17. Control and Co- ordination

17.1 : Structure and Function of Brain and Spinal Cord

Q.1. Explain human nervous system. Add a note on its function.

Ans: Human nervous system :

The human nervous system is derived from the embryonic ectoderm and is similar in all vertebrates.

It is divided into three divisions as follows :

i) Central Nervous System (CNS) :
It is mid-dorsal and hollow system consisting of brain and spinal cord.

ii) Peripheral Nervous System (PNS) :
The nerves given by CNS to connect all the body parts constitute peripheral nervous system.

iii) Autonomous Nervous System (ANS) :
It consists of motor nerves and controls internal environment or working of visceral organs and are semi independent in function.

Functions of nervous system :

i) It is a high speed co-ordinator, regulating the working of different organs in the body.
ii) It establishes quick connections among the cells, organs and tissues of the body.
iii) It controls the voluntary movements like locomotion.
iv) It controls involuntary movement or actions like breathing, circulation, functions of heart, peristalsis etc.
v) It receives and gives responses to the external stimuli.
vi) It enables man to adapt with changing environment.
vii) It stores information.

Q.2. Describe meninges. Also give its functions.

Ans: CNS is covered by a connective tissue membrane called meninges (singular meninx). In mammals, there are three membranes as given below:

i) Dura mater :
It is the outermost meninx attached to the cranium and vertebrae. It is thick, tough and fibrous. It is protective in function.

ii. Arachnoid mater :
It is middle layer which is thin and vascular. It is formed of reticular connective tissue. It has spider web like appearance. It is nutritive and protective.

iii) Pia mater :
It is the innermost thin and vascular membrane lying along CNS. Between dura mater and arachnoid mater subdural space is present. In between pia mater and arachnoid mater sub-arachnoid space is present. It contains lymph-like watery fluid called cerebrospinal fluid (CSF) secreted by choroid plexus. CSF is alkaline and approximately 120 ml in adults.

Functions of meninges and cerebrospinal fluid :

a) Meninges are protective and nutritive in function.
b) CSF acts as a shock absorber and protects brain from external shock and injury.
c) It maintains constant pressure around the brain and inside the cranium.
d) It helps in exchange of nutrients and wastes between blood and brain tissue.
e) It also helps in supply of O_2 to brain.
f) It keeps the CNS moist and prevents from drying (desiccation).
g) The additional epidural space (space outside the dura mater) around the spinal cord is filled up with adipose connective tissue which protects spinal cord from friction with vertebral column.

Q.3. Give the functions of meninges and CSF. OR
Give the functions of cerebrospinal fluid. **[Mar 2013 old course]**

Ans: For these short notes *Refer Q.2*

Q.4. What is meningitis ?

Ans: Infection of meninges is called meningitis.

Q.5. Enlist the meninges of human brain.

Ans: Dura matter,arachnoid matter and pia matter.

Q.6. Distinguish between dura mater and pia mater.

Ans:

No.	Dura mater	Pia mater
i.	Dura mater is the outermost meninx.	Pia mater is the innermost meninx.
ii.	Dura mater lies on the innermost side of skull or cranium.	Pia mater lies on outermost side of brain.
iii.	Dura mater is tough, thick and fibrous.	Pia mater is thin and highly vascular.
iv.	Dura mater is mainly protective in function.	Pia mater is mainly nourishing in nature.
v.	Below dura mater is subdural space.	Above pia mater is subarachnoid space.

Q.7. Briefly describe the structure of the brain.

OR

Give an account of human brain (Encephalon).

Ans:Human Brain (Encephalon):

The human brain is situated in the cranium of the skull.
It is soft, whitish, large-sized and slightly flattened structure.
It has a weight of 1300-1400 gms and volume of 1300-1500 c.c.
The brain develops to its full size at the age of six years and contains about 30,000 million neurons .
The supportive cells of nervous system are neuroglia, e.g. Schwann cells, ependymal cells.
The human brain consists of three parts as given below:

i) Forebrain (Prosencephalon): consists of olfactory lobes, cerebrum and diencephalon.
ii) Midbrain (Mesencephalon): consists of corpora quadrigemina and crura cerebri.
iii) Hindbrain (Rhombencephalon): consists of cerebellum, pons varolii and medulla oblongata.

Q.8. With the help of labelled diagram of dorsal and ventral views describe the structure and functions of fore brain.

Ans:Forebrain (Prosencephalon) :

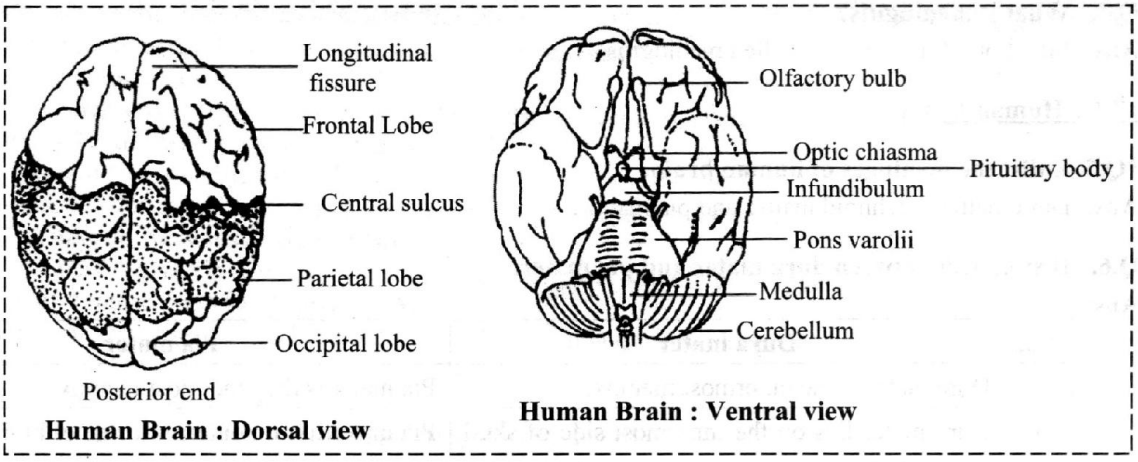
It consists of three regions: namely olfactory lobes, cerebrum and diencephalon.

i) Olfactory lobes (Rhinencephalon):

Olfactory lobes are a pair of small sized solid bodies present ventrally in the forebrain.
They are completely surrounded by frontal lobe of cerebral hemisphere.
Each lobe has long olfactory tract and swollen anterior olfactory bulb

Functions of Olfactory lobes :

Olfactory lobes are concerned with sense of smell.
In human beings, sense of smell is comparatively poor due to the small size of olfactory lobes.



Human Brain : Dorsal view **Human Brain : Ventral view**

ii) Cerebrum (Telencephalon) :

It is **largest** part of the brain accounting for **80-85%** of its weight.
It is divided into cerebral hemispheres (right and left) by a **median longitudinal cerebral fissure.**
Two cerebral hemispheres are connected by a single thick bundle of nerve fibres called **corpus callosum.**
It is the largest commissure in human brain.
It connects both the hemispheres and helps in co-ordination.
The **outer part** of cerebrum is called **cortex** while the **inner part** is called **medulla.**
Cerebral cortex is formed by neurons cell bodies which appear grey and hence are called **grey matter.**
Cerebral medulla is mainly formed of **white matter** (axons of nerve cells).
Deep within the white matter, certain masses of grey matter are located which are called basal nuclei.
Thick dorsal wall (roof) of cerebrum is called **pallium** and the ventrolateral wall is known as **corpora striata.**
Cerebral cortex shows number of ridges called **gyri** and depressions called **sulci.**
The gyri increase the surface area of cerebral cortex.
There are three deep sulci on the cerebrum namely **central sulcus, lateral sulcus and parietooccipital sulcus.**
These sulci divide each cerebral hemisphere into four lobes viz.,**anterior frontal lobe, middle parietal lobe, posterior occipital lobe, lateral temporal lobe.**
The frontal and parietal lobes are separated by central sulcus, the parietal and temporal lobes are separated by lateral sulcus while the parieto-occipital sulcus separates parietal lobe from occipital lobe.

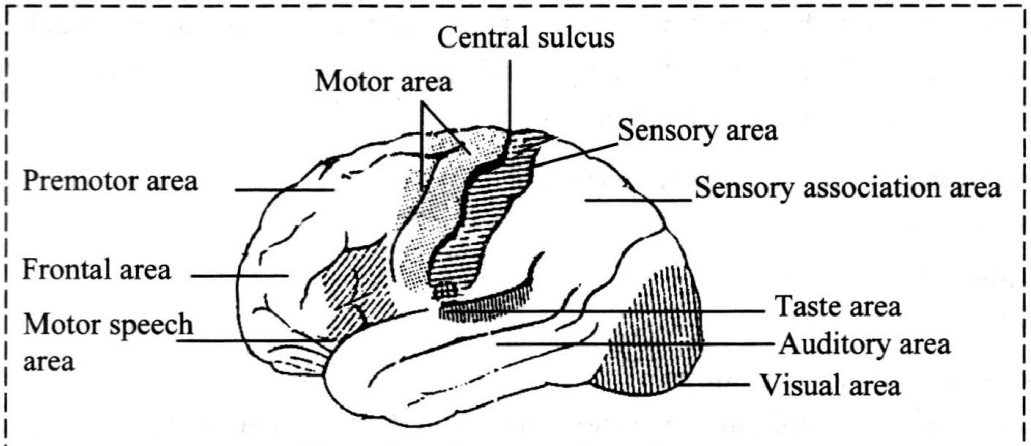
Functions of Cerebrum :

It controls all voluntary activities.
It perceives sensory stimuli through vision, taste, smell, sound, touch and speech.
It is a centre of memory, will power, intelligence, reasoning and learning.
It is a centre for micturition, defaecation, weeping and laughing.
It is also a centre for emotions, thoughts and feelings like pain, pleasure, fear, fatigue, pressure, temperature etc.

Functional areas of cerebral cortex : There are three functional areas as given below.

a) Sensory areas: They receive impulses from sensory receptors and are concerned with analysis of sensation.
Sensory speech area is present in parietal lobe while temporal lobe shows olfactory, auditory and gustatory areas. The visual areas lies in the occipital lobe.

b) Association areas :
They form major portion of the cortex and are present in each lobe.
They are involved in input processing, analysis and storage of information.
They are also concerned with power of reasoning, will, understanding and memory.



Functional areas of cerebrum

c) Motor area :

It is mostly present in frontal lobe and concerns with origin of motor impulses. Motor area lies in the frontal lobe immediately anterior to the central sulcus. It controls involuntary movement and ANS. Immediately anterior to motor area lies pre motor area. It controls voluntary movement. In the lower part of motor area, just above the lateral sulcus, is present motor speech area or Broca's area which controls the movements for speech. It is dominant in the left hemisphere in right handed people and vice versa.

iii) Diencephalon (Thalamencephalon) :

It is located below the corpus callosum and dorsal to mid brain.
It is completely surrounded by cerebral hemispheres.
It is divisible into three regions :

a) Epithalamus :

It is the roof of diencephalon and is non-nervous and highly vascular.
Epithalamus and part of pia mater form anterior choroid plexus that secretes cerebrospinal fluid.
Behind the plexus, a projection known as pineal stalk is present to which pineal body is attached.
Pineal body is an endocrine gland which secretes two hormones serotonin and melatonin. Serotonin is involved in metabolic activities while melatonin is concerned with biological rhythm.

b) Thalamus :

The lateral parts of diencephalon are called thalami.
Two thalami are connected by **habencular commissure.**
All sensory impulses except olfactory impulses pass through thalamus to the cerebrum.

c) Hypothalamus :

The floor of diencephalon is called hypothalamus.
It is located beneath the **thalamus** and behind the **optic chiasma.**
It gives out downward growth called **infundibulum** to which pituitary gland is attached. The hypothalamus has many masses of grey matter called hypothalamic nuclei scattered in white matter.

Functions of Diencephalon :

It is a relay centre for motor and sensory impulses between spinal cord, brain stem and various areas of cerebral cortex.
It controls ANS and maintains steady state and equilibrium (homeostasis) of the body. Hypothalamus is the co-ordinator between nervous system and endocrine system. It secretes neurohormones (Stimulating and inhibiting factors) which influence the pituitary gland. Hypothalamus has higher centre of ANS that controls involuntary functions like thermoregulation, hunger, eating, thirst, fear, anger, emotions, sleep, sexual desire etc.
It regulates heart beats, blood pressure and water balance in serial order.
Anterior choroid plexus secretes CSF.

Q.9. Describe the functional areas of cerebral cortex.

Ans: *Refer Q. 8(Functional areas of cerebral cortex)*

Q.10.Give the functions of diencephalon.

Ans: *Refer Q. 8 iii (functions).*

Q.11.Give the importance of hypothalamus.

Ans:i) Hypothalamus is the co-ordinator between nervous system and endocrine system.
ii) It secretes neurohormones (Stimulating and inhibiting factors) which influence the pituitary gland.
iii) Hypothalamus has higher centre of ANS that controls involuntary functions like thermoregulation, hunger, eating, thirst, fear, anger, emotions, sleep, sexual desire etc.
iv) It regulates heart beats, blood pressure and water balance in serial order.
v) Anterior choroid plexus secretes CSF.

Q.12. Write a short note on forebrain.

Ans: *Refer Q.8.*

Q.13. Draw a neat labelled diagram of ventral and dorsal view of human brain.

Ans: *Refer Q. 8 diagram.*

Q.14. Write an account of structure and functions of cerebrum.

Ans: *Refer Q. 8.ii*

Q.15. Differentiate between the thalamus and hypothalamus.

Ans:

No.	Thalamus	Hypothalamus
i.	One pair of masses of neurons present inner to basal ganglia in the cerebral medulla.	One pair of masses of neurons present in cerebral medulla below thalami.
ii.	It act as relay centres and conduct the nerve impulses of pain, temperature, touch, etc. to cerebral hemispheres.	It acts as thermostat of body (temperature regulation) though also controls hunger, thirst, sweating, sleep, fatigue, sexual desire, water balance, blood pressure, etc. It also secretes releasing factors (neurohormones).

Q.16. Write short notes on the following.

i) Olfactory lobes.
ii) Sulci and gyri.
iii) Hypothalamus.
iv) Functions of Diencephalon.

Ans: *For short notes i, iii and iv Refer Q.8*

ii) Sulci and gyri :

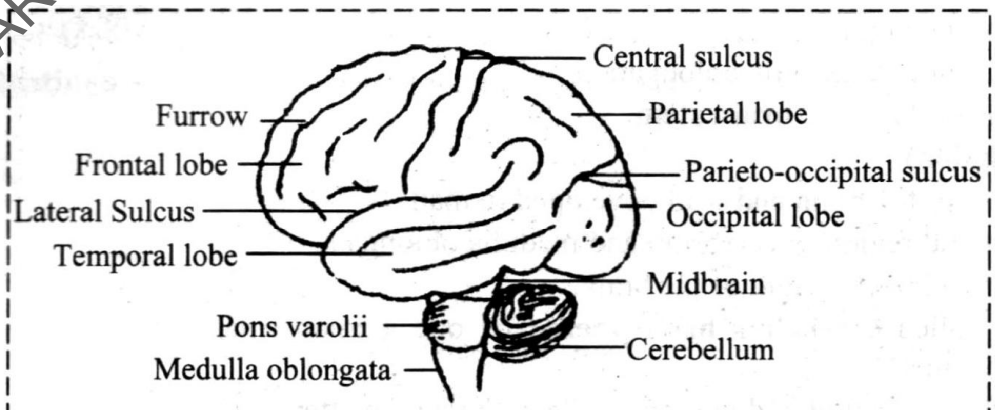
a) On the roof of cerebral hemisphere or pallium there are ridges and depressions.
b) These are formed due to highly folded surface.
c) The ridges are called gyri and the depressions are called sulci.
d) Due to sulci and gyri the surface of cerebral cortex is increased.

Q.17.Draw a neat labelled diagram of functional areas of cerebrum.

Ans: *Refer Q.8 diagram.*

Q.18. Give an account of structure and function of mid brain.

Ans:



Brain Lateral view

Midbrain (Mesencephalon):

It is the middle part of brain present between diencephalon and pons varolii.
It is also completely covered by the cerebral hemisphere.
It consists of two regions.

i) Corpora quadrigemina :

These are two pairs of lobes viz. superior colliculi and inferior colliculi present in dorsal thick wall of midbrain.
These colliculi control and coordinate eye movement and head movement.
Superior colliculi controls and co-ordinates visual reflexes.
Inferior colliculi are concerned with auditory reflexes.

ii) Crura cerebri :

These are a pair of thick bands of longitudinal nerve fibres present on the floor of midbrain.
These fibres connect cerebrum to cerebellum and spinal cord.

Functions :

It transmits the impulses from fore brain to hind brain and vice versa.
It controls reflexes of vision and hearing.
It connects the cerebrum to cerebellum and spinal cord.

Q.19. Write a short note on midbrain.

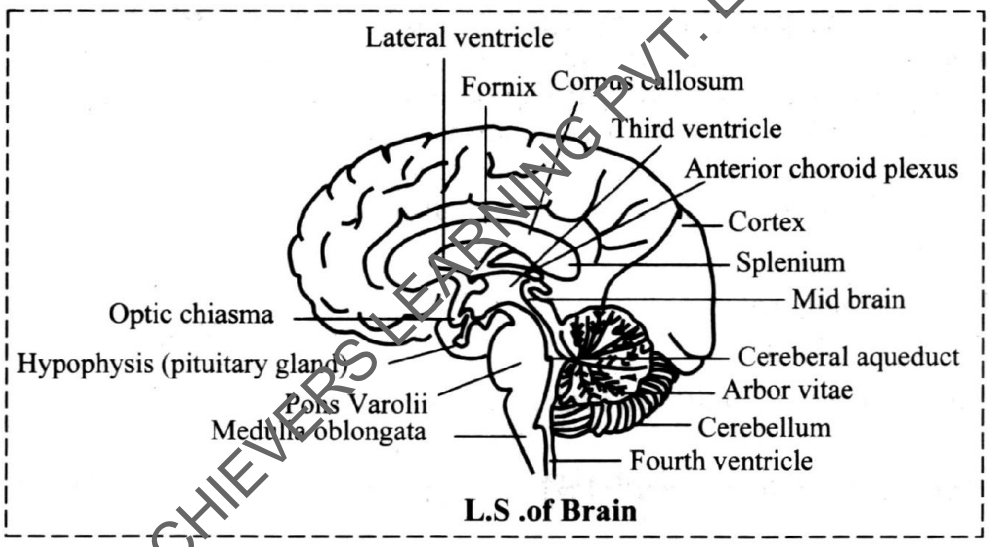
Ans: *Refer Q. 18.*

Q.20. Draw and label lateral view of human brain. Describe hind brain and give its functions.

OR

Give an account of structure and functions of hind brain. OR
Describe the lateral view of human brain.

Ans:



L.S .of Brain

Hind brain (Rhombencephalon) :

It is the most posterior region of the brain.
It includes cerebellum, Pons varolii and medulla oblongata.
Pons varolii and medulla oblongata form the brain stem.

i) **Cerebellum (Metencephalon) :**

It is the second largest part of the brain and well developed in man.
It is present between occipital region of cerebrum and medulla oblongata.
It is ovoid, solid and forms 11% of weight of the brain.
It has two lateral lobes called **cerebellar hemisphere** and one median small lobe called vermisgiving butterfly like appearance.
It shows outer cortex with grey matter and inner medulla with white matter.
Cerebellar cortex also shows gyri and sulci.
The spreading of white matter in grey matter forms a **branching tree** like appearance called **arbor vitae.**

Functions of cerebellum.

It is primary center for control of equilibrium, posture, balancing and orientation.
It co-ordinates voluntary movement of skeletal muscles and normal muscle tone.
It also controls rhythmic movement such as walking, running, speaking etc.

ii) **Pons Varolii :**

The word pons means **'bridge'.**
It is a transverse connection between cerebrum, cerebellum and medulla oblongata.
It is located below cerebrum, infront of cerebellum and above the medulla oblongata
It consists of thick band of transverse nerve fibres.
It has grey matter inside and white matter outside and it contains cranial nerve nuclei.

Functions of pons varolii:

It connects two cerebellar hemisphere and co-ordinates their activities.
It forms network of nerve fibres and controls consciousness of brain.
It acts as a reflex centre for **breathing** together with medulla oblongata.

iii) **Medulla oblongata (Myelencephalon):**

It is most posterior part of brain and continues as spinal cord.
It is located below the cerebellum and between the spinal cord below and the pons above.
It has white matter outside and grey matter inside. .
Roof of medulla oblongata is thin, non-nervous and forms **posterior choroid plexus.**

Functions of medulla oblongata :

It controls involuntary activities like heart beat, respiration, constriction of blood vessels, secretion of saliva etc.

It also controls reflex activities like vomiting, sneezing, coughing, peristalsis, swallowing, hiccupping, yawning etc. Nerve fibres in medulla crossover and innervate the opposite sides due to which the right side of brain controls activities of the left side of the body and vice versa.

It is main pathway of impulse from spinal cord to brain and vice-versa.

As it has respiratory and circulatory centres injury to medulla oblongata result in paralysis or instant death.

Q.21.Give the functions of medulla oblongata.

Ans: Refer Q.20 iii.

Q.22. Draw a neat labelled diagram of L. S. of human brain.

OR

Draw a neat, labelled diagram showing the lateral view of human brain.

Ans: *Refer Q.20 diagram.* **[Mar 2013 old course]**

Q.23.Explain the structure and function of cerebellum.

Ans: *Refer Q.20 i.*

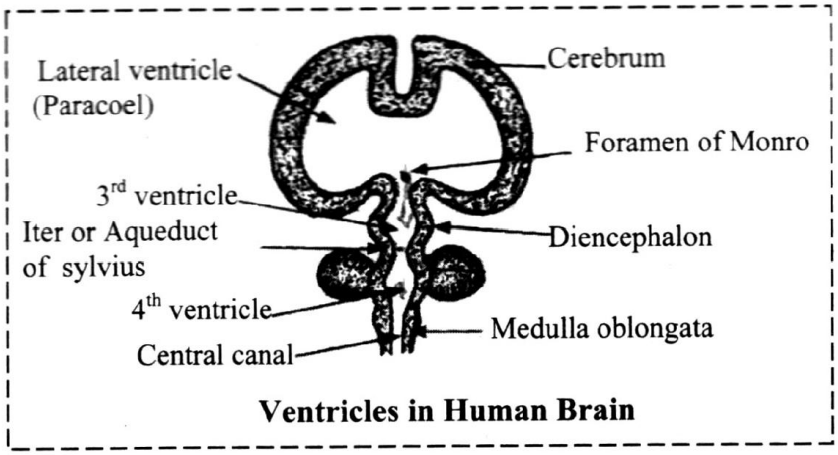
Q.24. Distinguish between cerebrum and cerebellum.

Ans:

No.	Cerebrum	Cerebellum
i.	The cerebrum is the larger part forming 85% of the brain.	The cerebellum is the smaller part forming 11% of the brain.
ii.	It has four lobes.	It has three lobes.
iii.	The cerebrum co-ordinates the functions of the sensory and motor areas.	The cerebellum co-ordinates the equilibrium of muscular movements during walking and running.
iv.	The cerebrum plays an important role in receiving the sensory impulses such as touch, pain, heat, cold, etc.	The cerebellum plays an important role in maintaining the posture and balance of the body.
v.	The cerebrum is concerned with higher mental faculties such as memory, will, intelligence.	The cerebellum is concerned with neuromuscular mechanism.

Q.25.With a neat labelled diagram, describe the ventricles in human brain. OR
Write a note on ventricles of human brain.

Ans: Ventricles of human brain :



Ventricles in Human Brain

i) Ventricles are the cavities present in different parts of the brain.
ii) The human brain shows four ventricles, which are connected with each other.
iii) The cavities in cerebral hemisphere are called lateral ventricles or paracoel 1 and 2.
iv) These open commonly in 3rd ventricle by an opening called foramen of Monro.
v) The cavity of diencephalon is called diocoel or 3rd ventricle.
vi) It opens in 4th ventricle by a narrow canal called Iter or aqueduct of Sylvius.

vii) The cavity of medulla oblongata is the 4th ventricle which continues into neurocoel or central canal of spinal cord.
viii) All these cavities are occupied by CSF.

Q.26. Which part of human brain is the most developed ?

Ans: Cerebrum of forebrain is the most developed part of the brain .

Q.27.Which part of our central neural system acts as a master clock?

Ans: Hypothalamus of forebrain acts as a master clock.

Q.28. Explain the following.

i) Injury to Medulla Oblongata causes sudden death.

Ans: a) Medulla has vital nuclei which control vital reflex centers of involuntary action (e.g. heart beat, vasoconstriction, respiration etc).
b) Any little injury to medulla oblongata blocks all the above vital functions result in paralysis or instant death

ii) Number of gyri is related with the degree of intelligence.

Ans: a) Gyri are the elevations/ridges present on cerebral cortex.
b) These increase the surface area and thus the number of neurons, memory and intelligence.

iii) Drunken person cannot maintain balance.

Ans: a) Alcohol acts as a depressant on CNS.
b) It also effects cerebellum, which is primary centre for controlling equilibrium, posture, balancing and orientation.
c) Even the neuro-muscular activities are affected.
d) This is why drunken person cannot maintain balance.

17.1.2 Spinal cord

Q.29. Give an account of structure and functions of spinal cord. OR
***Explain the structure and functions of spinal cord.**

Ans: Spinal cord (Myelon) :

i) It is a 42 to 45 em long, 2 em thick hollow tube extending from medulla oblongata to lumbar region.
ii) It lies in the neural canal of vertebral column.
iii) It extends up to second lumbar vertebra. Here it is tapering and known as conus medullaris.
iv) The posterior most end is called filum terminale which appears as a thread-like structure.
v) Beyond second lumbar vertebra it forms a fibrous horse taillike structure called cauda equina.
vi) Cauda equina is a bunch of dorsal and ventral roots of last pair of spinal nerves.
vii) The posteriormost non-nervous end of spinal cord is called filum terminale. It is posterior extension of meninges.
viii) Spinal cord has two swellings viz., the upper cervical swelling and lower lumbar swelling.
ix) Cervical swelling gives nerve plexus which supply nerves to hand while lumbar swelling produces lumbar plexus which supply nerves to legs.
x) 31 pairs of spinal nerves arise from spinal cord.

Functions of spinal cord :

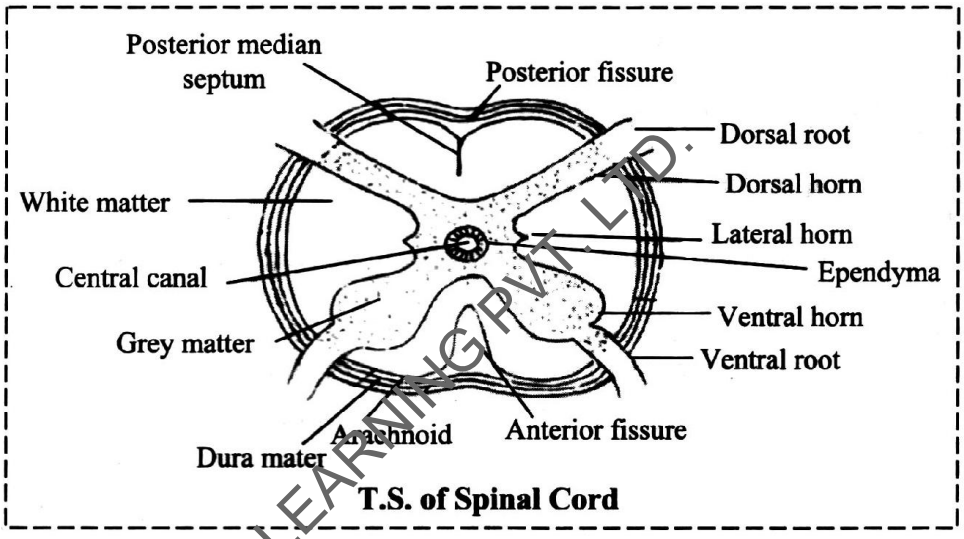
i) It is the main pathway for conduction of sensory and motor nerve impulses.
ii) The sensory impulses travel from the body to the brain and the motor impulses travel from the brain to the body.
iii) Spinal reflexes are controlled by spinal cord.
iv) The spinal cord gives relief to the brain.

Q.30.Describe T.S. of spinal cord in man, with a neat and labelled diagram. [Mar 08]

OR

Describe the T.S. of spinal cord.

Ans: Histology of spinal cord (T.S. of Spinal Cord) : T.S of spinal cord shows the following features. Spinal cord is externally covered by the three meninges (dura mater, arachnoid mater and pia mater). It is cylindrical but dorsoventrally flattened. It shows deep ventral fissure and shallow dorsal fissure. From dorsal fissure, there extends a thin sheet of connective tissue called **dorsal septum** which extends inward. It shows a central space called central canal. The **central canal** is continuous with the 4th ventricle of brain and contains cerebro-spinal fluid. The central canal is lined by single layer of **ependymal cells.**



T.S. of Spinal Cord

Central canal is surrounded by inner, grey matter containing cytons or cell bodies of neurons. Two dorsolateral horns and two ventrolateral horns give 'H'–shaped appearance to the grey matter. Dorsal horns extend in dorsal roots while ventral horns extend in ventral roots of spinal nerves. Grey matter is surrounded by white matter which divides into three columns or funiculi on either side. These are dorsal funiculi, lateral funiculi and ventral funiculi. They have the bundles of nerve fibres forming two types of nerve tracts:

i) Ascending tracts :
These are sensory and conduct sensory impulses to the brain and are present in dorsal funiculi.

ii) Descending tracts :
There are motor and carry motor impulses from brain to spinal cord and further to motor organs like muscles and glands. These are located in ventral and lateral funiculi.

17.2 : PNS and ANS

17.2.1 Peripheral ervous System

Q.31. Write a note on Peripheral Nervous System.

Ans: Peripheral ervous System (PNS) :

i) It is formed by the nerves arising from or ending into the brain and the nerves arising from spinal cord.
ii) The nerves may be myelinated or non-myelinated.
iii) On the basis of function and origin nerves are of different types as given below.

According to their function the nerves are of three types:

a) Sensory nerves : conduct impulses from sense organs to CNS.
b) Motor nerves : conduct nerve impulses from CNS to effectors or motor organs.
c) Mixed nerves : consist of sensory as well as motor nerve fibres and carry nerve impulses both ways.

On the basis of their origin the nerves are of two types.

1) Cranial nerves: arising from or terminating in brain.
2) Spinal nerves: arising from spinal cord.

There are 12 pairs of cranial nerves and 31 pairs of spinal nerves in human being.

Q.32.Write an account of cranial nerves and spinal nerves.

OR

Enlist any four motor cranial nerves. **[Mar 10]**

OR

Write a short note on spinal nerves.

OR

Enlist the number and names of motor cranial nerves in human being. **[Mar 2013]**

Ans:Cranial nerves :

These nerves arise from or terminate into the brain.
There are twelve pairs of cranial nerves in man as shown in the table given below :

No.	Name	Origin	Distribution	Type	Function
i	Olfactory	Olfactory lobe	Temporal lobe, olfactory epithelium of nose	Sensory	Sense of smell
ii.	Optic	Optic Lobe	Retina of eye	Sensory	Sense of light and vision.
iii.	Occulomotor	Cerebrum	Eye muscles (4)	Motor	Movement of eye ball.
iv.	Pathetic (trochlear)	Floor of midbrain	Eye muscles (2)	Motor	Rotation of eye ball.
v.	Trigeminal (Dentist nerve) [largest cranial nerves] a. Ophthalmic b. Maxillary c. Mandibular	Ant. medulla oblongata	Tongue, touch receptors, jaws, tooth Lacrymal glands conjunctiva, eyelids, forehead, cheeks, lips, gums, lower jaw,tongue, pinna, lower jaw, lower lip, tongue	Mixed Sensory Sensory Mixed	Sensation of touch, taste, jaw movement
vi.	Abducens	Ventral surface of medulla oblongata	Lateral rectus muscles of eyeball	Motor	Movement of eye
vii.	Facial	Lateral side of pons varolii	Muscles of face, neck, taste buds and salivary glands	Mixed	Facial expressions, Movement of neck, tongue, saliva secretion.
viii.	Auditory (Vestibulocochlear)	Lateral side of medulla	Internal ear	Sensory	Hearing and equilibrium
ix.	Glosso-pharyngeal	Lateral side of medulla	Muscles and mucosa of pharynx, tongue parotid salivary glands	Mixed	Taste, pharyngeal contraction, saliva secretion
x.	Vagus	Lateral side of medulla	larynx, trachea, pharynx, oesophagus stomach, lungs, heart and intestine	Mixed	Visceral sensation and visceral movements.
xi.	Spinal accessory	Lateral and posterior side of medulla	Muscles of larynx, pharynx, neck or shoulders	Motor	Movement of pharynx, neck or shoulders.
xii.	Hypoglossal	Ventral side of medulla	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
1	Cervical	8	Neck region
2	Thoracic	12	Thoracic region
3	Lumbar	5	Upper part of back
4	Sacral	5	Lower part of back
5	Coccygeal	1	Coccygeal (tail) region

Q.33.Enlist IV, V and VI cranial nerve.

Ans:*Refer Q.32.*

Q.34. Differentiate between cranial and spinal nerves.

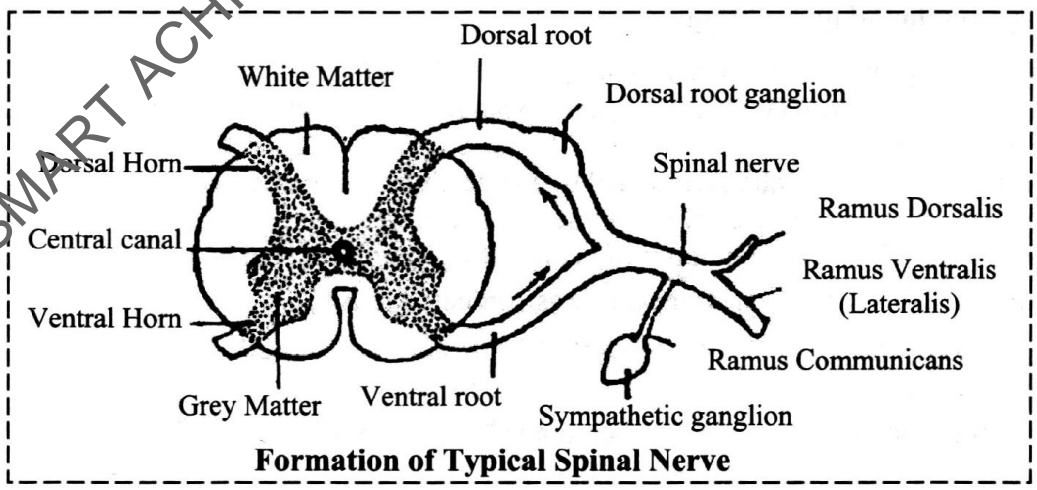
Ans:

No.	Cranial nerves	Spinal nerves
i.	Cranial nerves originate from or terminate in brain.	Spinal nerves originate from spinal cord.
ii.	There are twelve pairs of cranial nerves in man.	There are thirty one pairs of spinal nerves in man.
iii.	They are either sensory, motor or mixed	They are only mixed.
iv.	There are no branches of cranial nerves.	Spinal nerve is divided into three branches after its formation.

Q.35.With the help of a neat and labelled diagram, describe formation of a typical spinal nerve in man.

Ans:Formation of Typical spinal nerve :

Spinal nerve is formed by fusion of dorsal root and ventral root of spinal cord.
Dorsal root arises from dorsal horn of grey matter and contains sensory nerve fibres.
Ventral root arises from ventral horn of grey matter and contains motor nerve fibres.
The dorsal root and ventral root join in the neural canal and form short mixed spinal nerve.
Spinal nerves emerges out through paired aperture called intervertebral foramina and divides into three branches, namely ramus dorsalis, ramus ventralis, and ramus communicans.
Ramus dorsalis short dorsal branch of spinal nerve innervating skin and muscles of dorsal side.
Ramus ventralis longest ventral branch of spinal nerve innervating skin and muscles of lateral and ventral side.
Ramus communicans short branch that joins spinal cord to the sympathetic ganglion of ANS.



Formation of Typical Spinal Nerve

17.2.2 Autonomic Nervous System

Q.36.Describe Autonomous nervous system.

Ans:Autonomous Nervous System (ANS):

It controls internal environment or working of visceral organs.
It gives response to internal receptors and is involuntary except micturition.
It consists of only motor nerve fibres.
ANS is of two types :

a) Sympathetic nervous system (SNS):
SNS is formed by 22 pairs of sympathetic ganglia.
These ganglia are linearly arranged on two sympathetic cords running on either side of the vertebral column.
SNS is connected to CNS by spinal nerve fibres.
It works during stress, pain, anger, fear or emergency (Fight, Flight or Fright).
It secretes adrenaline or nor adrenaline as emergency hormones.

b) Parasympathetic nervous system (PNS) :
PNS consists of nerve fibres of some cranial nerves, sacral nerves, parasympathetic ganglia present on the side of visceral organs like heart, lungs, stomach, kidney etc. and parasympathetic fibres.This system releases acetylcholine which acts as neurotransmitter as well as inhibitor of visceral organs.
This system works during rest and brings about relaxation, comfort, pleasure etc.
Both the systems are antagonistic in function.

Q.37. Compare the following: CNS and PNS.

Ans:

No.	CNS	PNS
i.	It is dorsal, hollow, non-ganglionated and lies along the longitudinal axis of body.	It lies between CNS and various body parts.
ii.	It lies inside the hard skeletal elements like skull and vertebral column of body.	It does not lie inside the skeletal elements of body.
iii.	It is formed of brain and spinal cord.	It is formed of thread-like nerves like cranial nerves and spinal nerves.
iv.	It acts as command and control system of body.	It conducts nerve impulses between CNS and body parts.

Excitation and conduction of nerve impulse

Q.38. How are nerve impulses transmitted through nerve fibres ?

Ans: i) The theory of impulse conduction is best explained by Hodgkin and Huxley. As per this theory, it is an electrochemical event.

ii) Neurons are excitable cells surrounded by extracellular fluid (ECF).

iii) Membrane of neuron is selectively permeable to different ions.

iv) In resting state i. e. when neuron is not conducting impulse it is in polarisedstate.

v) Interior of axon is more electronegative as compared to E.C.F .

vi) E.C.F. is electropositive due to more cations.

vii) Major cations are Na+ and K+

viii) After application of a stimulas the membrane becomes freely permeable to use rapid influx of Na +.

vii) Major cations are Na+ and K+.

viii) After application of a stimulus the membrane becomes freely permeable to cause rapid influx of Na+.

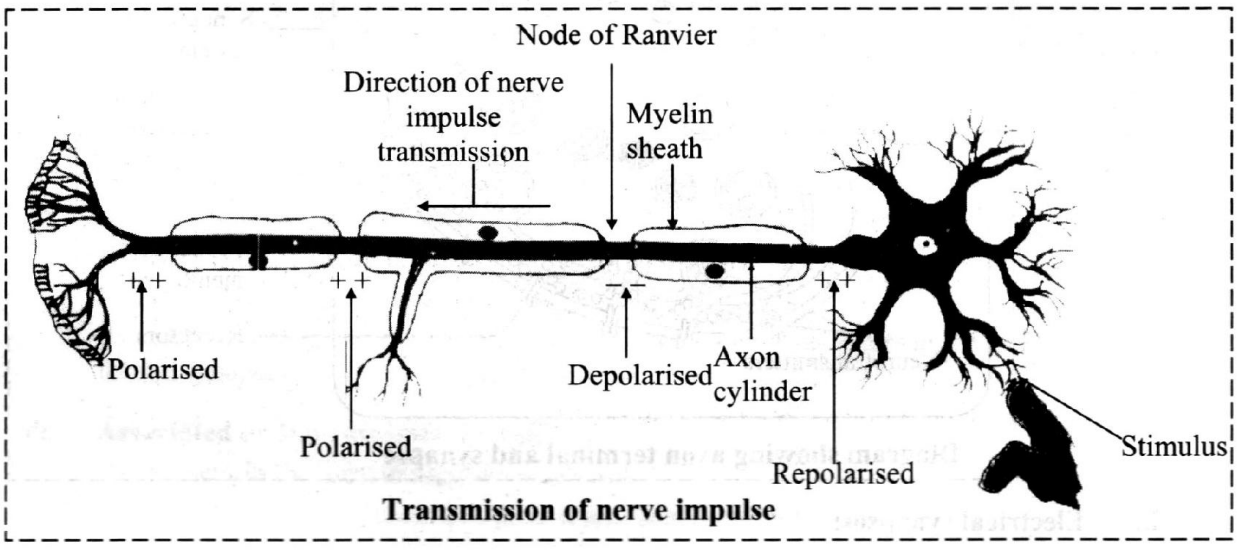
ix) It reverses the polarity at that site i.e. inner side becomes positively charged.

x) As a result local circuit is formed.

xi) Change of polarity results in potential difference at that site and axonal end.

xii) Current flows from dendron to axon . In the same way local circuits are formed along the length of axon and impulse is conducted along the length of nerve fibre.

xiii) After impulse conduction membrane becomes repolarised and ready to receive further stimuli.



Transmission of nerve impulse

17.3 : Transmission of Impulse through Synapse

Q.39. What is synapse? What are the types of synapses? Explain the mechanism of synapse.

Ans: i) A nerve impulse is transmitted from one neuron to another through junctions called synapses.

ii) There are two types of synapses

a) Chemical synapse b) Electrical synapse

iii) Axonic end of one neuron can communicate with dendritic end of next neuron. Minute gap between the two is known as synaptic cleft.

iv) On the basis of mechanism of communication, two types of synapses can be classified:

a) Chemical synapse :

i) Chemical synapse is formed of three components. Pre-synaptic membrane, post-synaptic membrane and synaptic cleft.

ii) Axonic end has the pre-synaptic membrane while dendritic end has post-synaptic membrane.

iii) Pre-synaptic membrane is capable of releasing the neurotransmitter while post synaptic membrane has protein molecule which can act as receptor sites.

iv) The synaptic bulb possess synaptic vesicles, which are filled with neurotransmitter.

v) The impulse when arrives at synaptic bulb, it stimulates the release of neurotransmitters in the synaptic cleft.

vi) The released neurotransmitters stimulates the post synaptic membrane. This binding opens the ion channels allowing the entry of ions which generates the action potential in the post synaptic membrane.

vii) Once this impulse is transmitted further, the neurotransmitter (Acetylcholine) is neutralized by respective enzyme (Cholinesterase). The end product of this reaction is absorbed by pre-synaptic membrane and is used to resynthesize the neurotransmitter. Impulses transmitted across such chemical synapses can be excitatory or inhibitory.

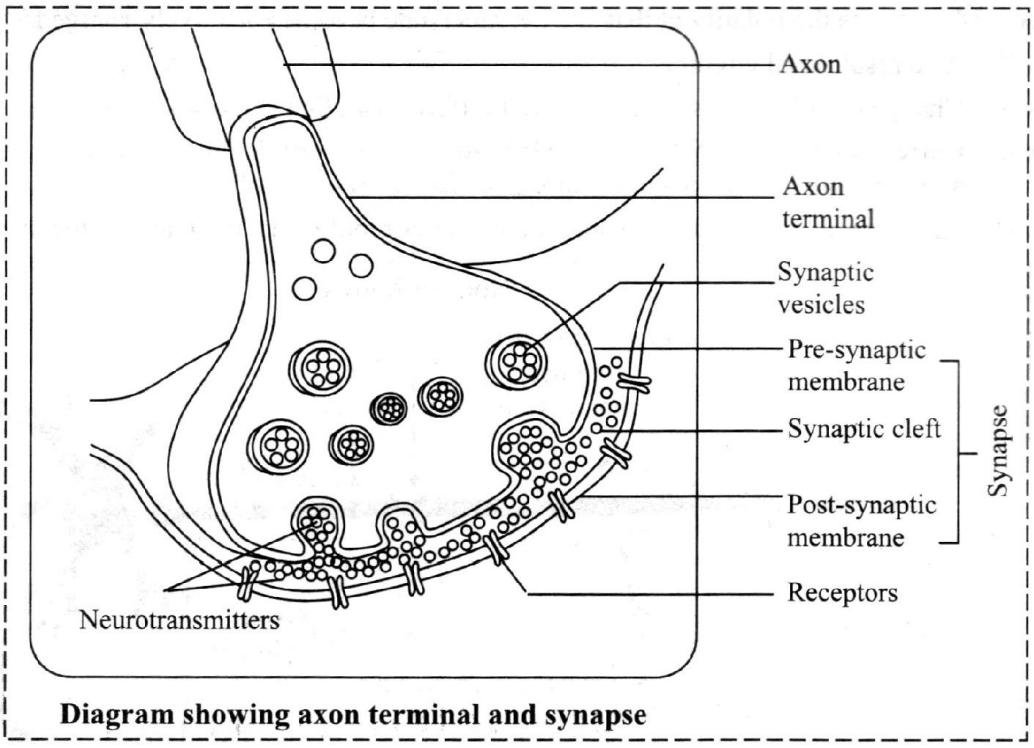


Diagram showing axon terminal and synapse

b) Electrical synapses :

i) In this kind of synapse, the pre and post synaptic membranes are very close to one another.

ii) Electric current can be transmitted directly from one neuron to another one. The mechanism of impulse conduction in this type of synapse is similar to that in the axonic fiber and is much faster than that in the chemical synapses. Such impulses are found in cardiac muscles, muscles of the intestinal wall, etc.

17.4 : Reflex Action

Q.40.Define reflex action and reflex arc. Describe various components of reflex arc. Add a note on the mechanism of reflex action. [Mar 09]

OR

Defme reflex action and reflex arc. Explain different components of reflex arc.

OR

Describe various components of reflex arc. [Mar 2013 old course]

Ans: Reflex action: It is defined as a quick, automatic involuntary and often unconscious action brought about when the receptors are stimulated by external or internal stimuli [Best and Taylor]. e.g. hammering by hand at the site of mosquito bite.

Reflex arc: The pathway of nerve fibres along which the reflex impulse travels is known as **reflex arc.** It is always unidirectional from receptor organs to the effector organ via eNS.

Reflex arc is structural and functional unit of reflex action.

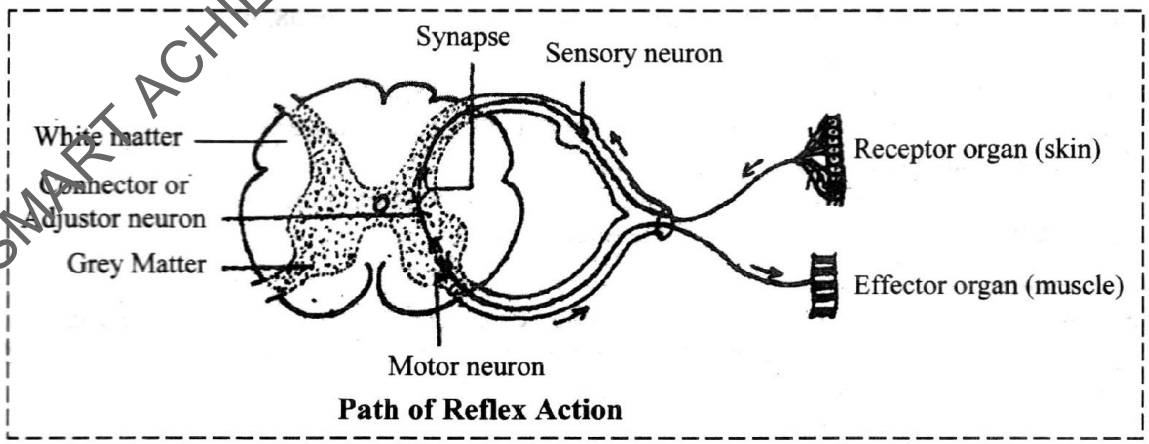
Component of simple reflex arc :

Simple reflex arc is formed of five components as given below:

i) Receptor organ :

It is a specialized part of body called sense organ that receives the stimulus and converts it into the impulse.

e.g. skin, eye, tongue, nose and ears.



Path of Reflex Action

ii) ensory or Afferent neuron :

It carries sensory nerve impulse from receptor organ to eNS.

Its cyton is located in dorsal root ganglion.

Its dendron is long and connected to receptor while the axon enters in the grey matter of spinal cord to form a synapse.

iii) Associated or Intermediate neuron :

It is present in the grey matter of spinal cord.

It receives sensory impulse, interprets it and generates motor impulse.

iv) Motor or effector nenron :

Its cyton is present in the ventral horn of grey matter and axon travels through ventral root.

It conducts motor impulse from spinal cord to effector organ.

v) Effector organ :

It is a specialized part of the body which is excited by receiving the motor impulse.

It gives proper response to the stimulus. e.g. Muscles and glands.

Synapse: It is a small gap between axon of one neuron and dendron of the other neuron.

It contains a neurotransmitter Acetylcholine which helps in chemical transmission of impulse.

Mechanism of reflex action :

i) Reflex action takes place through the reflex arc.

ii) Transmission of impulses takes place through two synapses one of which is present in between the axon of sensory neuron and dendron of associated neuron. The other is present in between the axon of associated neuron and dendron of motor neuron.

iii) The impulse from the sense organ is received by the associated neuron through sensory neuron.

iv) On receiving the impulse axon of associated neuron secretes a neurohormone called acetylcholine.
v) Acetylcholine fills up the synaptic gap so that the impulse is further transmitted to the motor neuron through the second synapse with the same mechanism.
vi) The motor neuron transmits the impulses to the effector organ which responds to the impulses.
vii) Effector organ may be gland or muscle. Glands gives response by its secretion and muscle by its contraction e.g. on being pricked by a needle, hand is immediately withdrawn from the source.

Q.41. Draw a neat labelled diagram of simple reflex arc.
Ans: *Refer Q. 40.diagram.*

Q.42.Write a note on reflex arc.
Ans: *Refer Q.40.*

Q.43.Explain mechanism of reflex action and give its significance. [Mar 08, 09] .
Ans: Mechanism of reflex action: *Refer Q.40.*

Significance of reflex action :
i) It gives immediate response so we can protect ourselves from danger.
ii) It is a type of adaptation for changing conditions.
iii) As most of reflexes are controlled by spinal cord it gives relief to brain.
iv) Reflex action control the activities of the internal organs.

Q.44.What is synapse in reflex action ?
Ans:i) Synapse is functional gap between axon of one neuron and dendron of another neuron.
ii) Synapse in reflex action is present at junction of associated neuron and sensory neuron and at the junction of associated neuron and motor neuron.
iii) It is present in grey matter.
iv) It contains neurotransmitter acetylcholine which helps in chemical transmission of the impulse.
v) It transmits impulses.
vi) This in turn helps the effector organ to get excited and respond to the stimulus.

Q.45.Explain the types of reflex action.

OR

Give the types of reflexes.

Ans:Types of reflex action :
The reflex action may be cerebral (controlled by the brain) or **spinal** (controlled by spinal cord).
In man, most of the reflex actions are controlled by spinal cord.

Reflexes are of two types :

a) Unconditioned or Inborn reflexes.
These are inborn or hereditary.
They are permanent and do not require previous experience.
ego blinking of eyes with strong light, withdrawal of hand when pricked, sucking of milk by baby, swallowing, knee jerk, sneezing, coughing etc.

b) Conditioned or acquired reflexes :
a) These are non-inherited and are acquired during life.
These are acquired through long experience and proper training.
These are temporary and may disappear or reappear.
ego driving motor car, cycling, playing water polo, cricket or any other game etc.

Reflexes can be grouped as:
a) Somatic reflexes : In this type of reflex, effector organ is body structures like skeletal muscles.
b) **Visceral reflex :** Visceral organs like glands or smooth muscles are effector organs. On the basis of number of neurons there are two types of reflexes:
a) Simple or monosynaptic reflex :
One sensory and one motor neuron are involved.
b) Polysynaptic or complex reflex :
More than two neurons are involved.

Q.46. Give examples of unconditional reflexes. [Oct 2013]
Ans: Examples of uncondition reflexes are blinking of eyes with strong light, withdraw Iof hand when pricked, breast feeding, swallowing, knee jerk, sneezing, coughing etc.

Q.47. Give detailed account of reflex arc, reflex action, types and significance of reflexes.

OR

Write short notes on reflex arc and reflex action.

Ans: *Refer Q.40, 45 and 43.*

Q.48. Write a note on Ivan Pavlov demonstration of conditioned reflex.

Ans: i) Russian physiologist Ivan Pavlov (1929) first demonstrated the conditioned reflex.
ii) When Pavlov offered food to a dog, he noticed that dog started salivating after seeing and smelling the food.
iii) Second time instead of offering the food Pa lov rang a bell before the dog.
iv) Third time, Pavlo rang the bell before offering food to the dog.
v) This time the dog started ali ating.
vi) The experiment as repeated number of times and dog salivated.
vii) Finally, Pavlov only rang the bell but did not offered food to the dog.
viii) Although food was not given still dog salivated.
ix) Hence, Pavlov concluded that dog was conditioned to ringing of the bell and therefore started sali ating e en after hearing the sound of the bell only.

Q.49. Give reasons for the following.

i) Even in sound sleep, if mosquito bites, then quickly your hand hammers at that site.

Ans: a) Some action of the body are governed by reflex arc.
b) These actions are reflex actions which are quick, automatic, involuntary and often unconscious.
c) They are brought about by receptors due to external stimulation caused by mosquito bite.
d) Therefore, even if we are in deep sleep the reflex action makes us quickly hammer the hand at the site of the mosquito bite.

ii) Reflex action prevent overloading of brain.

Ans: a) Most of the relaxes are controlled by spinal cord.
b) In these reflexes brain is not involved.
c) Hence, reflex action prevents overloading of brain.

17.5 : Sensory Perception and Receptors

Q.50. Define receptors. De cribe different types of receptors. **[Sep 08]**

OR

Define receptors. Enlist different types of receptors.

Ans: Receptors :

Receptors are the specialized cells, tissues or organs of the body which are able to receive different stimuli.

Types of receptors :

Receptors are of two types viz., exteroceptors and interoceptors.

a) Exteroceptors :

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

No.	Type	Location		Function
i.	Mechanoreceptors	Touch corpuscles of skin	a. b.	Sensitive to touch. Tactile receptors for touch Tango receptors for pressure
ii.	Thermoreceptors	Skin	 a. b.	Sensitive to temperature Frigido receptors for cold Heat receptors for warmth
iii.	Chemoreceptors	Tongue, nasal mucosa		Gustatoreceptors for taste Olfactoreceptors for smell
iv.	Statoacoustic receptors	Internal ear	a. b.	Cochlea for hearing Semicircular canals for balance and equilibrium
v.	Photoreceptors	Retina of the eye	a. b.	Rods – sensitive to dim light and produce black and white image. Cones – sensitive to bright light and produce coloured image

b. Interoceptors :

Interoceptors are present inside the body and are visceral in nature.

They respond to internal changes in the body.

Various types ofinteroceptors are given below:

No.	Type	Location	Function
i.	Proprioceptors	Muscles and joints	a. Sensation of pain, tension, b. Sensitive to vibrations.
ii.	Enteroceptors	Visceral organs	Hunger, thirst, pain, temperature, pH, osmotic changes etc.
iii.	Baroreceptors	Wall of carotid artery	Sensitive to changes in blood pressure.

Q.51. Write short notes on the following.

i) Exteroceptors.

ii) Interoceptors.

Ans: For these short notes *Refer Q.50*

Q.52.What are effectors?

Ans: Effectors :

i) These are the organs which give the response to the stimuli.

ii) Some effectors are muscles and glands.

iii) These bring into effect, the action initiated by nerve impulse.

Q.53.What are sense organs ?

Ans: Sense organs are extension of the nervous system that allow us to perceive our internal and external environment.

Q.54. Define: i) Sensation ii) Perception.

Ans:i) Sensation : It is the conduction of sensory impulse to the brain.

ii) **Perception:** Conscious interpretation of the stimulus rece~ved by the receptor is called as perception.

Q.55.Explain the mechanism of sensory perception.

Ans:i) Conscious interpretation of the stimulus received by the receptor is called as perception.

ii) Response to a stimulus depends upon perception, processing of impulse takes place at three levels.

iii) Stimulus-is received at the receptor tissue. The receptor is generally specific about the type of stimulus to be received.

iv) Exteroreceptors receive the stimuli from external environment whereas interoceptors receive stimuli from internal environment.

Q.56. Why skin is sensitive to temperature changes, touch and pressure ?

Ans:i) Various types of receptors such as mechanoreceptors and thermoreceptors are present on the skin.

ii) Mechanoreceptors include Tactile receptors (sensitive to touch) and Tangoreceptors (for pressure).

iii) Thermoreceptors include Frigido receptors for cold and heat receptors for warmth.

iv) These receptors make skin sensitive to touch and changes in temperature and pressure.

Q.57. Which receptors are present in nose and how it helps in sense of smell ?

Ans: i) The nose contains mucus coated receptors which are specialised for receiving sense of smell called olfactory receptors.

ii) They are made up of olfactory epithelium that consist of three kind of cells.

iii) The neurons of olfactory epithelium conduct the impulse from outside environment to olfactory bulb which are extension of brains limbic system.

Q.58. Describe the structure of an eye.

OR

Describe the different parts of human eye.

Ans: In human photoreceptors or the organs of sight are the two large eyes.

Location :

Each eyeball is roughly spherical and lodged inside an orbit in the dorso-lateral side of head.

The exposed part of the eye is protected by a upper and a lower eyelid which are provided with eyelashes.

Structure :

Each eyeball measure about 2.5 em in diameter. Of its total surface are only the anterior one sixth is

exposed.

It is composed of three coats.

The outermost coat is called fibrous coat or tunica fibrosa. Middle one as vascular coat and the inner one is nervous coat.

I. Fibrous coat or Tunica fibrosa

Fibrous coat consists of two parts, the sclera and cornea.

a) Sclera :

It form about five-sixth of the outer coat.

It is white and opaque and popularly called white of eye. Most part of sclera is concealed in the orbit.

It protects and maintain shape of eye ball

b) Cornea :

It is the anterior transparent part of sclera and constitutes about 1/6 th of the fibrous coat.

It is non-vascular and convex anteriorly.

It is a highly organized group of cells of protein.

The cornea is transparent because of the collagen fibres in this region.

Function : It refracts the incident light rays to focus on the retina.

II. Vascular coat or uvea: Middle coat is incomplete anteriorly called vascular coat or Uvea. It is differentiated into three layers.

a) Choroid :

It is thin, .pigmented (with melanin), chocolate coloured and highly vascular part present along inner side of sclerotic. It is formed of loose fibrous connective tissue.

Functions :

i) It darken the eyeball for total absorption of light.

ii) It provides nutrition to retina.

b) Ciliary body :

It is a less vascular and less pigmented thickened ring like structure present inner to the junction of sclerotic and cornea.

Its inner surface is folded to form ciliary processes.

It has two set of smooth ciliary muscles and meridional muscles.

Function: It increases the convexity of lens and increase the level of refraction of light passing through it.

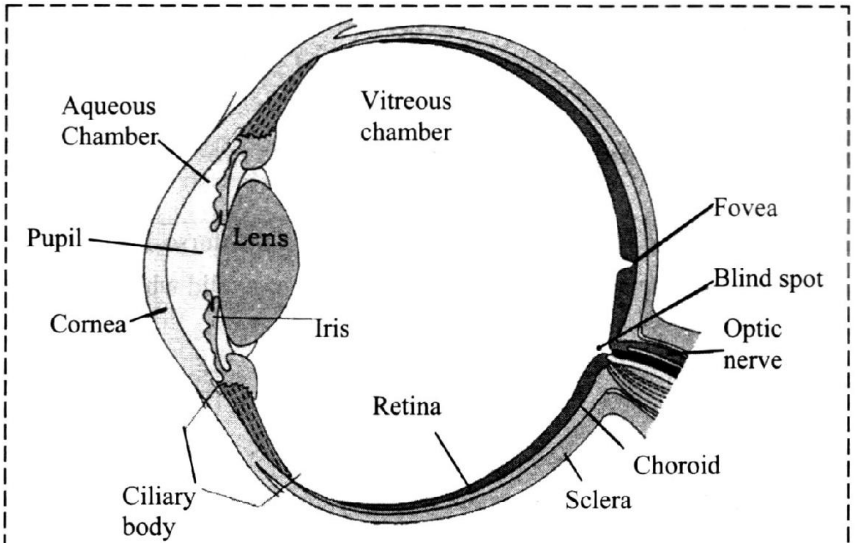


Diagram representing parts of an eye

c. Iris :

It is the anterior part of vascular coat which lies behind the cornea.

It is circular, muscular diaphragm containing the pigments which gives the eye it's colour. The central circular aperture is called pupil whose size can be regulated by two sets of smooth radial muscles.

Sphincter muscles: These are circularly arranged and when contract decrease the size of pupil.

Dilator muscles: These are radially arranged and when contract, increase the size of pupil.

III) Nervous coat :

It is the innermost and incomplete layer. It consists of delicate non-vascular light sensitive coat called retina.

It is also formed of three parts :

i) Optic part ii) Ciliary part iii) Iridial part

i. Optic part :

It is thick, pigmented and photosensitive part which is present along inner side of the choroid. It is formed of four layers of cells which from outer to inner side are pigment cells, photoreceptor cells, bipolar nerve cells and ganglion cells.

Photoreceptor cells called rods and cones.

These receptor, rods and cones apparently evolved from hair cells.

Rods detect difference in light intensity, cone detect colour.

Cones occur in the centre (or fovea centralis) of the retina.Rod contains photosensitive pigment rhodopsin and cone contain iodopsin pigment.

Rhodopsin consists of the protein scotopsin and retinae a derivative of vitamin A.

Retina contains four types of neurons including bipolar nerve cells and ganglia.

Rods are absent in fovea and macula.

On the optical part of retina there two spots:

Blind spot or optic disc: The area of the eye where the optic nerve leaves the eye called the blind spot as no image is seen here due to absence of rod and cone.

Yellow spot :

It is also called macula lutea or area centralis.

It is small area on retina which lies opposite to optical axis of the lens. It is with only cones so it is most sensitive to day light vision.

It has depression in the middle called fovea centralis.

It is the area of most distinct day vision.

On either side of a yellow spot, cones and rods are equal in number near the ciliary part of retina. Optical part of retina i with more rod than cones.

Lens :

It is a transparent elastic and biconca e structure, attached by suspensory ligament to the ciliary body. It is present ju t behind the iri and is surrounded by a thin, transparent and elastic membrane, lens capsule.

The lens and uspensory ligament divide the cavity of eye ball in two unequal chamber.

a) Aqueous chamber
b) Vitreous chamber

a) Aqueous chamber :

It i anterior and smaller. It lies between cornea and lens.

It is filled with a watery fluid, aqueous humor.

Functions :

It maintains the shape of the cornea. It supply nutrition to both lens and cornea.

b) Vitreous chamber :

It is posterior and larger.

It lies between the lens and the retina.

It is filled with transparent gelatinous material, vitreous humour or vitreous body or Wharton's jelly.

Functions : It maintains the shape of eye ball.

Q.59. Sketch and label anatomical structure of human eye. **[Oct 2013]**

OR

Sketch and label V.S. of human eye. **[Mar 2014]**

Ans: *Refer Q. 58 (diagram)*

Q.60.Give a brief account of mechanism of vision.

Ans: i) Light rays from objects pass through the cornea and the lens.
ii) Rods and cones contains photopigments which are conjugated proteins composed of opsin and retinol.
iii) Light induces dissociation of retinol from opsin, resulting in changes in the structure of opsin.

iv) It ultimately changes permeability of retinal cell and generates action potential.
v) Action potential is carried via bipolar cells and ganglion cells. and further by optic nerves to visual cortex.
vi) Neural impulses are analyzed and image formed on retina is recognised.

Q.61.Write it short note on Retina.

Ans:i) It is the inner layer of eye ball.
ii) It has 2 types of photoreceptors-rods and cones.
iii) The rods contain rhodopsin. Cones are of three types having their own peculiar photopigments which perceive green, blue and red radiations.

Q.62.Eyes respond to different intensities of light. Give reason.

Ans:i) Eyes respond to different intensities of light because in retina of eye photoreceptors viz (rods and cones) are present.
ii) Rods are sensitive to dim light whereas cones are sensitive to bright light.
iii) Cones are of three types which contain photopigments that respond to red, green and blue lights.

Q.63.Distinguish between the following :

i) Aqueous humor and vitreous humor.

Ans:

No.	Aqueous humor	Vitreous humor
i.	Aqueous chamber contains a clear watery fluid called aqueous humor.	Vitreous chamber contains a clear transparent jelly like substance called vitreous humor.
ii.	It is watery and transparent in nature.	It is gelatinous and transparent in nature
iii.	It lies in aqueous chamber between lens and cornea.	It lies in vitreous chamber between lens and retina.

ii) Blind spot and yellow spot.

Ans:

No.	Blind spot	Yellow spot
i.	It is present at the point of origin of optic nerve.	It is present on retina opposite to optical axis of lens.
ii.	It does not have a shallow depression.	It has at its middle shallow depression called fovea centralis.
iii.	It does not have neither rods nor cones.	It has only cones, no rods.
iv.	No image is formed due to absence of rods and cones.	Image is sharpest at this region.

iii) Rods and cones.

Ans:

No.	Rods	Cones
i.	Rod cells are sensitive to dim light.	Cone cells are sensitive to bright light.
ii.	They contains visual-purple (Rhodopsin).	They contains visual-violet (Iodopsin).
iii.	They are longer,slender and filamentous.	They are shorter and thicker.
iv.	They are specialised for light vision.	They are specialised for colour vision.

iv. Choroid and retina.

Ans:

No.	Choroid	Retina
i.	It is second coat of eye ball and lies inner to sclerotic.	It is third coat of eye ball and lies inner to choroid.
ii.	It is thin, pigmented (with melanin) and highly vascular part but has no photoreceptor.	It is thick, pigmented and is with two types of photoreceptors: Rods and cones.
iii.	It helps in absorption of light and provides nutrition to retina.	It helps in vision.

Q.64.Describe the structure of human ear.

OR

Describe the internal structure of human ear.

Ans: The organ of hearing (phonoreceptor) in man are a pair of ears. It is situated on the lateral side of head.

Structure: It is formed of three parts.

i) External ear ii) Middle ear iii) Inner ear.

i) External ear : It consists of pinna, external auditory canal and tympanum.

a) Pinna :

It is roughly funnel shaped and has ridges and grooves.

It is meant for collecting sound waves.

b) Auditory canal or maetus :

It is the circular tube which leads inside up to tympanic membrane.

It contains few hair and specialized sebaceous gland called ceruminous glands.

It conducts sound wave to middle ear.

c) Tympanic membrane (also called ear drum) :

It is formed of connective tissue having outer skin cover and inner mucus membrane.

It is a delicate membranous structure that vibrates in response to the sound waves tapping on its outer surface.

ii) Middle ear :

It is formed of an irregular, air filled cavity called tympanic cavity.

It is bounded externally by ear drum and internally by auditory capsule.

Tympanic cavity is connected to nasopharynx by a tubular canal called eustachian tube or pharyngotympanic canal.

Its pharyngeal opening is guarded by a valve which normally remain closed.

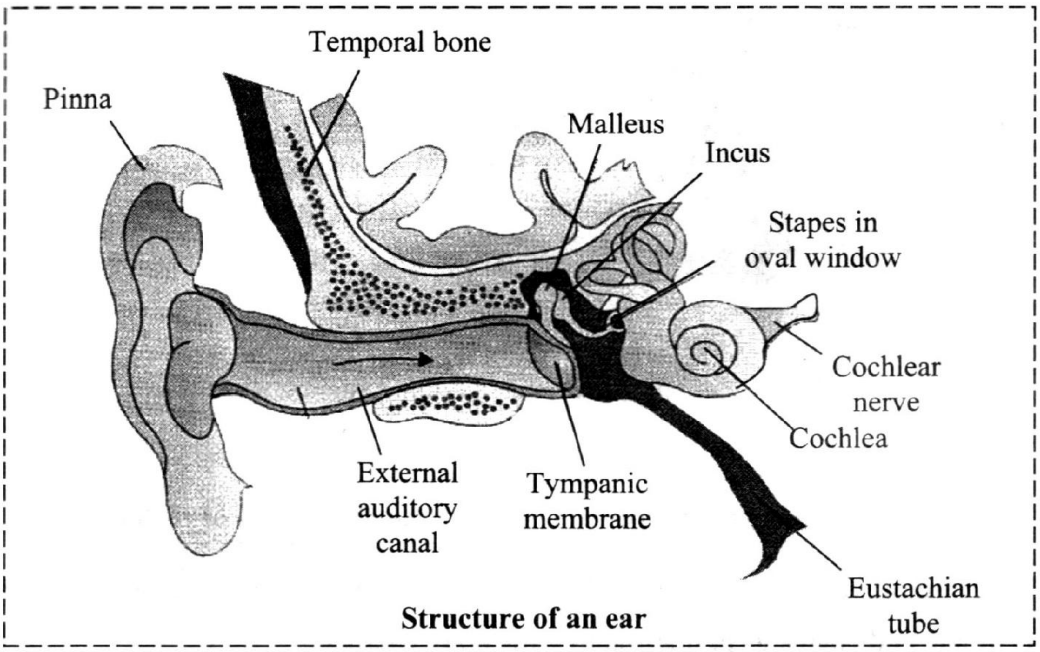
Functions: To equalize air pressure in both side of tympanic membrane.

Middle ear consists of three tiny bones called ear ossicle that vibrate in response to the vibrations of the ear drum.

Three ear ossicles are malleus, incus and stapes.

Malleus is attached to the tympanic membrane and the steps is connected to the oval window of the internal ear.

Ear ossicles supported by a ligament occurs between tympanum and oval window (fenestra ovalis).



Structure of an ear

iii) Internal ear :

The internal ear is fluid filled structure called as labyrinth.

It consists of the bony and membranous labyrinth.

The outer bony labyrinth is formed by series of channels in which the membranous labyrinth is present.

The membranous labyrinth is filled with a fluid called endolymph.

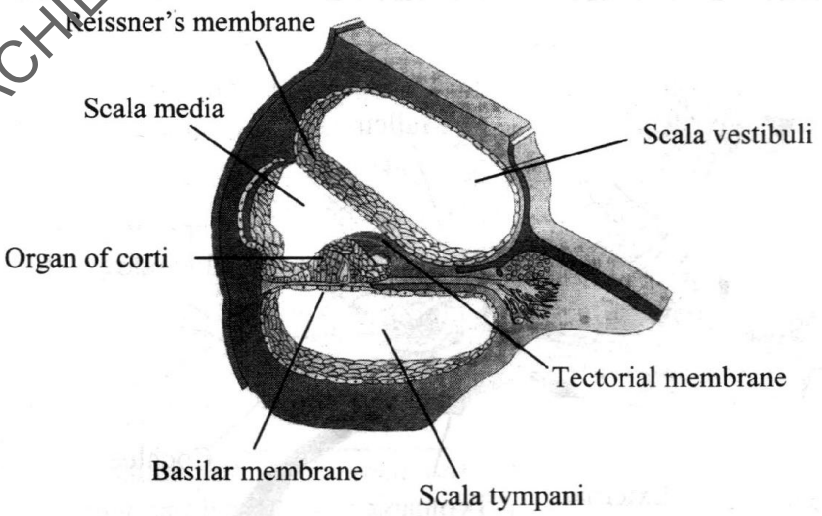
The membranous labyrinth consists of coiled cochlea, Reissner's and basilar membranes.

Bony labyrinth is divided into an upper scala vestibuli and lower scala tympani by membranous labyrinth.

The space within cochlea is known as scala media. Scala media is filled with endolymph. The scala

vestibuli ends at the oval window of the base of cochlea.
The scala tympani terminates at the round window which opens to the middle ear.
Basilar membrane is with a hearing apparatus organ of corti containing hair cells which act as auditory receptors.
Hair cells are columnar ciliated cells present in rows.
The basal ends of the hair cells are in close contact with afferent nerve fibres. Apical end of hair cells contain numerous cilia.
A thin elastic membrane projects above the rows of the hair cells called as tectorial membrane. Internal ear also contains vestibular apparatus and semicircular canals.
It also contains vestibular apparatus and semicircular canals.

a) **Vestibular apparatus:** It is central sac-like part consists of otolith organ. Otolith organ is made up of utriculus and sacculus. Utriculus and sacculus also have projecting ridge called macula.
b) **Macula,** a group of sensory cells are found in both sacs.It takes part in maintaining static equilibrium.
c) **Semicircular canals:** These are three in number which are mutually perpendicular to one another. Each opens in the utriculus on both side.
Each duct on one side, swell up to form an ampulla which has a sensory spot called crista.so there are three cristae ampullares.
Cristae maintain dynamic equilibrium of the body.



Diagrammatic representation of the sectional view of cochlea

Ear is most sensitive to frequency 1000-3000 cycles/see The measuring unit of sound is decibel.

Q.65.Which part of our body helps us in maintaining the body balance?

Ans: Cristae present in the ampullae of semicircular canals of internal ear control dynamic equilibrium (When body is in motion) and equilibrium during angular acceleration (turning movements of head); while macuiae of vestibule of internal ear control static equilibrium (when body at rest) and linear acceleration (rapid forward movements).

Q.66. Mention the role of semicircular canals in ear.

Ans: Semicircular canals helps in maintenance of balance and equilibrium.

Q.67. Draw a labelled diagram of human ear.

Ans: *Refer Q. 64. Structure of an ear diagram.*

Q.68. Write a short notes on the following:

i) Ear ossicles ii) Cochlea iii) Organ of Corti

i) **Ear ossicles :** There are 3 ear ossicles in mid ear named incus, malleus and stapes. They increase efficiency of transmission of sound waves to inner ear.
ii) **Cochlea :** It is coiled part of membranous labyrinth. Membranes that make cochlea, the Reissner's and basilar, divide surrounding perilymph filled bony labyrinth into an upper scala vestibuli and a lower scala tympani. Space within cochlea is called scala media. It is filled with endolymph. At base of

cochlea, scala vestibuli ends at oval window. Scala tympani ends at the round window that opens to middle ear.

iii) **Organ of Corti :** It is a structure situated on basilar membrane that possesses hair cells which act as auditory receptors. Hair cells are found in rows on the internal side of the organ of corti. Basal end of hair cell lies in close contact with afferent nerve fibres. Many process s called stereo cilia are projected from apical part of each hair cell. Above rows of hair cells, thin elastic membrane (tectorial membrane) lies.

Q.69.Give the names of ear ossicles.

Ans: There are 3 ear ossicles in mid ear named incus, malleus and stapes.

Q.70.Give a brief account of mechanism of hearing.

Ans:i) External ear collects recei ed the sound waves and sent to tympanic membrane.

ii) The ear drum ibrates and the vibration are transmitted by the chain of three ossicles to the oval window.

iii) The vibrations are further passed to the fluid of cochlea.

iv) The wa es in the endolymph induce movement in the basilar membrane.

v) The hair cells of organ of Corti bend and passed against the tectorial membrane.

vi) The nerve impulses are generated and sent to the afferent nerve fibres.

vii) The impulses are carried by the auditory nerves to the auditory centre of the brain.

viii) Auditory area of brain analysed the impulse and the sound is perceived.

Sound waves at pinna
↓
Auditory canal
↓
Tympanic membrane
↓
Three ear ossicles
↓
Oval window
↓
Perilymph in vestibular canal
↓
Scala vestibuli of cochlea
↓
Reissner's membrane
↓
Endolymph in Scala media
↓
Basilar membrane
↓
Perilymph in tympanic canal
↓
Round window
↓
Nerve impulse
↓
Auditory area of brain

17.6 : Endocrine Glands and their Hormones

Q.71.What is endocrine system ?

Ans: Endocrine system are those system which generally control long term activities of target organ as well as physiological process such as digestion, metabolism, growth, development and reproduction in contrast to more rapid activities under the control of nervous system either directly or indirectly.

Q.72.Why endocrine glands are called as ductless glands?

Ans:i) Endocrine glands do not have duct system.
ii) Endocrine gland release their secretions directly into the blood stream.
iii) Hence they are called as ductless glands.

Q.73. Define the following :

i) Exocrine gland ii) Endocrine glands iii) Hormone

Ans:i) Exocrine glands : are glands releasing their secretion in ducts which carry them on the body surface (e.g., sweat glands) or to some specific body part (e.g., liver).
ii) Endocrine glands: are ductless glands and secrete their secretions, called hormones, generally in the blood and have specific effect on a specific target organ of the body.
iii) Hormones: are secretions of endocrine glands and are generally released in the blood and have specific effect on specific target organ of the body. These are also called chemical messangers or information molecules.

Q.74. List the hormones secreted by the following :

i) Hypothalamus ii) Pituitary iii) Thyroid iv) Parathyroid
v) Adrenal vi) Pancreas vii) Testis viii) Ovary
ix) Thymus x) Atrium xi) Kidney xii) G. I. Tract

Ans:

No.	Endocrine gland		Hormone/s
i.	Hypothalamus	**a.**	**Releasing Factors (RF)** like TSH-RF; ACTH-RF; FSH-RF; LH-RF; ICSH-RF; PRF; MSH-RF.
		b.	**Inhibitory Factors (IF)** like Somatostatin; PIF and MSH-IF.
ii.	Pituitary		
	a. Anterior lobe		TSH; STH; ACTH; FSH; LH; ICSH and Prolactin
	b. Middle lobe		MSH
	c. Posterior lobe		Oxytocin and Vasopressin (ADH)
iii.	Thyroid		Thyroxine and Thyrocalcitionin (TCT).
iv.	Parathyroid		Parathormone (PTH)
v.	Adrenal		
	a. Adrenal cortex	1.	Mineralcorticoids like Aldosterone, 11-deoxy-corticosterone, etc.
		2.	Glucocorticoids like cortisol, cortisone, corticosterone, etc.
	b. Adrenal medulla	3.	Sex corticoids like Androsterone, Androstenedione, etc.
			Epinephrine and Nor-epinephrine.
vi.	Pancreas		Insulin (from β-cells); Glucagon (from α-cells) and somatostatin (from Δ-cells)
vii.	Testis		Androgens like Testosterone, Androsterone, etc.
viii.	Ovary		Estrogens (e.g., β-estradiol); Progesterone
ix.	Thymus		Thymosine.
x.	Atrium		Atrial natriuretic factor (ANF).
xi.	Kidney		Erythropoietin.
xii.	G. I. Tract		Gastrin (from stomach); Secretin, Cholecystokinin, Pancreozymin and Duocrinin (from duodenal mucosa); and Enterocrinin and Villikinin (from intestinal mucosa).

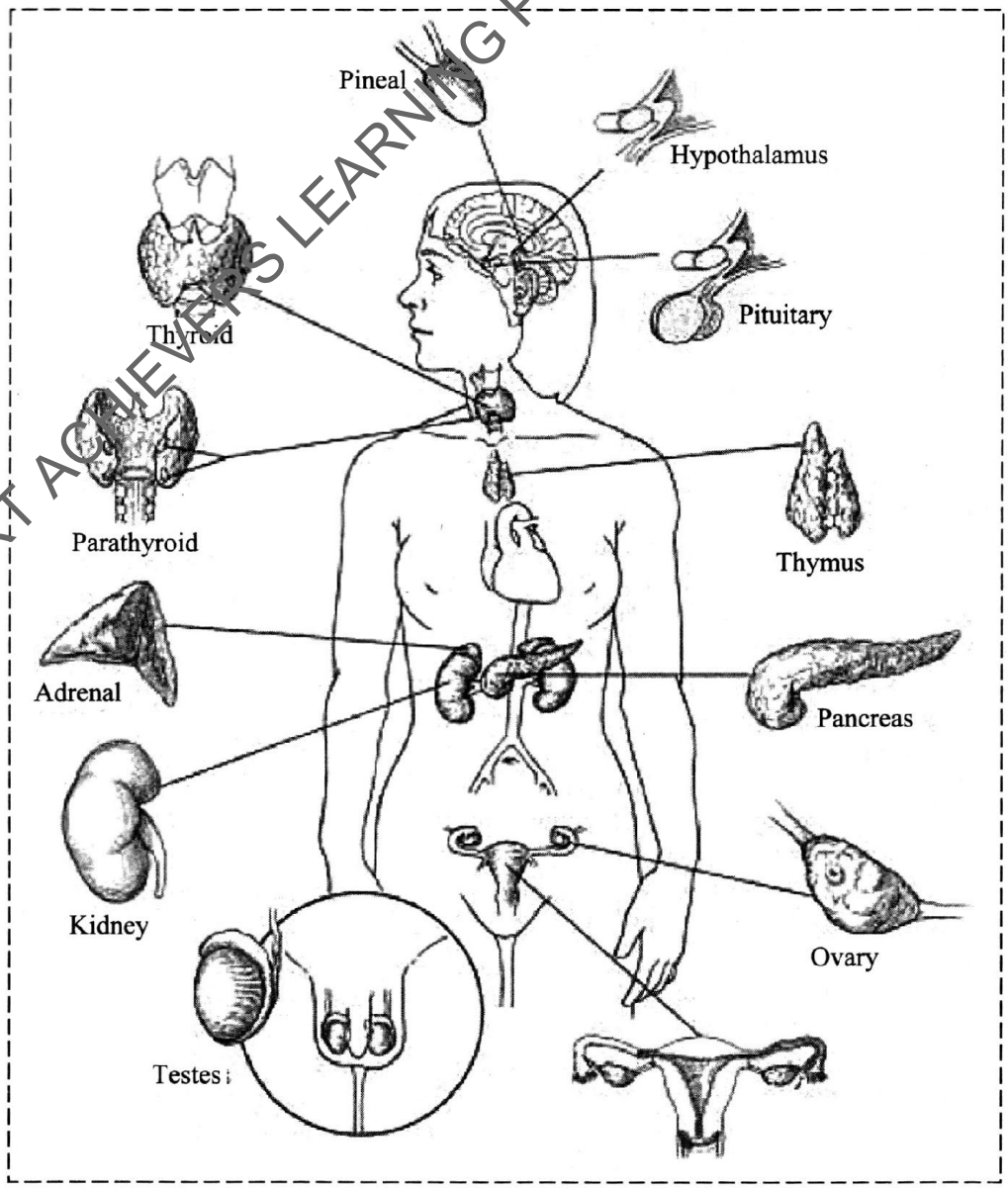
Q.75. Write the common properties of hormones.

Ans: Common properties of hormones :

i) Hormones are produced by endocrine glands and directly poured into the blood.
ii) The rate of secretion varies from low to very high depending on nature and intensity of the stimulus.
iii) They are produced in one organ and show their effect on distant "target" organ.

iv) Every hormone acts by modifying some aspect of cellular metabolism.
v) The excessive secretions or deficiencies of hormones lead to serious disorders.
vi) They are required in very small quantities.
vii) They are transported by blood.
viii) The effect of hormone is slow and lingering.
ix) These vary widely in their specificity e.g. TSH acts only on the thyroid gland while thyroxin acts on a variety of target cells.

Q.76. Diagrammatically indicate the location of various glands in our body.
Ans:



17.6.1 Pituitary glands

Q.77. With a neat labelled diagram, describe the pituitary gland. Add a note on its functions.

OR

Write an account of position, structure and functions of pituitary glands.

OR

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

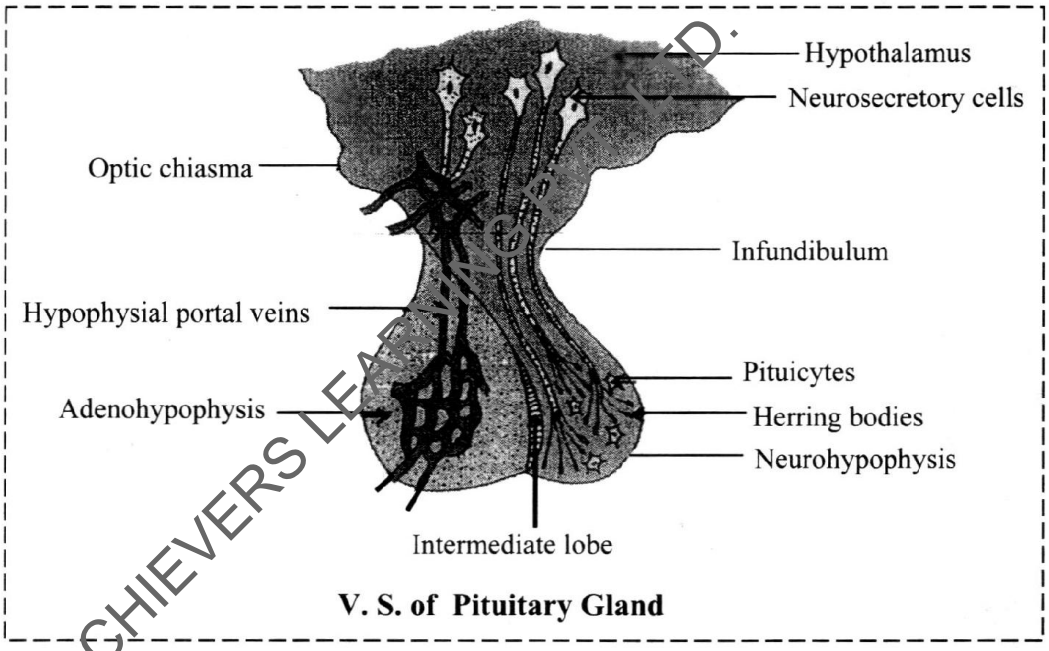
Ans: Pituitary gland (hypophysis):

Origin :

Pituitary gland is ectodermal and endodermal in origin (dual origin) and develops from nervous tissue and epithelial tissue.

Position :

It is situated on the ventral side of mid brain just below the hypothalamus behind the **optic chiasma.**
It is present in the cavity of **sphenoid bone** called **sella turcica** or hypophyseal fossa.
It is connected to the hypothalamus by a stalk of nervous tissue called pituitary stalk or infundibular stalk.



V. S. of Pituitary Gland

Structure (Morphology):
The pituitary gland shows two distinct regions. They are:

i) Adenohypophysis (anterior lobe) :
It is anterior and larger part of pituitary gland.
It occupies about 75% region of pituitary gland.
It develops as outgrowth called Rathke's pouch, from the roof of buccal cavity.
It is further divided into 3 parts as given below:

a) Pars distalis :
It is largest part of adenohypophysis.
It is made up of loose cords of epitheloid secretory cells separated by reticular connective tissue containing blood sinusoids.
It is connected to the hypothalamus by portal system formed by blood sinusoids.
It consists of glandular secretory cells.

b) Pars tuberalis :
It is tubular region present below the hypothalamus.
It is like a collar around the infundibulum.
The cells of this region are non-secretary.

c) Pars intermedia :
It is a narrow cleft between the pars distalis and pars nervosa of neurohypophysis.
It shows presence of cystic spaces.

ii) Neurohypophysis (posterior lobe) :
It is the posterior lobe of pituitary gland. It is smaller and accounts for 25% of pituitary.
It is attached to the hypothalamus by infundibular stalk.
It grows as an extension of hypothalamus called neural bud.
It is composed of following parts.

a) Median eminence :
It is swollen median part of the hypothalamus where infundibulum gets attached.

b) Infundibulum :
It is hypophyseal stalk and helps in attachment of pituitary gland to the hypothalamus.
It also serves as a passage for the axonic fibres of neurosecretory cells present in hypothalamus.

c) Pars nervosa :
It is the lowermost, larger region of neurohypophysis and has axons in between pituicytes.

Function:

Pituitary gland and hypothalamus act as a unit, regulating the activity of most of the other endocrine glands. Pituitary gland produces seven hormones and receives two hormones from hypothalamus. Adenohypophysis produces hormones such as Growth hormone (GH), Thyroid stimulating hormone (TSH), Adreno cortico trophic hormone (ACTH), Prolactin (PL) or Leuteotropic hormone (LTH), Gonadotropic hormones (GTH).

Neurohypophysis stores hormones ADH and oxytocin which are produced by hypothalamus.

Q.78. Write a short note on the following.

i) Morphology of pituitary gland.

ii) Adenohypophysis.

iii) Neurohypophysis.

Ans: *Refer Q.77*

Q.79. Distinguish between Adenohypophysis and Neurohypophysis.

Ans:

No.	Adenohypophysis (Anterior Pituitary)	Neurohypophysis (Posterior Pituitary)
i.	It develops as an outgrowth from the roof of buccal cavity called **Rathke's Pouch.**	It develops from the extension of hypothalamus.
ii.	It is mainly made up of anterior lobe of pituitary gland.	It is mainly made up of posterior lobe of pituitary gland.
iii.	It is made up of pars distalis, pars tuberalis and pars intermedia.	It is made up of pars nervosa and infundibulum mainly.
iv.	Larger ($3/4^{th}$ or 75% of pituitary).	Smaller ($1/4^{th}$ of pituitary).
v.	It consists of acidophils, basophils and chromophobes.	It consists of axonic end knobs and pituicytes.
vi.	Not directly connected to hypothalamus.	Directly connected to hypothalamus.
vii.	It secrets seven hormones.	It stores and releases two hormones.
viii.	It is non nervous, secretory part contains secretory cells.	It is nervous, non-secretary part contains axons, their terminals are associated with pituicytes.

Q.80.Enlist different pituitary hormones.

Ans: Pituitary gland secretes following hormones:

i) STH: Somatotrophic Hormone or GH: Growth Hormone.

ii) TSH: Thyroid Stimulating Hormone.

iii) ACTH: Adrenocorticotropic hormone.

iv) PL: (Prolactin) or LTH: Leuteotropic Hormone.

v) GTH: Gonadotrophic hormone.

vi) ADH: Anti Diuretic Hormone (ADH) or Vasopressin.

vii) Oxytocin.

Q.81.Give an account of hormones secreted by anterior pituitary and enlist different disorders.

OR

Enlist the names of any four hormones secreted by adenohypophysis and give their role.

[Mar 2013 old course]

Ans: Pituitary anterior (Adenohypophysis) secretes the following hormones:

i) STH : Somatotropic Hormone or GH: Growth Hormone :

The hormone is secreted by acidophils and its secretion is controlled by hypothalamus. GHRF (Growth hormone releasing factor) and GHIF (Growth hormone inhibiting factor) or somatostatin regulate the secretion of GH.

Function :

a) It stimulates growth of the body.

b) Increases amino acid uptake and protein synthesis.

c) It increases lipolysis (breakdown of lipids) in adipose tissue.

d) It increases absorption of calcium for growth of bones.

e) It increases glucose level in blood by decreased secretion of insulin.

Disorders:

Hypersecretion

a) Gigantism: In childhood, hypersecretion of GH leads to gigantism (abnormal increase in height).
b) Acromegaly: In adults, its hypersecretion leads to acromegaly.

Hyposecretion :

a) Dwarfism : In childhood, hyposecretion of GH leads to dwarfism (retardation of growth) also called pituitary infantilism. They may be 1 m or even less in height and are called midgets.

b) Simmond's disease: In adults, its hyposecretion causes Simmond's disease.

ii) TSH : Thyroid Stimulating Hormone or Thyrotropin :

The hormone is secreted by basophils and regulated by TRF (Thyroid releasing factor) of hypothalamus. Its secretion is also regulated by negative feedback between thyroxine level in the blood.

Functions :

a) It stimulates growth and secretion of thyroid gland.
b) It also regulates the rate of iodine intake by thyroid gland.

Disorders:

Hyposecretion of TSH leads to thyroid atrophy while hypersecretion causes increased BMR, loss of weight, increased heart rate and blood pressure.

iii) ACTH : Adreno Cortico Trophic Hormone or corticotropin :

The hormone is secreted by basophils and regulated by hypothalamic CRF (corticotropin releasing factor). The plasma level of cortisol also regulates ACTH secretion in negative feedback manner.

Function :

It stimulates growth and secretion of adrenal cortex hormones, glucocorticoids secretionsand mineralocorticoids.

Disorders:

Hyposecretion of ACTH leads to rheumatoid arthritis (inflammation of joints), Addison's disease (adrenal failure) while its hypersecretion leads to excessive growth of adrenal cortex causing Cushing's disease.

iv. PL : (Prolactin) or LTH : Leuteotropic Hormone :

The hormone is secreted by acidophils and regulated by PIF (Prolactin inhibiting factor) of hypothalamus.

Functions :

a) Development of mammary glands (Mammotropin), Milk secretion by mammary glands (Lactogenic hormone); maintenance of corpus luteum which secretes progesterone during pregnancy (Leuteotropin).
b) It reduces chances of pregnancy during lactation period. It expresses itself fully only in the presence of other hormones such as oestrogen, progesterone, insulin, glucocorticoids and thyroxine.

v) GTH : Gonadotrophic Hormone or Gonadotropins :

These hormones are secreted by basophils and regulated by gonadotropin releasing factor (GHRF) of hypothalamus.

Two types of gonadotropins are released by pituitary gland.

a) Follicle Stimulating Hormone (FSH) :

In male, it stimulates spermatogenesis and development of seminiferous tubule.

In female, it stimulates germinal epithelium of ovary for oogenesis and development of graafian follicle and secretion of estrogen by follicular cells.

Rise in oestrogen level of blood, inhibit pituitary in negative feedback manner to stop its secretion.

Disorder :

Deficiency of FSH leads to infertility in both the sexes.

b) Luteinizing hormone (LH) :

In **female**, LH stimulates the ovarian follicle for **ovulation** [to rupture and release ovum], formation and maintenance of **Corpus luteum.** It stimulates the corpus luteum to secrete a hormone called **progesterone.**

In **male,** LH is called ICSH (Interstitial cell stimulating Hormone) and stimulates interstitial cells to produce male sex hormones **testosterone.**

Disorder :

Hyposecretion ofLH may result in impairment of reproductive functions and sexuality.

Q.82.Give the role of prolactin hormone.

Ans: *Refer Q.81. iv.*

Q.83.Give an account of hormones released by posterior pituitary and describe different disorders.

OR

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

OR

Describe the hormones of neurohypophysis.

Ans: Pituitary anterior (Neurohypophysis) does not secrete any hormone, but stores the hormones secreted by hypothalamic neurons and releases them as and when required. These hormones are:

i) ADH : Anti Diuretic Hormone (ADH) or Vasopressin.

Functions:

It increases reabsorption of water in kidney tubules particularly in DCT (Distal convoluted tubule).

It controls the constriction of arterioles to increase blood pressure in kidney which facilitates ultrafiltration.

It regulates water balance by reducing output of urine.

Disorders:

Its deficiency leads to diabetes insipidus (excess loss of water through urine; polyuria or diuresis), polydipsia (increased thirst). Its hypersecretion causes antidiuresis (less urine formation) and retention of water in body fluids.

ii) Oxytocin (Birth hormone) :

Functions:

It stimulates contraction of smooth muscles of uterus to produce labour pains for normal parturition process.

It stimulates myoepithelial cells of mammary glands for milk ejection during breast feeding.

It helps fertilization by bringing about strong contractions of uterine muscles which helps propulsion of sperms towards fallopian tubes.

iii) Coherin :

Functions:

It is supposed to induce prolonged,rhythmic contraction of jejunum.

Q.84.Give an account of hormones secreted by pituitary gland.

Ans: *Refer Q.81 and 83.*

Q.85.Give the role/functions of any 'two' gonadotropins. [Oct 08]

OR

Explain the role of gonadotropins.

Ans: *Refer Q. 81. v.*

Q.86.What is the cause of diabetes insipidus?

Ans: Deficiency of ADH(antidiuretic hormone) is the cause of diabetes insipidus.

Q.87. Write short notes on the following.

i) Growth Hormone [Sep 09]
ii) Hypersecretion of GH
iii) Hyposecretion of GH.
iv) Thyroid Stimulating Hormone (TSH)
v) ACTH (Adreno Cortico Tropic Hormone).
vi) Prolactin
vii) Gonadotropins.
viii) Vasopressin
ix) Oxytocin.

Ans: *For these short notes Refer Q.81 and Q. 83*

Q.88.Differentiate between the effects of hyposecretion and hypersecretion of somatotrophic hormone.

Ans:

No.	Hyposecretion of STH / GH	Hypersecretion of STH/GH
i.	In children it leads to **Pituitary infantilism** and **dwarfism** or **midget** retarded growth upto 3–4 feet.	In children it leads to **gigantism** abnormal increased height upto 7 – 8 feet.
ii.	In adult it leads to **Simmond's disease** degeneration of sex organs, early sterility, dry and wrinkled skin.	In adult it leads to **acromegaly** (abnormal elongation of limbs lower jaw, cheeks, spine get curved).

17.6.2 Thyroid gland

Q.89. Describe the morphology of thyroid gland. [Mar 09, Oct 09]

OR

Write a short note on morphology of thyroid gland. [Mar 09, Oct 09]

Ans: Location: It is situated on ventrolateral side of trachea just below the larynx in the neck.

Origin: It is endodermal in origin.

Shape: It is 'H' shaped or butterfly or bow tie shaped gland.

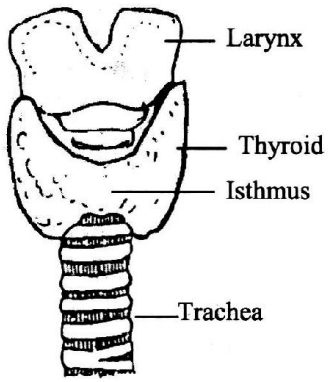
Size: It measures about 5 cm in length and 3 ems in width. Size of thyroid gland varies with age, sex an diet. It is larger in the female than in the male.

Weight: It is the largest endocrine gland and weighs about 25 to 30 gms.

Colour : It is reddish brown in colour.

Structure: It is bilobed and highly vascular. The two lobes (Right and left lobe) are joined by an isthmus.

Isthmus is a narrow, non-glandular median part. It lies across the trachea at the level of 2nd to 4th tracheal cartilage.The structural and functional units of thyroid gland are thyroid follicles.



Position of Thyroid Gland in Human Body

Q.90.Describe the histological (internal) structure of thyroid gland. [Oct 08]

OR

With the help of a suitable diagram describe the T.S. of thyroid gland.

OR

Write a short note on Histology of thyroid gland.

Ans: Histological structure of thyroid gland:

Thyroid gland is externally covered by connective tissue sheath or capsule.

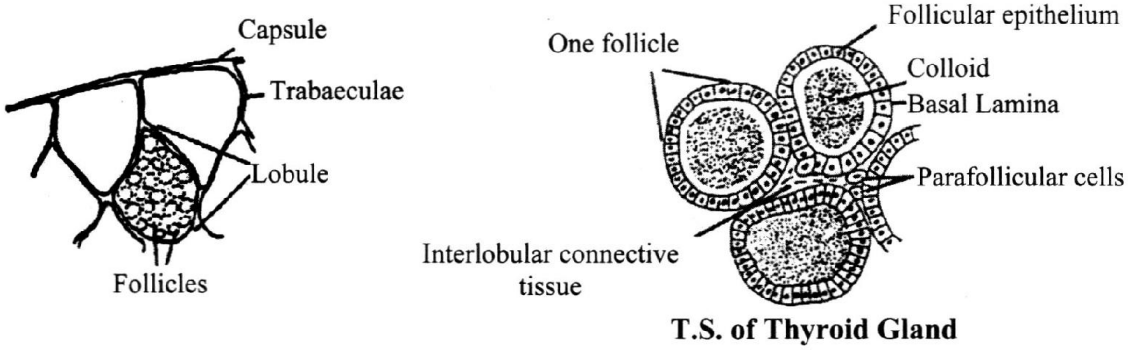
From the capsule, number of septa arise called trabeculae which divide the thyroid gland into several **lobules.**

The lobules contain about 3 million thyroid follicles.

There are about 3 million follicles in thyroid gland.

Each thyroid follicle is oval in shape and varies in size.

Larger follicles are present towards periphery whereas smaller ones are interiorly present.



T.S. of Thyroid Gland

The follicles are surrounded by a connective tissue called interfollicular tissue which contains blood vessels and nerve fibres.

Each follicle is lined by single layer of cuboidal glandular epithelium which rest on very thin basement. The follicular cavity or acinus is filled by dense amorphous semisolid substance called colloid, which is thyroglobulin, a precursor of thyroid hormone, thyroxine. Other cells bigger than follicular cells are also present singly or in groups in connective tissue. These are called parafollicular or 'C' cells. They secrete hormone thyrocalcitonin.

Q.91.Draw a neat labelled diagram showing T.S. of thyroid gland. [Mar 2013 old course]

Ans: *Refer Q. 90.'*

Q.92. Write an account of hormones secreted by thyroid gland and describe different disorders.

OR

Write an account of hormones secreted by thyroid gland.

Ans: The thyroid gland synthesizes, stores and discharges two hormones viz.

i) Thyroxine (T4) also called tetraiodothyronine, triiodothyronine (T3).
ii) Thyrocalcitonin.

T3 and T4 are iodinated derivatives of amino acid tyrosine and their secretion is regulated by thyroid stimulating hormone (TSH) or thyrotropin of pituitary gland by negative feedback manner.

i) Thyroxine :

Thyroxine is the main metabolic hormone in the body.
It increases glucose oxidation and energy production (calorigenic effect) thereby maintaining basal metabolic rate (BMR) of the body.
It controls normal protein synthesis, physical growth, development of gonads and mental faculties.
It controls tissue differentiation and metamorphosis in amphibia.
It also controls body weight, respiration rate, heart rate, blood pressure, temperature, digestion, etc.

Disorders:

Hypotliyroidism.

a) Cretinism :

In childhood, deficiency of thyroxine causes cretinism.
It leads to retardation of physical and mental growth of the child.
Patient has low I.Q. (mentally retarded), delayed puberty, dwarfism and sterility.

b) Myxoedema (Gull's disease) :

In adults, deficiency of thyroxine causes myxoedema.
It causes thickening and puffiness of the skin and subcutaneous tissue.
Patient has low BMR, low body temperature, reduced heart rate, low pulse' rate and BP, low blood sugar and iodine level, increased body weight.
It also causes mental dullness (loss of memory), falling of hairs, dry skin and intolerance of cold.

c) Simple goiter (Iodine deficiency goiter or endemic goiter) :

Deficiency of iodine in diet or drinking water causes simple goiter.
It causes enlargement of thyroid gland (15 time or more) for synthesis of thyroxine hormone.
It is commonly found in hilly regions.

Hyperthyroidism.

a. Exopthalmic goiter (Grave's disease) :

There is slight enlargement of thyroid gland and increase in BMR, heart rate, pulse rate and BP.
It leads to reduced body weight due to rapid oxidation, nervousness, irritability.
Peculiar symptoms are bulging of eyeballs with staring look and less blinking.
There is also deposition of fats in eye sockets and muscular weakness.

ii) Thyrocalcitonin (TCT) :

It is a peptide hormone secreted by parafollicular cells.
Its secretion is regulated by feedback mechanism depending on level of calcium in blood.
It regulates blood calcium level by stimulating bones to take up Ca^{++} from the blood.

Q.93. Name the disorder caused by hyposecretion of thyroxine in children and adults. [Oct 20.13]
Ans: Hyposecretion of thyroxine in children causes cretinism and in adults causes myxodema.

Q.94.Describe the role of hormones secreted by thyroid gland.
Ans: *Refer Q. 92.*

Q.95.Describe histology of thyroid gland and role of hormones secreted by thyroid gland.
Ans: *Refer Q.90. and 92.*

Q.96. Write short note on the following.

i) Thyroxine **ii) Cretinism.**
iii) Myxoedema. **iv) Simple goiter**
v) Exopthalmic goiter. **vi) Thyrocalcitonin**

Ans: *For these short notes Refer Q.92 .*

Q.97. Distinguish between the following.

i) T_3 and T_4 hormone.

Ans:

No.	T_3 (Tri-iodothyronine)	T_4 (Tetra– iodothyronine)
i.	It is called as tri-iodothyronine.	It is called as tetra-iodothyronine also called thyroxine.
ii.	It contains 3 iodine atoms.	It contains 4 iodine atoms.
iii.	It is produced in less quantity.	It is produced in more quantity.
iv.	It is more active.	It is less active than T_3.
v.	It is long lasting and the effects are similar to T_4 .	It last for short time and effects are similar to T_3.

ii. Hyperthyroidism and Hypothyroidism

Ans:

No.	Hyperthyroidism (Hypersecretion of T_3, T_4)	Hypothyroidism (Hyposecretion of T_3, T_4)
i.	It is caused due to more secretion of TSH and more activity of thyroid gland.	It is caused due to less secretion of TSH and low activity of thyroid gland.
ii.	Salty, moist, skin.	Scaliness of skin, thinning and loss of hair.
iii.	Body temperature increases.	Body temperature decreases.
iv.	Intolerance to heat.	Intolerance to cold.
v.	There is weight loss.	There is weight gain.
vi.	BMR increases (as food oxidation increases) therefore food intake increases.	BMR decreases.
vii.	Heart rate increases, B.P. increases.	Heart rate decreases, B.P. decreases.
viii.	Physically more active, therefore fatigue. Protein breakdown, weakens muscles.	Physically sluggish (muscle sluggish).
ix.	It causes Exophthalmic goitre.	It causes Cretinism, myxoedema, endemic colloid goitre, Hashimoto's disease.

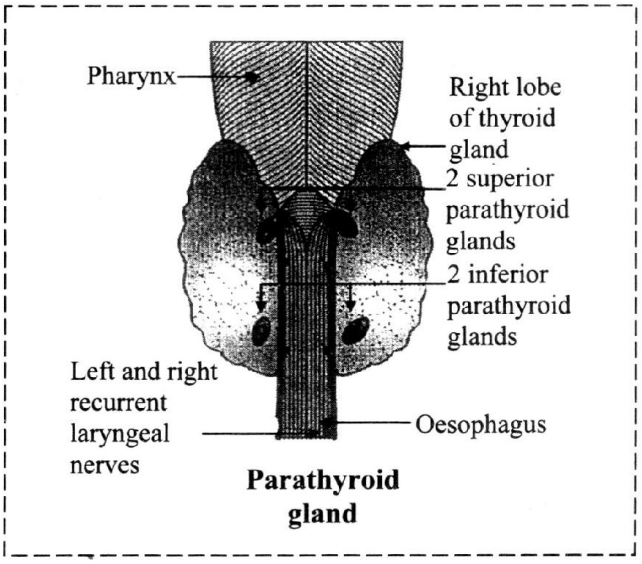
17.6.3 Parathyroid Glands

Q.98.Describe the morphology of parathyroid glands.

Ans: Morphology :

i. There are four oval parathyroids, partially or completely embedded in the dorsal surface of thyroid gland.

ii) Each is oval shaped and yellow coloured. There are four parathyroids in human body. These are situated close to the near surface of the two lobe of thyroid two on each side.



Parathyroid gland

Q.99.Describe the hormones produced by parathyroid gland and their functions.

Ans: Parathyroid gland secretes PTH. The level of Ca^{++} in the blood regulates the secretion of PTH.This hormone increases the Ca^{++}level in the blood. PTH is hypercalcaemic hormone.

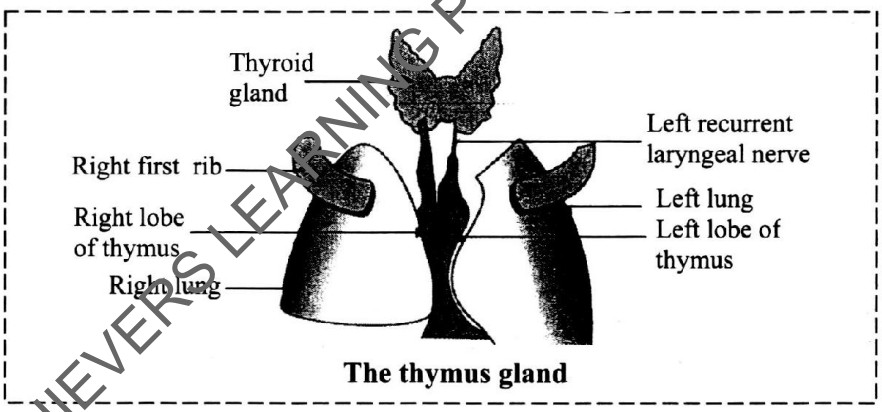
Q.100.Give the role of parathormone.

Ans: Parathormones increases Ca^{++} level in the blood. It is hypercalcemic hormone.

Q.101. Where thymus gland is located? Enlist the functions of thymus gland.

Ans: Location:

i) Thymus is endodermal in origin.
ii) It is situated in the upper part of the thorax nearest to the heart.
iii) The gland weighs 10-12 gm. In infants, 20-30 gm at puberty and 3-6 gm. at old age.
iv) It is bilobed mass of tissue lymphoid,soft, pinkish.
v) It is a prominent gland at the time of birth but it gradually atrophies in adult.



The thymus gland

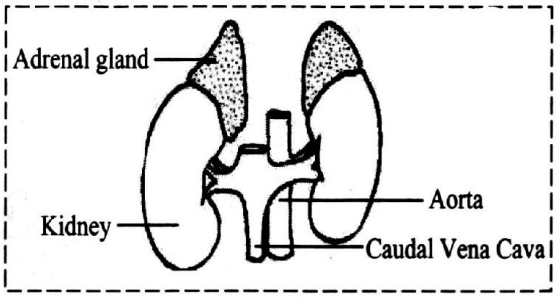
Functions:

i) The thymus is a primary centre for the formation of lymphocytes (T-Iymphocytes) and antibodies which keep the young ones immune to some diseases. Therefore, thymus is also called **"the throne of immunity", or training school of T-lymphocytes.**
ii) Thymosin promotes production of antibodies by providing humoral immunity.

17.6.5 Adrenal gland

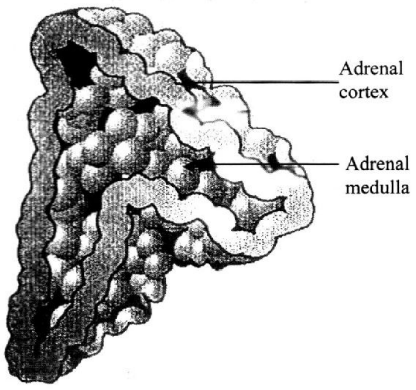
Q.102. Where are the adrenal glands located in the body ?

Ans: Adrenal glands are also called suprarenal glands.Adrenal glands are located superior to the kidneys hence called suprarenals.

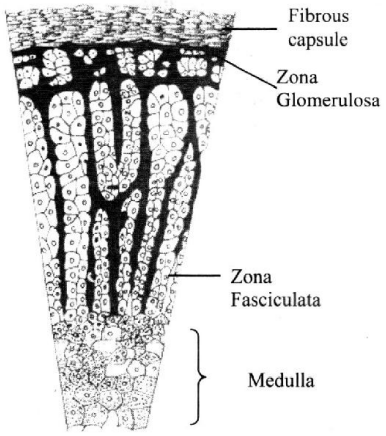


Q.103. Describe the histological structure of the adrenal gland.

Ans: i) Adrenal gland is covered by connective tissue capsule.
ii) It is differentiated into two parts: Outer larger adrenal cortex and inner medulla.
iii) Adrenal cortex has 3 zones (form bulk, derived from mesoderm).
a) Zona glomerulosa: (Outer) secretes mineralocorticoids. ego aldosterone (95%)



Adrenal Gland



T.S. of Adrenal gland

b) Zona fasciculata : (Middle) widest zone, secretes glucocorticoids e.g. cortisol (most abundant (95%), corticosterone, cortisone.

c) Zona reticularis : (Inner) produces androgens e.g. DHEA (dehydro epiandrosterone).

iv) Adrenal medulla :

The adrenal medulla is the central part of the adrenal gland and is derived from ectoderm. Secretes catecholamines.

Q.104. Describe the hormones secreted by the adrenal gland and their functions.

Ans:Hormones secreted by the adrenal gland:

i) Mineralocorticoids: Zona glomerulosa secretes mineralocorticoids.

a) Aldosterone is the main rnineralocorticoids.

b) It acts mainly on renal tubules and stimulates the reabsorption of Na+ and water and excretion of K+ and phosphate ions.

c) The aldosterone helps in the maintenance of electrolytes, body fluid volume,osmotic pressure, blood pressure.

ii) Glucocorticoids :

Zona fasciculata secretes glucocorticoids.Cortisol is main glucocorticoid.

Functions:

a) Stimulate liver cells to convert amino acids to glucose (gluconeogenesis i.e. conversion of noncarbohydrate to glucose).

b) Breaks down proteins in muscles.

c) Lipolysis (break down triglycerides from fatty tissue to fatty acid).

d) Cortisol helps in maintaining kidney function.

e) Cortisol stimulates the RBC production.

iii) Androgens

a) Androgens help in development of secondary sexual characters in male like growth of pubic hairs, facial hairs.

b) In female, they contribute to sex drive (Libido).

iv) Adrenaline (epinephrine) and Noradrenaline (norepinephrine) :

Adrenal medulla secretes adrenaline and noradrenaline.

Adrenaline is called as emergency hormone and adrenal glands are called glands of emergency.

Functions :

a) Both hormones increase alertness, papillary dilation, pilo erection etc.

b) Both hormones increase heart beat, strength of heart, contraction and rate of respiration.

Q.105. Which hormone deficiency causes Cushing disease? What are the symptoms of Cushing disease?

Ans:i) Hypersecretion of corticosteroids causes Cushing disease.

ii) Symptoms of Cushing disease :

a) alkalosis

b) polydiapsia

c) increased B.P.

d) muscle paralysis

e) increase in total quantity of electrolytes in extracellular fluid.

Q.106. Which hormone deficiency causes Addison's disease? What are the symptoms of Addison's disease ?

Ans:i) Hyposecretion of corticosteroids causes Addison's disease.

ii) Symptoms of Addison's disease :

a) Weakness, weight loss. b) Low body temperature

c) Feeble heart action. d) Low B.P.

e) Acidosis.

f) Excessive of Na^+ and Cl^- in urine.

g) Impaired kidney functioning and kidney failure.

Q.107. What are cortisols? Give their role.

Ans: Cortisols are the glucocorticoids i.e. hormones secreted by adrenal cortex.

Role of corticoids: Corticoids stimulates glucogenesis, lipolysis,proteolysis and inhibits cellular uptake and utilization of amino acids.

17.6.6 Pancreas and its hormones

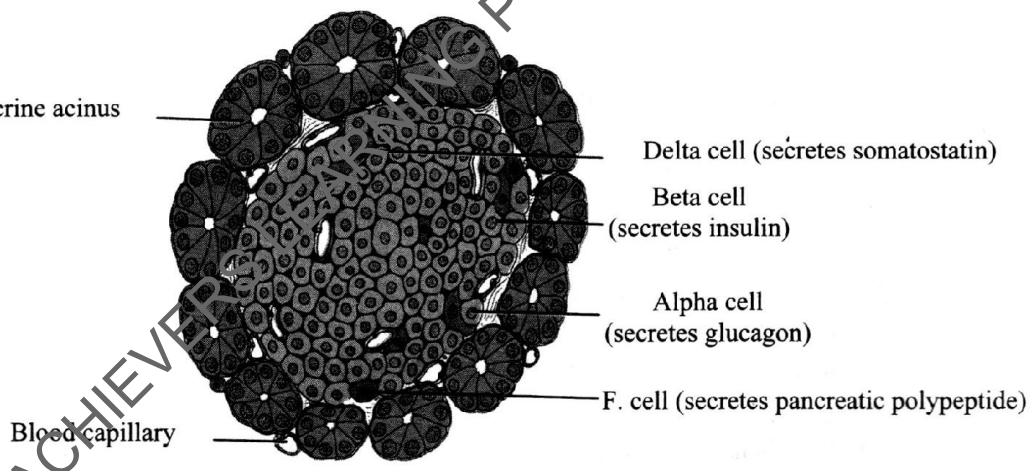
Q.108. Describe the histological structure of pancreas.

Ans: Pancreas has endocrine cells in groups called islets of langerhans. It has 4 types of cells.

a) **Alpha cells (α cells, oxyphils):** Secrete glucagon hormone which causes hyperglycemia.

b) **Beta cells (β cells):** Secrets insulin which causes hypoglycaemia (by increasing uptake of glucose by cells).

c) **Delta cells (δ cells):** Secrete somatostatin (ss).Somatostatin regulates insulin and glucagon.



Pancreatic islets (of Langerhans) and surrounding acini

Q.109.Describe the function of pancreatic hormones.

Ans: Hormones secreted by pancreas are:

i) **Insulin :**

Functions of insulin :

a) Insulin increases the permeability of cell membrane to glucose and greatly accelerates the passage of glucose into cells from the inter cellular fluid.

b) Insulin prevents the formation of glucose from non-carbohydrate substances like proteins and fats (Gluconeogenesis). Thus insulin acts as the most important regulator of carbohydrate metabolism.

ii) **Glucagon :** It is hyperglycemic hormone.

Glucagon acts on liver cells. It stimulates hepatocytes for glycogenolysis leading to increased level of blood glucose.

Glucagon reduces cellular glucose uptake and distillation.

iii) **Somatostatin.** It is a polypeptide. Somatostatin acts as a paracrine to inhibit the secretion of glucagon and insulin.

Q.110.Pancreas is a dual gland explain.

Ans: Pancreas is a dual gland because

i) Major part of the gland 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 have both the cells exocrine as well as endocrine.Hence it is called as heterocrine or dual gland.

Q.111. Give the causes of diabetes mellitus.

Ans:i) Diabetes mellitus is caused due to insufficient insulin secretion.

ii) Normal glucose blood level in human blood is 100mg/l00ml.

iii) Glucose level increases after every meal.

iv) Insulin is then released so that extra amount of glucose level is taken by body cells and normal glucose level is restored.

v) When insulin is secreted in less amount the blood-glucose level rises.
vi) When blood glucose level rises above 180 mg. glucose starts passing out in urine.
vii) In diabetes mellitus, blood glucose level rises to 300 to 500 gms per 100 milliliters of blood and urine become sweet in taste.

Q.112.What are the symptoms and treatment of diabetes mellitus?

Ans: Symptoms of diabetes mellitus.

i) Glucosuria
ii) Ketosis

Treatment : Diabetes mellitus can be treated with hypoglycemic drugs or insulin therapy.

17.6.7 Gonads

Q.113. Describe the histology of testis and hormones secreted by testes.

Ans: Histology :

i) A pair of small, oval shaped, pinkish primary sex organs of male are present in scrotal sacs outside the body.
ii) Each testis contains numerous round seminiferous tubules where formation of sperms (spermatogenesis) take place. In between the seminiferous tubules, groups of small endocrine cells called interstitial cells or Leydig's cells are present along with blood capillaries and connective tissues.
iii) These interstitial cells are responsible for secreting male sex hormones or androgens.

Hormones secreted by Testes:

Interstitial cells of Leydig produces male sex hormones (androgens):

Functions of androgens :

i) It controls the growth of sex glands like prostate, seminal vesicles etc.
ii) It stimulates spermatogenesis and formation of mature sperms.
iii) Promotes the development of male secondary characters like hair begins to grow on face and pubic region, the voice deepens and greater skeletal and muscular growth takes place.
iv) It stimulates the growth and functions of reproductive ducts, glands and external genital organ like penis.
v) Testosterone exerts a feed back inhibitory effect of pituitary ICSH secretion.

Q.114.Describe the hormones secre,ted by the ovary and its functions.

Ans: Ovaries secretes following hormones :

a) Progesterone (anti-abortion hormone): Progesterone mainly brings about secretory changes. Helps in preparing mammary glands for secretion of milk, along with oestrogen. Progesterone is called **pregnancy hormone.**

b) Estrogen: It regulates female sexual behaviour.

Functions of estrogens :

i) Estrogen is responsible for all puberty changes like growth of uterus, development of breasts, vagina fallopian tubes, sex glands etc.
ii) It controls the formation of secondary sexual characters like broadening of pelvis, growth of public and axillary hair, beginning of menstrual cycle.
iii) Development of fat deposits in subcutaneous tissues and other regions of the body to make a typical feminine body.

Functions of progesterone :

After ovulation, the ruptured follicle cells become transformed into **corpus luteum** that secreted the hormone, progesterone. It is secreted only after a female conceives.

i) Progesterone prepares the uterus for placentation. As progesterone begins to act, the thickening of the endometrium stops and the endometrium becomes secretory structure. The endometrial glands start secreting fluid which is also known as **uterine milk.**
ii) It enhances breast development during pregnancy.
iii) It maintains the foetus by forming placenta.

17.6.8 Hormones of gastrointestinal tract

Q.115.Give an account of hormones secreted by gastrointestinal tract, their origin and functions.

Ans: Gastrointestinal hormones are local hormones which execute action in same area of production or it's immediate neighbourhood. (Local hormones are produced in tissues or blood).

Hormone	Origin	Action
Gastrin	Stomach	Stimulates secretion of HCl and pepsinogen.
Secretin (1^{st} Hormone discovered)	Mucosa cells of duodenum	Stimulates secretion of water and $NaHCO_3$ in pancreatic juice and bile
GIP (gastric inhibitory peptide)	Stomach	Inhibits secretion of gastric juice and decreases peristalsis.
Pancreozymin	Mucosa of duodenum	Stimulates secretion of enzymes in pancreatic juice.
Cholecystokinin (CCK)	Mucosa of duodenum	Stimulates contraction of Gall bladder to release bile, and stimulates secretion of pancreatic enzyme.

17.6.9 Hormones of Heart

Q.116. Name the hormones secreted by heart and give its function.

Ans: Atrial wall of heart secretes a hormone called as atrial natriuretic factor(ANF). This maintains blood pressure. It is secreted when B.P increases and causes dilation of blood vessels which ultimately decreases blood pressure.

17.6.10 Hormones of Kidney

Q.117. Name the hormones secreted by the kidneys. Give their functions.

Ans: Juxtaglomerular cells of kidney produces a hormone erythropoietin. It stimulates erythropoiesis in bone marrow.

17.7 : Hypothalamus

Q.118. Which are secretory structures present in hypothalamus ?

Ans: Structure :

i) Several groups of neurosecretory cells are present in hypothalamus.

ii) Hypothalamic nuclei include supraoptic, paraventricular, dorso median and ventro median with other cell groups.

Q.119. Enlist the hormones produced by hypothalamus.

Ans: The hypothalamic neuro hormones regulating the release of pituitary hormones are

i) ACTH releasing factor (Adrenocorticotropin hormone releasing factor)
ii) TSH RF (thyroid stimulating hormone releasing factor)
iii) FSH RF (Follicle stimulating hormone releasing factor)
iv) GHRF (Growth hormone releasing factor)
v) GHRIF (Growth hormone release inhibiting factor i.e; somatostatin)
vi) PRIF (prolactin release inhibiting factor)
vii) MSHRF (melanocyte stimulating hormone releasing factor)
viii) MSH RIF (melanocyte stimulating hormone release inhibiting factor).

17.8 : Hormones as Messengers and Regulators

Q.120. "Hormones as chemical messengers and regulators." Explain.

Ans: i) Hormones are the organic compounds secreted in small amount by endogenously located endocrine glands of body. .

ii) They generally released in the blood stream (except a few local hormones like gastrin)

iii) They have specific effect (excitatory or inhibitory) on the specific organs called target organ, generally located distantly from endocrine glands.

iv) Though hormones are released in general blood circulation but each hormone stimulates only a specific target organ to initiate a specific response.

v) All major functions of body are controlled by hormones.

vi) Hence hormones are chemical messengers and regulators.

Q.121. Explain the mechanism of hormone action.

Ans: i) The hormones always act on their target organs or tissues to induce their effects.

ii) The target tissues have specific binding sites or receptor sites which contain hormone receptors.

iii) The hormone receptors are present at two places, either on the cell membrane (i.e. membrane bound receptors) or at intracellular level mostly nuclear receptors (i.e. intracellular receptors).

iv) When the hormone binds to its receptor, it forms hormone-receptor complex. Each receptor is specific to one hormone only and hence receptors are specific in the formation of hormonereceptor complex.

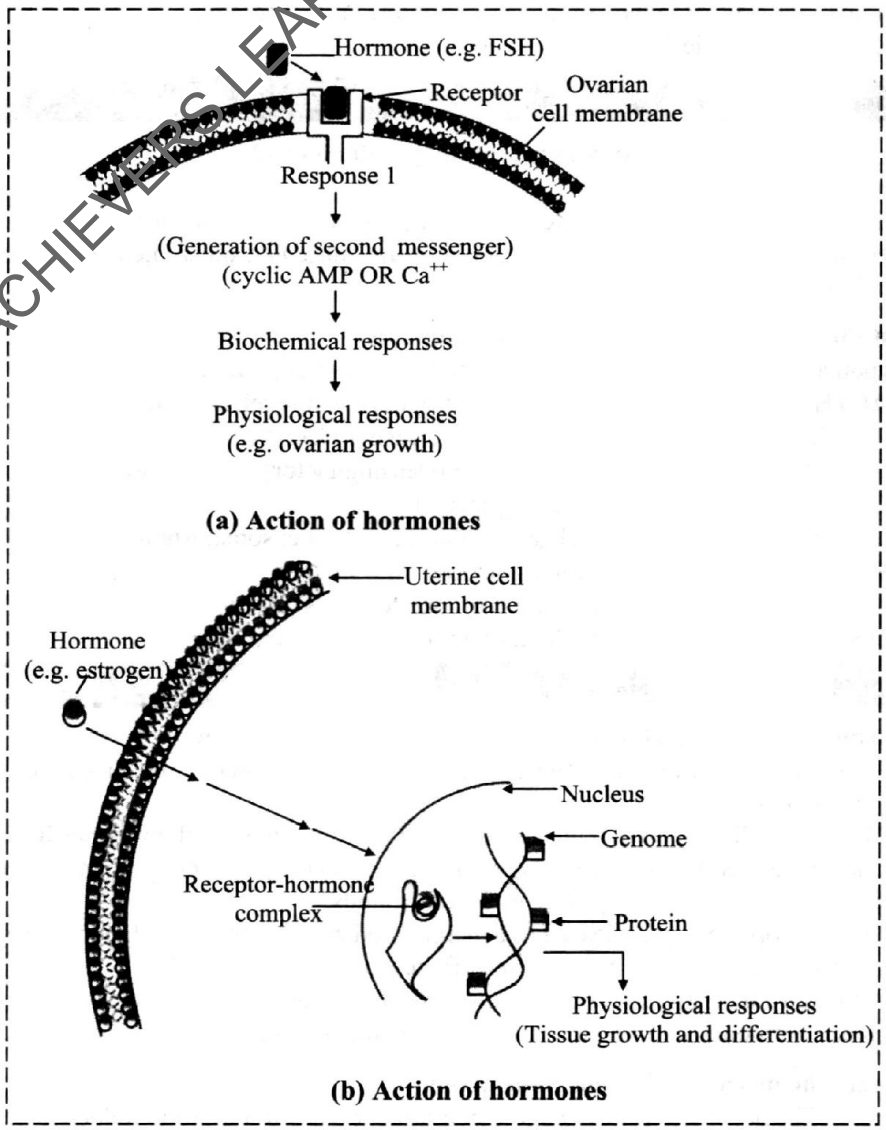
v. This leads to certain biochemical changes in the target tissue. Thus the tissue metabolism and consequently the physiological functions are regulated by hormones.

vi) The hormones which interact with membrane bound receptors normally do not enter the target cell but generate second messengers. Compounds like cyclic AMP, Ca^{++} or IP_3 (Inositol triphosphate), etc. are such second messengers.

vii) The second messengers further regulate the cellular metabolism.

viii) Certain hormones like steroid hormones and thyroxine which interact with intracellular receptors mostly regulate the gene expression or chromosome function.

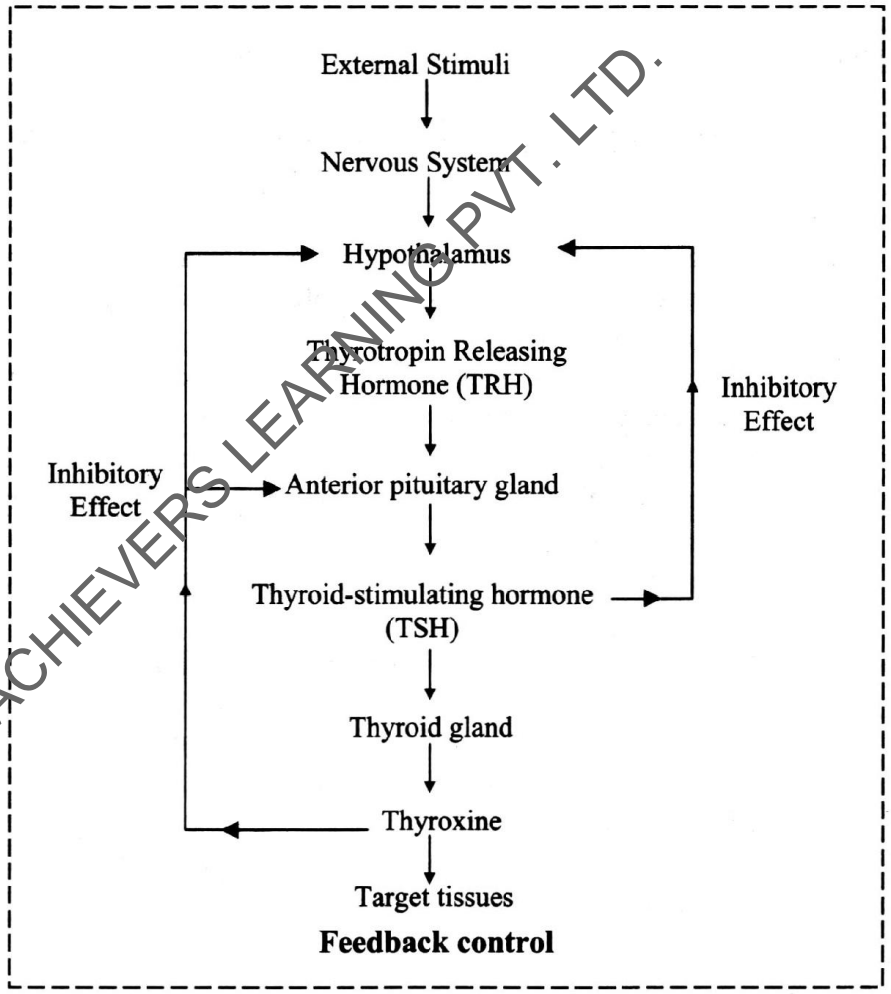
ix) The receptors are present inside the nucleus where hormone receptor complex is formed. These complexes interact with the genome to evoke biochemical changes that results in physiological and developmental functions.



Q.122. What is feedback control mechanism? Explain.

Ans: Normally, the endocrine glands secrete hormones depending upon the need of the animal. However, the amount of hormones actually secreted depends upon the age of body, the time of the day or night and requirement of the body in response to seasonal and other changes in environmental conditions. When target cells are using a hormone in larger amount, its circulating amount decreases. On the contrary, when the effect of a hormone upon its target cells has been achieved and these cells are not actively utilizing the hormone, its circulating amount increases. Decrease or increase in the circulating amount of a hormone has a directly inverse effect-upon the amount in which it is to be released by the concerned gland. This phenomenon is popularly known as the pull and push or plus-minus or feed back control mechanism of

hormonal secretion, operating between the regulator (hormone) and the regulated (target cells). Feed back control is of two types :



i) **Positive Feed Back Control :** If the level of thyroxine is less than normal limits in the blood, thyroxine level stimulates the hypothalamus to secrete thyrotropin releasing hormone (TRH). The TRH stimulates anterior lobe of pituitary to secrete thyroid stimulating hormone (TSH). The latter in turn stimulates the thyroid gland to produce thyroxine. Such regulatory effect is called positive feed back control.

ii) **Negative Feed Back Control:** If thyroxine is in excess, it exerts a negative feed back effect on the hypothalamus and anterior lobe of pituitary which then secretes less TRH and TSH respectively. This restores the normal blood thyroxine level. Secretion of hormone may be under the feed back control of a metabolite. For instance, increase in blood-glucose level stimulates pancreas to secrete insulin. The latter then brings the blood-glucose level to normal. With this normal value of blood-glucose level, insulin secretion decreases. In this way insulin maintains blood-glucose homeostasis. Another example of feed back control mechanism can be cited from the kidney which brings about body fluid osmoregulation by controlling the amount of water with the help of ADH and of sodium ions with the help of aldosterone.

Q.123.Explain negative feedback mechanism.

Ans: *Refer Q.122.*

Q.124. Write short notes on the functions of the following hormones :

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

Ans:

No.	Hormone	Function/s
i.	PTH	Increases calcium level in blood by stimulating the activity of osteoclasts; increasing absorption of calcium from intestine and reabsorption of calcium from the nephric filtrate.
ii.	Thyroid hormones a. Thyroxine Thyrocalcitonin	 Regulates BMR so controls physical, mental and sexual growth of child. Controls metamorphosis of tadpole larva into frog. Also helps in homeothermy. Decreases calcium level in blood by increasing the activity of osteoclasts and decreasing the reabsorption of calcium from the nephric filtrate.
iii.	Thymosin	Differentiation of T-lymphocytes which provide cell-mediated immunity. Stimulates the rate of cell division so controls growth in childhood.
iv.	a. Insulin b. Glucagon	Decreases sugar level in blood by stimulating glycogenesis in liver and muscle cells; increasing the utilization of glucose as respiratory fuel but prevents gluconeogenesis. Increases sugar level in blood by stimulating glycogenolysis in liver cells and gluconeogenesis.
v.	Estrogens (e.g., β - estradiol)	Promote growth and functioning of secondary sex organs in female. Promote growth and functioning of secondary sexual characters in female. Regulate sexual desire in female.
vi.	Androgens (e.g. Testosterone)	Promote growth and functioning of secondary sex organs in male. Regulate sexual desire in male.

Q.125. Give example (s) of :

i) Hyperglycaemic hormone and hypoglycaemic hormone.
ii) Hypercalcaemic hormone.
iii) Gonadotrophic hormones.
iv) Progestational hormone.
v) Blood pressure lowering hormone.
vi) Androgens and estrogens.

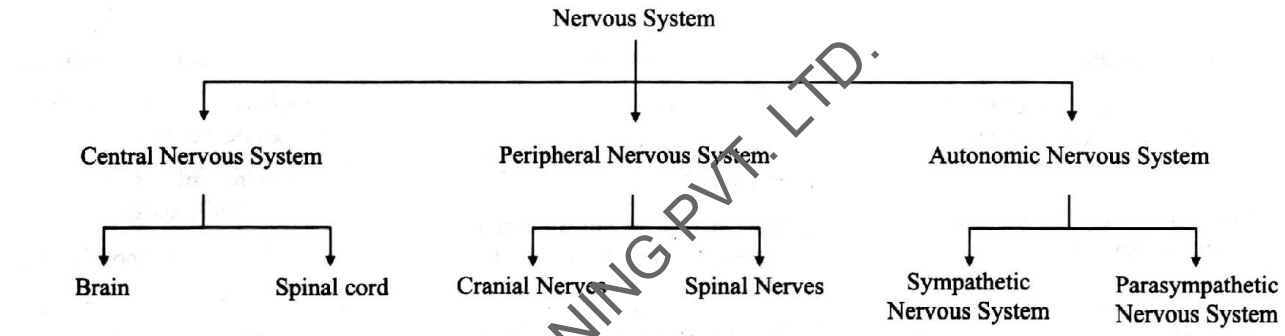
Ans:i) Glucagon and insulin
ii) Parathormone (PTH).
iii) FSH and LH/ICSH
iv) Progesterone
v) Atrial natriuretic factor (ANF)
vi) Testosterone and β -estradiol.

Q.126. Which hormone deficiency is responsible for the following ?

1) Diabetes mellitus
ii) Goitre
iii) Cretinism

Ans:i) Insulin.
ii) Iodine deficiency in water so thyroxine deficiency.
iii) Thyroxine deficiency from childhood period.

Quick Review



Central Nervous System

Brain (Encephalon)

Spinal Cord (myelon)

Fore Brain(Prosencephalon)

Olfactory lobe (Rhinencephalon)
Cerebrum (Telencephalon)
Basal Nuclei (Included in cerebrum)
Diencephalon (Thalamencephalon)

Mid Brain (Mesencephalon)

Hind Brain (Rhombencephalon)

Cerebellum (Metaencephalon)
Pons varolii – Bridge Medulla Oblongata (Myelencephalon)

Fore Brain

Olfactory lobe	**Cerebrum**	**Basal Nuclei**	**Diencephalon**
Not well developed.	Accounting 80% of the wt.	Grey matter concentrated in white matter.	(Functional link between the Cerebrum and brain stem)
Cavity called Rhinocoel	Consists of 2 cerebral hemisphere	Control automatic movement of skeletal muscles.	
Concern with smell	Connected by corpus callosum.		
	Grey matter outside & white matter inside.		
	Contains sensory, motor and association area contains I & II ventricle (lateral ventricle or Paracoel)		
	Conscious thought and intellectual activity.		

Hind brain

Cerebellum (little brain)

Consists of two cerebral hemisphere and middle vermis.

Controls & coordinates voluntary movement.

Maintains muscle tone posture and balance.

Pons Varolii

Acts as bridge.

Maintain normal rhythm of respiration.

Related with control of facial expression movement of eye ball, micturition etc.

Pathway between spinal cord and brain.

Medulla Oblongata

Contains cavity called IV ventricle or **metacoel.**

Centre of Respiratory & circulatory system.

Gives rise to most of cranial nerves.

Control involuntary activities of the body.

Peripheral Nervous System

Cranial nerves

It includes 12 pairs of cranial nerves.

They are

Sensory – 1, 2, 8

Mixed – 5, 7, 9, 10

Motor- 3, 4, 6, 11, 12

Spinal nerves

31 pairs of spinal nerves

All are mixed

C_8 Th_{12} L_5 S_5 CO_1

Multipal Choice Questions

1. Human nervous system consists of
a) central nervous system
b) peripheral nervous system
c) autonomous nervous system
d) all of the above

2. Thermoregulatory centre in the body is
a) hypothalamus b) cerebellum
c) spinal cord d) pituitary

3. Chemical transmission in synapse occurs due to
a) cholesterol b) ATP
c) cholesterol d) choline esterase

4. Voluntary muscular co-ordination is under control of
a) medulla b) cerebellum
c) hypothalamus d) cerebrum

5. All involuntary activities are under the control of
a) medulla oblongata
b) Cerebellum
c) Cerebral hemisphere
d) Pons varolii

6. Cerebellum is controlling centre for
a) muscular strength b) memory
c) equilibrium d) muscular co-ordination

7. Corpus callosum is nerve fibre bridge which connects
a) two cerebral hemispheres
b) cerebrum and cerebellum
c) cerebellum and medulla
d) midbrain and hind brain

8. Centre for thirst and hunger are located in
a) cerebrum b) cerebellum
c) hypothalamous d) medulla

9. Gyri in the brain are present in
a) cerebral cortex
b) cerebellum
c) medulla oblongata
d) hypothalamus

10. Medulla oblongata encloses
a) third ventricle b) fourth ventricle
c) first ventricle d) second ventricle

11. Third ventricle lies in
a) midbrain b) diencephalon
c) cerebrum d) medulla oblongata

12. Loss of memory may result from injury to the
a) corpus quadrigemina b) Pons
c) cerebellum d) cerebrum

13. The three coverings of CNS are called
a) ventricles b) central canal
c) meninges d) cranium

14. CSF is secreted by
a) choroid plexus b) neuron
c) both c) and b) d) neuroglia

15. Which of the following is not a function of CSF ?
a) Nutrition
b) Dessiccation prevention
c) Lubrication
d) Decussation

16. Which of the following IS a structure of mesencephalon ?
a) Inferior colliculi b) Thalamus
c) Cerebellum d) Pons varolii

17. Cavity of diencephalon is called
a) Diocoel b) IIIrd ventricles
c) Myleocoel d) Both c) and b)

18. Lateral ventricles open into 3rd ventricle by
a) foramen of Monro
b) aqueduct of sylvius
c) Iter
d) neurocoel

19. IIIrd ventricle is connected to IVth ventricle by
a) Iter
b) aqueduct of sylvius
c) both c) and b)
d) arbor vitae

20. Forebrain is also called
a) Prosencephalon b) Diencephalon
c) Telencephalon d) Mylencephalon

21. ___ is also called thalamencephalon.
a) Cerebrum b) Cerebellum
b) Diencephalon d) Pons varolii

22. Two thalami in diencephalon are interconnected by
c) optic chiasma
b) habencular commissure
c) choroid plexus
d) vermis

23. Control of eye movement during watching tennis is done by
a) corpora quadrigemina
b) crura cerebri
c) cerebral peduncles
d) cerebellum

24. Co-ordination of muscle movements is brought about by
c) cerebrum b) cerebellum
c) medulla d) diencephalon

25. is the second largest part of brain.
a) cerebrum b) cerebellum
c) medulla d) diencephalon

26. _____is the largest part of the brain.
a) cerebrum b) cerebellum
c) cranial nerve d) Spinal nerve

27. The lobe of cerebral hemisphere perceives the sensation of hearing and smell.
c) occipital b) temporal
c) parietal d) frontal

28. Breathing is controlled by
a) trachea
b) medulla oblongata
c) lungs
d) hypothalamus

29. How many pairs of cranial nerves arise from human brain ?
a) 10 b) 12
c) 13 d) 31

30. Which of the following is a sensory nerve ?
a) Vagus b) Auditory.
c) Facial d) lumbar

31. Terminal part of spinal cord is
a) funiculus b) filum terminale
c) cauda equina d) conus terminalis

32. The structural and functional unit of nervous system is
a) neuron b) neuroglia
c) nephron d) CNS

33. Spinal nerve formula in man is
a) $C_7\ Th_{12}\ L_5\ Sg\ Co_1$
b) $C_8\ Th_{12}\ L_5\ S_s\ CO_2$
c) $C_8\ Th_{12}\ L_5\ S_5\ CO_1$
d) $C_7\ Th_{12}\ L_4\ S_6CO_1$

34. Spinal cord and sympathetic ganglion of autonomous nervous system are connected by____. **[Mar 2014]**
a) ramus ventralis b) ramus commurucans
c) ramus dorsalis d) connective

35. ____.nerve is present in retina of the eye.
a) Olfactory b) Optic
c) Trigeminal d) Vagus

36. Who is called as father of conditioned Reflex ?
a) Marshall Hall b) LV. Pavlov
c) E.D. Adrain d) Sherrington

37. Reflex arc consists of
a) motor nerve b) sensory nerve
c) both of these d) none of these

38. The region of the vertebrate eye, where the optic nerve passes out of the retina, is called the
a) Fovea b) Iris
c) Blind spot d) Optic chiasma

39. _____produce colour image.
c) Cochlea
b) Rods in retina
c) Cones in retina
d) Ruffini's endings

40. In which of the following, only cone cells are found?
c) Fovea centralis b) Retina
c) Fossa Ovalis d) Blind spot

41. Static equilibrium is maintained by
a) utriculus b) sacculus
c) both c) and b) d) semi circular canals

42. Fovea in the eye is a central depression in the yellowish pigmented area called
c) blind spot b) Retina
c) cornea d) Macula lutea

43. Eustachian tube connects
a) pharynx with middle ear
b) middle ear with internal ear
c) middle ear with external ear
d) external ear with internal ear

44. Organ of Corti helps in
a) maintaining equilibrium
b) hearing
c) formation of wax
d) all of these

45. The innermost layer of human eye is
a) choroid b) cornea
c) sclera d) retina

46. Retina of the eye has following receptors
a) Chemoreceptor
b) Thermoreceptors
c) Photoreceptors
d) Baroreceptors

47. Which part of the Pituitary is neurohaemal organ?
c) Pars distalis b) Infundibulum
c) Pars nervosa d) Pars intermedia

48. Hypersecretion of STH in children causes
a) cretinism b) gigantism
c) dwarfism d) myxoedema

49. Milk secretion ill lactating woman is controlled by
c) LH b) prolactin
c) relaxin d) oestrogen

50. ADH is secreted by
a) insulin b) thyroid
c) hypothalamus d) pituitary

51. BMR is increased by administration of
a) insulin b) GH
c) thyroxine d) testosterone

52. The largest endocrine gland in the body is
c) pituitary b) adrenal
c) liver d) thyroid

53. Diabetes insipidus is caused by deficiency of
a) calcitonin b) oxytocin
c) prolactin d) vasopressin

54. The uterine contraction during delivery is from controlled by
a) oxytocin b) oestrogen
c) progesterone d) LH

55. Pituicytes are present in
a) Pars intermedia b) Pars nervosa
c) Pars distalis d) Pars tuberalis

56. Simple goiter is caused by deficiency of
a) TSH b) thyrocalcitonin
c) thyroxine d) iodine

57. Exopthalmic goiter is also known as
a) Grave's disease b) Gull's disease
c) Simple goiter d) Cusing's disease

58. Pituitary gland is under control of
a) thyroid b) adrenal
c) pineal d) hypothalamus

59. FSH is secreted by
c) pituitary b) thyroid
c) ovary d) testis

60. Median eminance is a part of
a) neuro hypophysis b) adeno hypophysis
c) thyroid d) adrenal

61. ICSH stimulates
a) ovary
b) Leydig cells
c) seminiferous tubules
d) kidney

62. Target of ADH is
a) adrenal gland
b) DCT and CT of nephrons
c) uterus
d) ovary

63. Oxytocin helps in
a) ovulation b) implanation
c) blastulation d) parturition

64. Calcitonin is a thyroid hormone which
a) elevates calcium level in blood
b) lowers calcium level in blood
c) elevates potassium level in blood
d) has no effect on calciuim

65. Midget arise due to the deficiency of hormone from
a) pituitary b) thyroid
c) pancreas d) adrenal

66. 'Herring bodies' are found in
a) thymus b) pituitary
c) abortion d) kidney

67. Anterior lobe develops from
a) infundibulum
b) Rathke's pouch
c) epithelial outgrowth pharynx
d) both b) and c)

68. LH is secreted by___gland.
a) pituitary gland b) thyroid gland
c) ovary d) adrenal gland

69. Growth hormone is also called
a) STH b) MSH
c) LTH d) TSH

70. Deficiency of FSH leads to
a) rise in oestrogen level
b) infertility
c) secondary sexual characters
d) delay ovulation

71. ADH is called vasopressin because
a) it is against dilute urine
b) it help in conservation of water
c) it causes the constriction of arterioles to increase blood pressure
d) regulates water balance of body fluids

72. Deficiency of ADH causes
a) diabetes insipidus
b) diabetes mellitus
c) antidiuresis
d) high blood pressure

73. Hyperesecretion of ADH causes
a) diabetes insipidus b) diabetes mellitus
c) antidiuresis d) polyuria

74. The two lobes of thyroid gland are connected by
a) trachea b) isthmus
c) epithelium d) cartilage

75. Thyroid gland is located
a) below larynx
b) ventrolateral to trachea
c) both a) and b)
d) ventrodorsal flattened to cartilage

76. TSH is secreted by____gland
a) thyroxine b) MSH
c) androgens d) insulin

77. Thyrocalcitonin is secreted by
a) 'C' cells
b) parafollicular cells
c) Both a) and b)
d) thyroid follicles

78. Deficiency in thyroxine in adults cause
a) cretinism b) myxodema
c) diabetes d) Parathyroid gland

79. Gonadotrophic hormone is also called
a) Gonadotrophin b) Adrenaline
c) Glucocorticoids d) Thyroxine

80. Which among the following is a heterocrine gland ?
a) Liver b) Pancreas
c) Sweat glands d) Stomach

81. Gigantism and acromegaly are due to
a) hypothyroidism b) hyperthyroidism
c) hypopituitarism d) hyperpituitarism

82. The catecholamines are secreted by **[Oct 2013]**
a) adrenal cortex b) adrenal medulla
c) thymus d) pancreas

83. Cushing's Syndrome is developed due to
a) hyposecretion of ACTH
b) hypersecretion of ACTH
c) hyposecretion of thyroxine
d) hypersecretion of thyroxine

84. Osmotic pressure and blood pressure are maintained by
a) glucocorticoids
b) aldosterone
c) atrial natriuretic factor
d) vasopressm

85. Hormone secreted by Corpus luteum is
a) estrogen b) progesterone
c) testosterone d) cortisol

86. Development of secondary sexual characteristic in female is under control of
a) growth hormone b) TSH
c) estrogen d) progesterone

87. Pituitary gland is under the control of
a) thyroid b) adrenal
c) pineal d) hypothalamus

88. TSH regulates secretion.
a) thyroxine b) MSH
c) androgens d) insulin

89. Damage to which endocrine gland may result in water and electrolyte imbalance **[Mar 2013]**
a) Thymus gland b) Thyroid gland
c) Adrenal gland d) Parathyroid gland

Answer Keys

1.	d)	**2.**	a)	**3.**	c)	**4.**	b)	**5.**	a)	**6.**	c)	**7.**	a)	**8.**	c)	**9.**	a)	**10.**	b)
11.	b)	**12.**	d)	**13.**	c)	**14.**	a)	**15.**	d)	**16.**	a)	**17.**	d)	**18.**	a)	**19.**	c)	**20.**	a)
21.	c)	**22.**	b)	**23.**	a)	**24.**	b)	**25.**	b)	**26.**	a)	**27.**	b)	**28.**	b)	**29.**	b)	**30.**	b)
31.	b)	**32.**	a)	**33.**	c)	**34.**	b)	**35.**	b)	**36.**	b)	**37.**	c)	**38.**	c)	**39.**	c)	**40.**	a)
41.	c)	**42.**	d)	**43.**	a)	**44.**	b)	**45.**	d)	**46.**	c)	**47.**	c)	**48.**	b)	**49.**	b)	**50.**	c)
51.	c)	**52.**	d)	**53.**	d)	**54.**	a)	**55.**	b)	**56.**	d)	**57.**	a)	**58.**	d)	**59.**	a)	**60.**	a)
61.	b)	**62.**	b)	**63.**	d)	**64.**	b)	**65.**	a)	**66.**	b)	**67.**	d)	**68.**	a)	**69.**	a)	**70.**	b)
71.	c)	**72.**	a)	**73.**	c)	**74.**	b)	**75.**	c)	**76.**	a)	**77.**	c)	**78.**	b)	**79.**	a)	**80.**	b)
81.	d)	**82.**	b)	**83.**	b)	**84.**	d)	**85.**	b)	**86.**	c)	**87.**	d)	**88.**	a)	**89.**	c)		