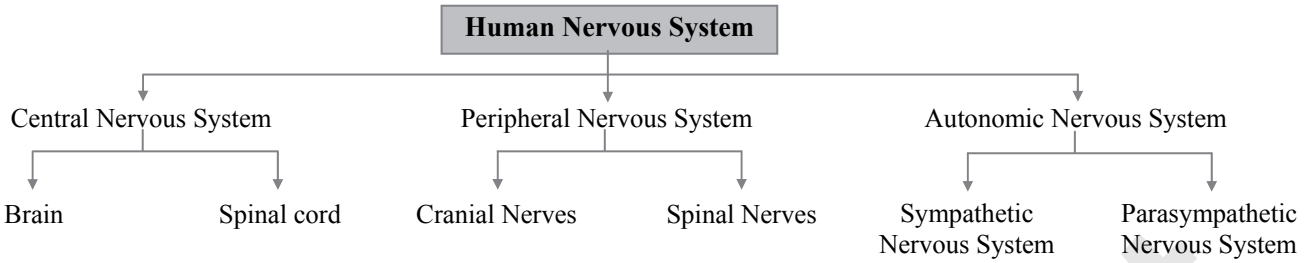
x. _____ is also known as Collip's hormone.
Ans: Parathormone

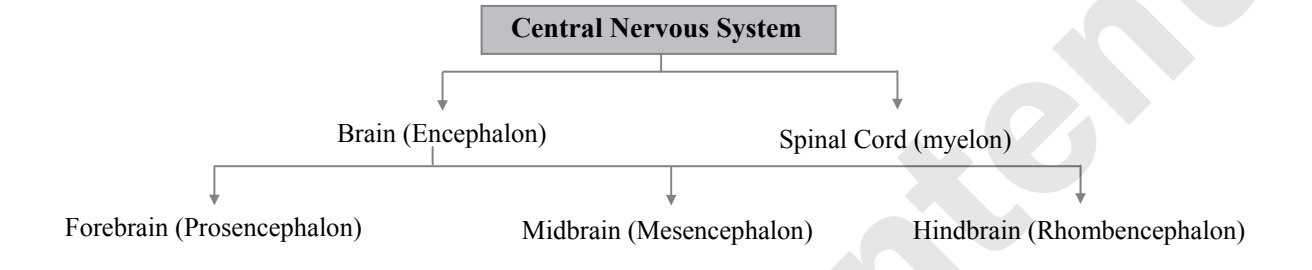
xi. Laxman has low secretion of ADH resulting in _____ type of diabetes. **[Mar 20]**
Ans: Insipidus

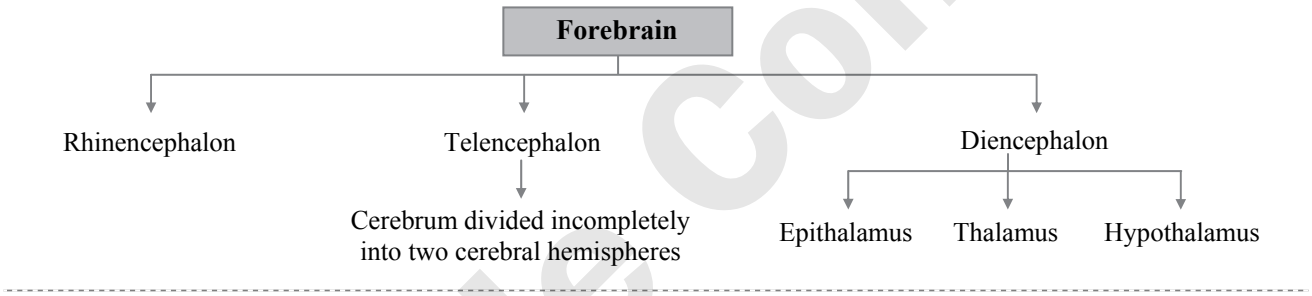
Practical / Project

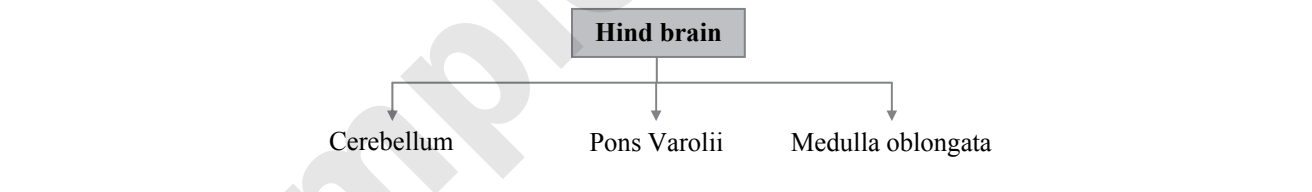
***Q.150. Project:**
Prepare animated PowerPoint presentation to explain mechanisms of hormonal action.
Ans:
[Students are expected to refer Q.85 and prepare the PowerPoint presentation on their own.]

Quick Review





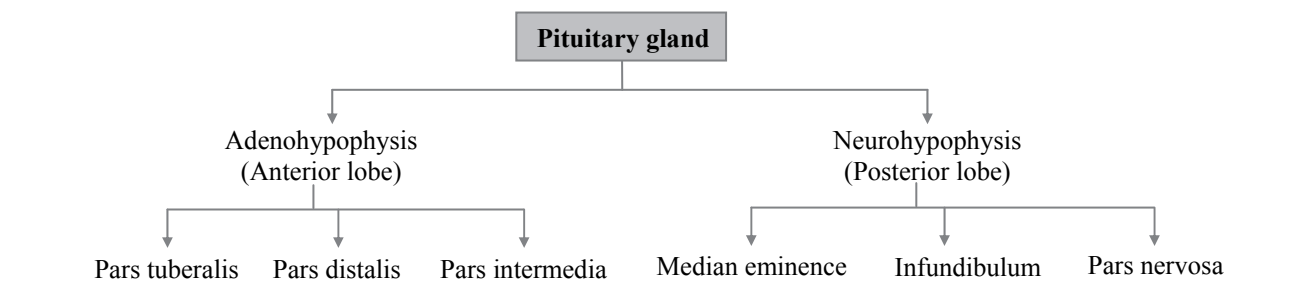


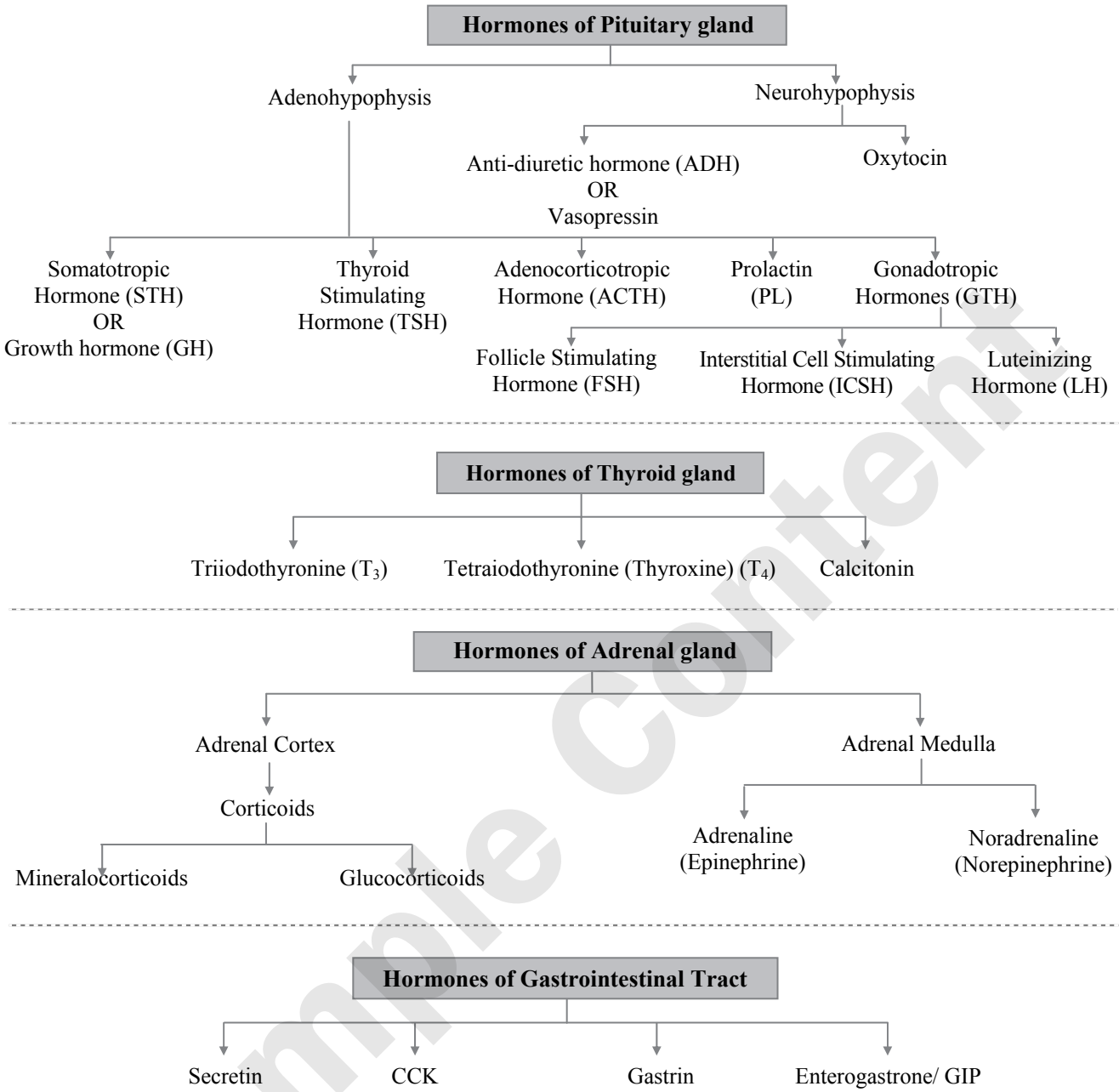


Peripheral Nervous System

Cranial nerves
- It includes 12 pairs of cranial nerves.
- They are
  Sensory – I, II, VIII; **Mixed** – V, VII, IX, X; **Motor** – III, IV, VI, XI, XII

Spinal nerves
- 31 pairs of spinal nerves.
- All are mixed.





Exercise

9.1 Nervous System in Lower Animals

1. Write a short note on nervous system in *Hydra* **[2 Marks]**

Ans: *Refer Q.1*

2. Explain the nervous system in *Planaria* **[2 Marks]**

Ans: *Refer Q.2*

9.2 Neural Tissue

3. Write a note on nerve cells. **[2 Marks]**

Ans: *Refer Q.6*

4. Describe the neuroglial cells in central nervous system. **[2 Marks]**

Ans: *Refer Q.9 (i-iv) and Q.11*

5. Give the role neuroglial cells of peripheral nervous system. **[1 Mark]**

Ans: *Refer Q.9 (v,vi).*

6. Describe in detail the glial cells. **[3 Marks]**

Ans: *Refer Q.8, 9, 11*

9.3 Synapse

7. What is a synapse? **[1 Mark]**

Ans: *Refer Q.19*

8. Describe the two types of synapses. **[3 Marks]**

Ans: *Refer Q.19. (iv)*

9. What is synaptic cleft? **[1 Mark]**
Ans: *Refer Q.15. (iii)*

10. Explain the process of transmission of nerve impulse through synapse. **[2/ 3 Marks]**
Ans: *Refer Q.20*

9.4 Transmission of Nerve impulse

11. Write a note on depolarization and repolarization. **[2 / 3 Marks]**
Ans: *Refer Q.21.*

12. Draw a neat and labelled diagram of polarization and repolarization. **[2 Marks]**
Ans: *Refer Q.21. (Diagram)*

13. What is Na-K pump? **[1 Mark]**
Ans: *Refer Q.22.*

9.5 Human Nervous System

14. Write a short note on autonomous nervous system. **[2 Marks]**
Ans: *Refer Q.26. (iii)*

15. Describe the parasympathetic and sympathetic nervous system. **[3/ 4 Marks]**
Ans: *Refer Q.27.*

16. Give the functions of meninges and CSF. **[3/ 4 Marks]**
Ans: *Refer Q.31, 32(ii), 33*

17. Describe the structure of cerebrum. Add a note on its functions. **[Mar 16]**
Ans: *Refer Q.36. (ii) and Q.37 (ii-a)*

18. What are olfactory lobes? **[1 Mark]**
Ans: *Refer Q.36. (i)*

19.
i. Name the nerve fibres internally connecting the cerebral hemispheres.
ii. Name the sulci which divide each cerebral hemisphere into 4 lobes.
iii. Describe the various functional areas found in the different lobes of cerebral hemispheres. **[July 22] [4 Marks]**

Ans:
i. *Refer Q.36 (ii-b)*
ii. *Refer Q.36 (ii-e)*
iii. *Refer Q.41*

20. Enlist the meninges of human brain. **[1 Mark]**
Ans: *Refer Q.31.*

21. Write a note on hypothalamus. **[2 Marks]**
Ans: *Refer Q.39. (iii)*

22. Give the function of hypothalamus. **[2 Marks]**
Ans: *Refer Q.39 (Functions of hypothalamus)*

23. Write a note on mid brain. **[2/ 3 Marks]**
Ans: *Refer Q.42.*

24. Describe the functional areas of the cerebrum. **[3 Marks]**
Ans: *Refer Q.41.*

25. Elaborate on: **[3 Marks]**
i. Cerebellum. ii. Medulla
Ans:
i. *Refer Q.45. (ii)* ii. *Refer Q.45. (iii)*

26. Rekha met with an accident and lower part of her brain was injured. The doctor feared that Rekha's medulla region is injured and informed her parents that she is critical as injury to medulla is fatal. Why is injury to medulla fatal? **[1 Mark]**
Ans: *Refer Q.48.*

27. Give examples of unconditional reflexes. **[Oct 13][1 Mark]**
Ans: *Refer Q.61 (ii)*

28. Enlist the number and names of motor cranial nerves in human being. **[Mar 13][2 marks]**
Ans: *Refer Q.55.*

29. Describe T.S. of spinal cord in man, with a neat and labelled diagram. **[Mar 08] [4 Marks]**
Ans: *Refer Q.52.*

30. Sketch and label formation of typical spinal nerve. **[Oct 14][3 marks]**
Ans: *Refer Q.58.*

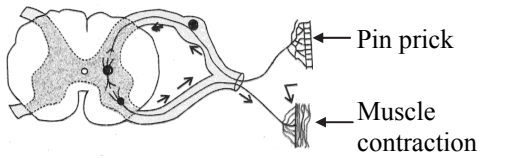
31. Give an account of structure and functions of hind brain. **[4 Marks]**
Ans: *Refer Q.45.*

32. i. Give names of cranial nerves VI and VII. **[July 18][1 mark]**
ii. Enlist any four motor cranial nerves. **[Mar 10]**
Ans: i. *Refer Q.55.* ii. *Refer Q.55.*

33. Explain mechanism of reflex action and give its significance. **[Mar 09; 08]**
Ans: *Refer Q.59 and Q.60*

34. Define reflex action and reflex arc. Describe various components of reflex arc. Add a note on the mechanism of reflex action. **[Mar 09]**
Ans: *Refer Q.59 and Q.60*

35. Redraw, complete and label the diagram given below, which relates to reflex arc:
[Mar 20] [2 Marks]



Ans: *Refer Q.60 (Diagram)*

9.6 Sensory Receptors

36. Write a short note on exteroceptors. **[2 Marks]**
Ans: *Refer Q.62. (i)*

37. Describe briefly about the interoceptors.
[2 Marks]
Ans: *Refer Q.62. (ii)*

38. Sketch and label V.S. of human eye.
[Mar 14] [3 Marks]
Ans: *Refer Q.66. (Diagram)*

39. With the help of a neat and labelled diagram describe the anatomy of 'human eye'.
Explain the mechanism of vision.
[Mar 18] [1 Mark]
Ans: *Refer Q.66 and Q.73*

40. Give the names of ear ossicles. **[1 Mark]**
Ans: *Refer Q.74. (ii)*

41. Draw a labelled diagram of human ear.
[NCERT] [3 Marks]
Ans: *Refer Q.74 (Diagram)*

42. Describe the inner ear in detail. **[2/3 Marks]**
Ans: *Refer Q.74. (iii)*

43. Mention the role of semicircular canals in ear.
[1 Mark]
Ans: *Refer Q.74. (iii – b)*

44. Explain the structure of external ear.
[2/ 3 Marks]
Ans: *Refer Q.74. (i)*

45. Give the location and one function of the following receptors : **[3 Marks]**
(i) Mechanoreceptors
(ii) Statoacoustic receptors
(iii) Baroreceptors **[Mar 20]**
Ans: *Refer Q. 62 (i-a,d and ii-c)*

9.7 Disorders of Nervous System

46. Write a note on Alzheimer's disease. **[2 Marks]**
Ans: *Refer Q.79. (ii)*

9.8 Chemical Co-ordination

47. What are paracrines? **[1 Mark]**
Ans: *Refer Q.80 (ii)*

48. Ishaan and his friend's studied how worker bees were maintained in a sterile state by anti-queen factor produced by the queen bee. Write a note on this type of hormone. **[2/ 3 Marks]**
Ans: *Refer Q.81*

9.9 Endocrine System

49. With the help of a suitable example, write the mechanism of hormone action through membrane receptors. **[July 22] [1 Mark]**
Ans: *Refer Q.85 (i)*

9.10 Major Endocrine Glands

50. Write a short note on Adenohypophysis.
[2 Marks]
Ans: *Refer Q.91. (ii – a)*

51. Name the cavity in which the pituitary gland is located. **[1 Mark]**
Ans: *Refer Q.91. (i)*

52. Explain the structure of anterior pituitary gland.
[2 Marks]
Ans: *Refer Q.91. (ii – a)*

53. Write a short note on growth hormone.
[2 Marks]
Ans: *Refer Q.92. (i), 100*

54. Give the function of progesterone. **[1 Mark]**
Ans: *Refer Q.133. (i)*

55. Name the disorder caused by under secretion of thyroxine in children. **[Oct 13][1 mark]**
Ans: *Refer Q.110 (ii)*

56. Name the endocrine gland which degenerates in old age. **[1 Mark]**
Ans: *Refer Q.122.(iii)*

57. Which hormone is secreted by β cells of pancreas? **[1 Mark]**
Ans: *Refer Q.130. (ii)*

58. The doctor examined Ravi's urine report and detected that he had high levels of glucose in his urine. What is the disease he may be suffering from? How is it caused? **[2 Marks]**
Ans: *Refer Q.89*

59. Give the role/functions of any 'two' gonadotropins. **[Oct 08]**
Ans: *Refer Q.92 (v)*

60. Mention the role of hormone secreted by thymus gland. **[1 Mark]**
Ans: *Refer Q.122. (iv)*

61. State the names of hormone and glands secreting them: **[Mar 22] [4 Marks]**

i. Growth of thyroid gland.

Ans: *Refer Q.145*

ii. Controls tubular absorption of water in kidney.

Ans: *Refer Q.145*

iii. Stimulates liver and muscles for glycogenesis.

Ans: *Refer Q.130 (ii)*

iv. Development of immune system and maturation of T-lymphocyte.

Ans: *Refer Q.122 (iv)*

62. Describe the histological (internal) structure of thyroid gland. **[Oct 08]**

Ans: *Refer Q.105.*

63. Give a brief account of Neurohypophysis. **[3 Marks]**

Ans: *Refer Q.91. (ii-b)*

64. Write a short note on Cretinism. **[2 Marks]**

Ans: *Refer Q.100. (ii -a)*

65. Give the role/function of hormones released by neurohypophysis. **[Mar 09]**

Ans: *Refer Q.96.*

66. Describe the role of hormones secreted by thyroid gland. **[3 Marks]**

Ans: *Refer Q.106. (iv)*

67. Describe the different disorders of hyper secretion of thyroid gland. **[2 Marks]**

Ans: *Refer Q.110. (i)*

68. Sketch and label T.S. of the thyroid gland. **[July 17] [3 Marks]**

Ans: *Refer Q.105.*

69. Give an account of hormones secreted by pituitary gland. **[3 Marks]**

Ans: *Refer Q.92.*

70. Describe briefly role of hypothalamus and pituitary in maintaining homeostasis. **[3 Marks]**

Ans: *Refer Q.98.*

71. Sketch and label V.S. of pituitary gland. **[Mar 10]**

Ans: *Refer Q. 91*

Multiple Choice Questions

[1 Mark Each]

*1. The nervous system of mammals uses both electrical and chemical means to send signals via neurons. Which part of the neuron receives impulse?

(A) Axon (B) Dendron
(C) Nodes of Ranvier (D) Neurilemma

*2. The supporting cells that produce myelin sheath in the PNS are _____.

(A) Oligodendrocytes (B) Satellite cells
(C) Astrocytes (D) Schwann cells

*3. A collection of neuron cell bodies located outside the CNS is called _____.

(A) Tract (B) Nucleus
(C) Nerve (D) Ganglion

*4. _____ is a neurotransmitter.

(A) ADH (B) Acetyl CoA
(C) Acetylcholine (D) Inositol

*5. _____ is in direct contact of brain in human.

(A) Cranium (B) Duramater
(C) Arachnoid (D) Piamater

6. _____ layer is in close contact of CNS in human being. **[Mar 22]**

(A) Cranium
(B) Dura matter
(C) Arachnoid matter
(D) Pia matter

7. Corpus callosum is a nerve fibre bridge which connects

(A) two cerebral hemispheres
(B) cerebrum and cerebellum
(C) cerebellum and medulla
(D) midbrain and hind brain

8. Spinal cord and sympathetic ganglion of autonomous nervous system are connected by _____. **[Mar 14]**

(A) ramus ventralis
(B) ramus communicans
(C) ramus dorsalis
(D) connective

9. Identify the following diagram from the alternatives given below: **[Oct 14]**

(A) T. S. of ovary
(B) T. S. of testis
(C) T. S. of vein
(D) T.S. of thyroid gland

10. Injury to _____ causes sudden death. **[Mar 20]**

(A) cerebrum
(B) pons varolii
(C) medulla oblongata
(D) diencephalon

11. Terminal part of spinal cord is

(A) Funiculus
(B) Filum terminale
(C) Cauda equina
(D) Conus terminalis

12. Membrane bound receptors and hormones produce second messengers like _____. **[Mar 19]**
(A) Renin (B) IP3
(C) ANF (D) GHRF

13. Which of the following is a sensory nerve?
(A) Vagus (B) Auditory
(C) Facial (D) Hypoglossal

14. The transparent anterior portion of sclera of eye is called _____. **[July 18]**
(A) iris (B) lens
(C) ciliary body (D) cornea

15. Photoreceptor cells are present in **[July 16]**
(A) blind spot (B) retina
(C) cochlea (D) cornea

16. _____ is a hormone that regulates amount of glucose (sugar) in the blood. **[July 18]**
(A) angiotensin (B) insulin
(C) adrenaline (D) erythropoietin

*17. Hormone thyroxine, adrenaline and nor adrenaline are formed from _____.
(A) Glycine (B) Arginine
(C) Ornithine (D) Tyrosine

*18. Pheromones are chemical messengers produced by animals and released outside the body. The odour of these substance affects
(A) skin colour (B) excretion
(C) digestion (D) behaviour

*19. Receptors for protein hormones are located
(A) in cytoplasm
(B) on cell surface
(C) in nucleus
(D) on Golgi complex

*20. Which one of the following is a set of discrete endocrine glands?
(A) Salivary, Thyroid, Adrenal, Ovary
(B) Adrenal, Testis, Ovary, Liver
(C) Pituitary, Thyroid, Adrenal, Thymus
(D) Pituitary, Pancreas, Adrenal, Thymus

21. Pituitary gland is under the control of
(A) thyroid (B) adrenal
(C) pineal (D) hypothalamus

22. TSH regulates _____ secretion.
(A) thyroxine (B) MSH
(C) androgens (D) insulin

23. FSH is secreted by
(A) pituitary gland (B) thyroid gland
(C) ovary (D) adrenal gland

24. Damage to which endocrine gland may result in water and electrolyte imbalance? **[Mar 13]**
(A) Thymus gland
(B) Thyroid gland
(C) Adrenal gland
(D) Parathyroid gland

25. Milk secretion in lactating woman is controlled by
(A) LH (B) Prolactin
(C) Relaxin (D) Oestrogen

26. Hypersecretion of STH in children causes
(A) Cretinism (B) Gigantism
(C) Dwarfism (D) Myxoedema

27. The uterine contraction during delivery is controlled by
(A) oxytocin (B) oestrogen
(C) progesterone (D) LH

28. The largest endocrine gland in the body is
(A) Pituitary (B) Adrenal
(C) Liver (D) Thyroid

29. _____ maintains basal metabolic rate. **[Mar 18]**
(A) Thyroxine (B) ADH
(C) GH (D) Oxytocin

30. The catecholamines are secreted by **[Oct 13]**
(A) adrenal cortex
(B) adrenal medulla
(C) thymus
(D) pancreas

*31. If parathyroid gland of man are removed, the specific result will be
(A) onset of aging
(B) disturbance of Ca^{++}
(C) onset of myxoedema
(D) elevation of blood pressure

32. ADH is secreted by
(A) Adrenal gland (B) Thyroid
(C) Hypothalamus (D) Pancreas

33. Which among the following is a heterocrine gland?
(A) Liver (B) Pancreas
(C) Sweat glands (D) Stomach

34. Which of the following hormones is responsible for regulating the blood sugar level in the human body? **[Oct 14]**
(A) Insulin
(B) Growth hormone
(C) Oxytocin
(D) Vasopressin

*35. After ovulation, Graafian follicle changes into
(A) Corpus luteum
(B) Corpus albicans
(C) Corpus spongiosum
(D) Corpus callosum

*36. Which one of the following pair correctly matches a hormone with a disease resulting from its deficiency?
(A) Parathyroid hormone – Diabetes insipidus
(B) Luteinizing hormone – Diabetes mellitus
(C) Insulin – Hyperglycemia
(D) Thyroxine – Tetany

Answers to Multiple Choice Questions

1.	(B)	2.	(D)	3.	(D)	4.	(C)
5.	(D)	6.	(D)	7.	(A)	8.	(B)
9.	(D)	10.	(C)	11.	(B)	12.	(B)
13.	(B)	14.	(D)	15.	(B)	16.	(B)
17.	(D)	18.	(D)	19.	(B)	20.	(C)
21.	(D)	22.	(A)	23.	(A)	24.	(C)
25.	(B)	26.	(B)	27.	(A)	28.	(D)
29.	(A)	30.	(B)	31.	(B)	32.	(C)
33.	(B)	34.	(A)	35.	(A)	36.	(C)

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