9. Control and Coordination

Exercise

Q. 1 Multiple choice questions.

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

Ans. Dendron

2) ..... is a neurotransmitter.

Ans. Acetyl choline

3) The supporting cells that produce myelin sheath in the PNS are .....

Ans. Schwann cells

4) A collection of neuron cell bodies located outside the CNS is called.....

Ans. ganglion

5) Receptors for protein hormones are located.....

Ans. on cell surface

6) If parathyroid gland of man are removed. The specific result will be .....

Ans. disturbance of Ca^{++}

7) Hormone thyroxine, adrenaline and non adrenaline are formed from .....

Ans. Tyrosine

8) Pheromones are chemical messengers produced by animals and released outside the body. The odour of these substance affects.....

Ans. Behaviour

9) Which one of the following is a set of discrete endocrine gland.....

Ans. pituitary, thyroid, adrenal, thymus

10.) After ovulation, Graafian follicle changes into.....

Ans. corpus luteum

11.) Which one of the following pair correctly matches a hormone with a disease resulting from its deficiency?.....

Ans. Insulin - Hyperglycemia

12.) ..... is in direct contact of brain in human

Ans. Pia mater

Q. 2 Very very short answer questions.

1) What is the function of red nucleus?

Ans. Red nucleus plays an important role in controlling posture and posture and muscle tone, modifying some motor activities and motor coordination.

2) What is the importance of Corpora quadrigemina?

Ans. Corpora quadrigemina consists of 4 solid rounded structures, viz. superior and inferior colliculi. Superior colliculi control visual reflexes while inferior colliculi control auditory reflexes.

3) What does the cerebellum of brain control?

Ans. Cerebellum of brain is an important centre which maintains equilibrium of body, posture, balancing orientation, moderation of voluntary movements and maintenance of muscle tone.

4) Name the three ossicles of the middle ear.

Ans. malleus [hammer], incus [anvil] and stapes [stirrup].

5) Name the hormone which is anti abortion hormone

Ans. progesterone.

6) Name an organ which acts as temporary endocrine gland.

Ans. placenta. Corpus luteum in ovary.

7) Name the type of hormones binding to DNA and alter gene expression.

Ans. steroid hormones.

8) What is the cause of abnormal elongation of long bones of arms and legs and of lower jaw.

Ans. Hypersecretion of growth hormones in adults causes abnormal elongation of long bones of arms and legs and of lower jaw Le acromegaly.

9) Name the hormone secreted by the pineal gland.

Ans. melatonin.

10) Which endocrine gland plays important. Role in improving immunity?

Ans. The endocrine gland, thymus plays an important role in improving immunity.

Q. 3 Match the organism with the type of nervous system found in them.

Ans.

A	B(Ans)
1. Neurons	(a) human
2. Ladder type	(b) Flatworm
3. Ganglion	(c) Earthworm
4. Nerve net	(d) hydra

Q. 4 very short answer questions.
1) Describe the endocrine role of islets Langerhans.

Ans. Endocrine cells of pancreas form groups of cells called Islets of Langerhans. There are four kinds of cells in islets of Langerhans which secrete hormones.

2) Mention the function of testosterone?

Ans. Testosterone is a steroid sex hormone secreted by testes and cortex of adrenal glands. It controls the secondary sexual characters in males.

3) Give symptoms of the disease caused by hyposecretion of ADH.

Ans. Polydipsia, i.e. frequent thirst and polyuria, 1.e. frequent urination are the symptoms of the disease caused by hyposecretion of ADH.

Q. 5 short answer questions

1) Rakesh got hurt on his head when he fell down from his motorbike. Which inner membranes must have protected his brain? What other roles do they have to play?

Ans. When Rakesh fell down from his motorbike. The inner membranes that protected his brain were meninges, viz. dura mater, Arachnoid membrane and pla mater Morevover, CSF must have also acted as a shock absorber.
Dura mater: It is the outer tough membrane protective in function.
Arachnoid membrane: It is the middle web-like membrane which communicates with fluids of upper sub dural space and lower sub arachnold space.
Pia mater: It is the innermost highly vascularised nutritive membrane in close contact with brain and spinal cord.

2) Give reason - Injury to medulla oblongata may prove fatal.

Ans. (1) Medulla oblongata is the region of the brain that controls all the involuntary activities.
(2) Vital activities such as heartbeats. respiration, vasomotor activities, peristalsis. etc. are under the control of medulla oblongata.
(3) When medulla oblongata is injured, all these vital functions are instantly stopped.
(4) Therefore, injury to medulla oblongata causes sudden death.

3) Distinguish between the sympathetic and parasympathetic nervous system on the basis of the effect they have on:

Ans.	Sympathetic Nervous System	Parasympathetic nervous system
(a) Heartbeat	Increases	Decreases
(b) Urinary bladder	Relaxes and stores urine	Contracts causing micturition

4) While holding a tea cup Mr. Kothari's hands rattle. Which disorder he may be suffering from and what is the reason for this?

Ans. (1) This condition is due to Parkinson's disease.

(2) It is due to degeneration of dopamine producing neurons in the CNS.

(3) 80% of the patients develop this condition along with stiffness, difficulty in walking. balance and coordination.

5) List the properties of the nerve fibres.

Ans. (1) The symptoms observed in Krishna were due to sympathetic nervous system. Emergency conditions trigger sympathetic nervous medulla. system to stimulate adrenal

(2) The cells of adrenal medulla secrete catecholamines like adrenaline and nor adrenaline.

(3) These hormones have direct effect on the pacemaker of the heart which causes increase in the heart rate and other associated symptoms.

(4) This is a typical fright reaction caused by intervention of sympathetic nervous system

6) How does tongue detect the sensation of taste?
Ans. (1) The surface of tongue is with gustatoreceptors.

(2) These receptors are sensitive to the chemicals [sweet, salt, sour, bitter and umami (savory)] present in the food.

(3) The receptor cells get stimulated, generate the impulse which is given to the sensory neuron.

7) State the site of production and function of Secretin, Gastrin and Cholecystokinin.

Ans.

Hormone	Site of production	Functions
(i) secretin	(i) Duodenal mucosa	(i) Sumulates secretion of pancreatic juice and bile from pancreas and liver respectively.
(ii) Gastrin	(ii) Gastric mucosa	(ii) Sumulates gastric glands to secrete gastric juice.
(iii) Cholecys	(iii) Duodenal mucosa	(iii) Stimulates pancreas and gall bladder to release pancreatic enzymes and bile respectively.

8) An adult patient surffers from low heart rate, low metabolic rate and low body temperature. He also lacks alertness, intelligence and initiative. What can be this disease? What can be its cause and care?
Ans. (1) The above symptoms indicate that the person is suffering from Myxoedema.

(2) Myxoedema is condition caused due to hypothyroidism.

(3) Hypothyroidism causes deficiency of thyroid hormones like T_3 and T_4 (thyroxine). This results in low BMR.

(4) This condition can be cured by giving injections of thyroxine or tablets containing hormone preparation.

9) Where is the pituitary gland located? Enlist the hormones secreted by anterior pituitary.

Ans. (1) The pituitary gland is attached to hypothalamus on the ventral surface of brain.

(2) It is lodged in a bony depression called sella turcica of sphenoid bone.

(3) For names of hormones: (1) Adenohypophysis is the large anterior lobe of pituitary gland.

(2) It is derived from embryonic ectoderm in the form of Rathke's pouch which is a small outgrowth from the roof of embryonic stomodaeum.

(3) It is made up of epitheloid secretory cells.

(4) It secretes following hormones:
i. GH: [Growth Hormone/ STH: Somatotropic Hormone]
ii. TSH/TTH - [Thyroid Stimulating Hormone/ Thyrotropic Hormone]
iii. ACTH - [adrenocorticotropic hormone]
iv. PRL - [prolactin]
v. Gonadotropins -
(a) FSH [follicle stimulating hormone]

(b) LH/ICSH - [leutinizing hormone/ interstitial cells stimulating hormone]

10) Explain how the adrenal medulla and sympathetic nervous system function as a closely integrated system.

Ans. (1) Adrenal medulla originates from embryonic neuro-ectoderm.

(2) It consists of rounded group of large granular cells called chromaffin cells. They are modified post-ganglionic cells of sympathetic nervous system which have lost normal processes glandular function. and acquired

(3) These cells are connected with pre-ganglionic fibres of sympathetic nervous system.

(4) Hence adrenal medulla is an extension of sympathetic nervous system.

(5) Thus adrenal medulla and sympathetic nervous system functions as a closely integrated system.

11) Name the secretion of alpha, beta and delta cells of islets of langerhans. Explain their role.

Ans.

Pancreatic islet cells	secretion	Functions
(i) Alpha cells	(i) Glucagon	(i) Sumulates glycogenalysis in the liver
(ii) Beta cells	(ii) Insulin	(ii) Stimulates glycogenesis in the liver and muscles
(iii) Delta cells	(iii) Somatostatin	(iii) Inhibits the secretion of glucagon and insulin. It also decreases the gastric secretions, motility and absorption in digestive tract

12) Which are the 2 types of goitre? What are their causes?

Ans. (1) Goitre is the enlargement of thyroid gland. It is easily visible at the base of neck when a person is suffering from it.

(2) Goitre is of two types:

(i) Simple goitre: It is also called endemic goitre. This is due to iodine deficiency in the food. This causes iodine deficit in blood. In an attempt to take more fodine from blood, the blood supply to the gland increases. This results in swelling on the thyroid.

(ii) Exophthalmic goitre: It is also called toxic goitre. This is due to hyperactive thyroid gland. This can happen if there is overstimulation of thyroid due to excess of ACTH. This disorder is also called Grave's disease or hyperthyroidism.

13) Name the ovarian hormone and give their functions.

Ans. Ovaries produce following hormones.

Hormone	Functions
(i) Oestrogen	(i) It is responsible for secondary sexual characters in female.
(ii) Progesterone	(ii) Essential uterine preparing for thickening of endometrium, the uterus thus for implantation of fertilized ovum. It is responsible for development of mammary glands during pregnancy. It inhibits uterine contractions during pregnancy.

(iii) Relaxin	(iii) It relaxes the cervix of the pregnant female and ligaments of pelvic girdle during parturition.
(iv) Inhibin	(iv) It inhibits the FSH and GnRH production.

Q. 6 Answer the following.

1. Complete the table. (Answer are given directly)

(a) Location	(b) Cell Type	(c) Function
(i) PNS	**(i) Schwann cells**	(i) Produce myelin sheath.
(ii) PNS	(ii) Satellite cells	**(ii) Supply nutrients to surrounding neurons, protect and cushion nearby neurons.**
(iii) CNS	(iii) Oligodendrocytes	(iii) Form myelin sheath around central axon.
(iv) CNS	**(iv) Microglia**	(iv) Pathogens are destroyed by phagocytosis. (Phagocytose)
(v) CNS	**(v) Ependyma cells**	(v) Form the epithelial lining of brain cavities and central canal.

Q. 7 Long answer questions.

1) Explain the process of conduction of nerve impulses upto development of action potential

Ans. (i) The origin and maintenance of resting potential depends on the original state of no stimulation.

(ii) Any stimulus membrane or disturbance to the will make the membrane permeable to Na^+ ions. This causes rapid influx of Na^+ ions.

(iii) The voltage gated Na^+/K^+ channels are unique. They can change the potential difference of the membrane as per the stimulus received and also the gates operate separately and are self closing.

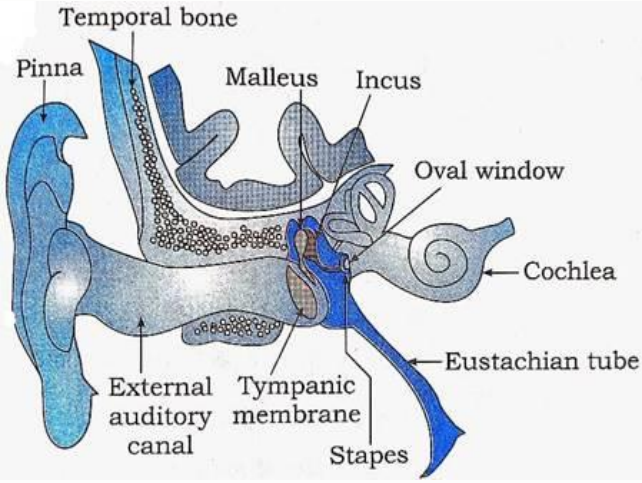
(iv) During resting potential, both gates are closed and resting potential is maintained.
(v) However during depolarization, the Na^+ channels open but not the K^+ channels. This causes Na^+ to rush into the axon and bring about a depolarisation. This condition is called action potential.

(vi) Extra cellular fluid (ECF) becomes electronegative with respect to the inner membrane which becomes electropositive.

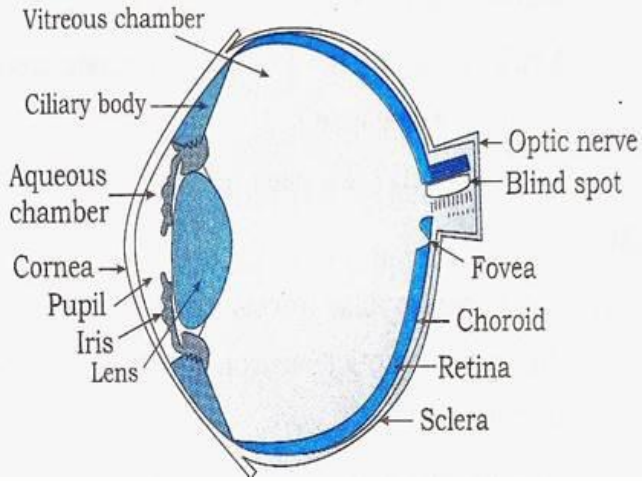
2) Draw the neat labelled diagrams of.

a. Human ear

Ans.

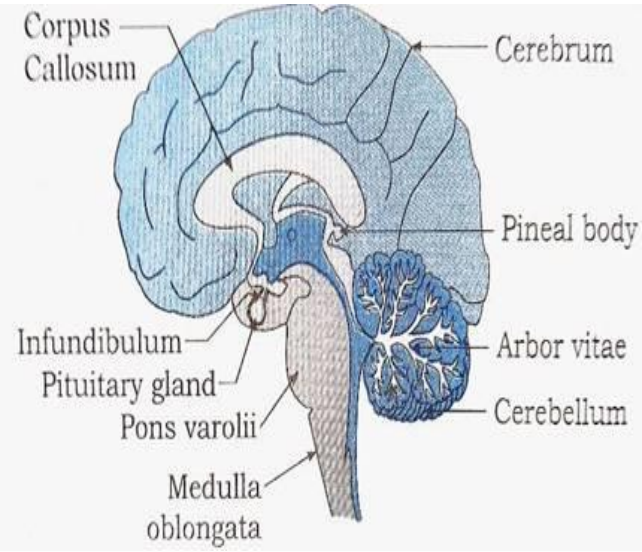


b. Sectional view of human eye
Ans.

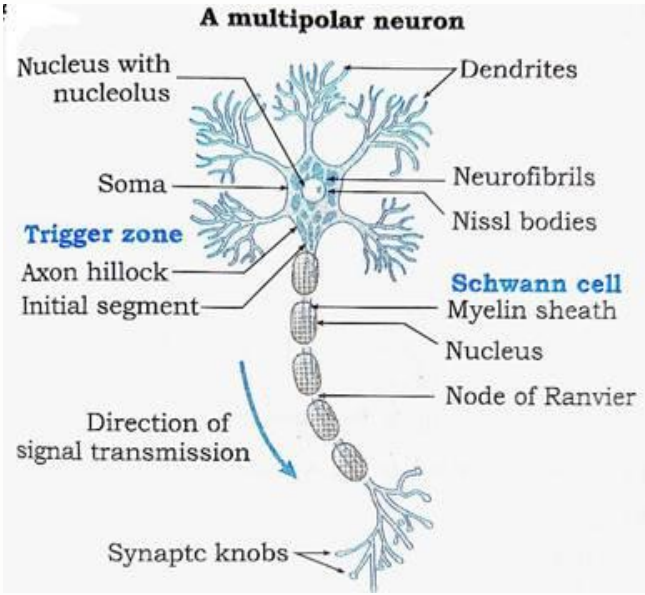


c. L. S. Of human brain

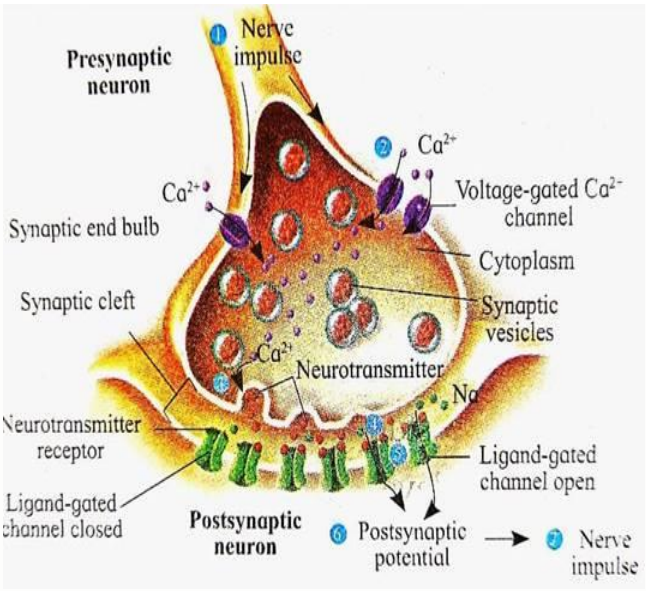
Ans.



d. Multipolar Neuron
Ans.



3. Answer the questions after observing the diagram given below.



a. What do the synaptic vesicles contain?

Ans. Synaptic vesicles contain a neurotransmitter - acetyl choline.

b. What process is used to release the neurotransmitter?

Ans. Exocytosis.

c. What should be the reason for the next impulse to be conducted?

Ans. Removal of neurotransmitter by the action of acetyl cholinesterase.

d. Will the impulse be carried by post-synaptic membrane carried even if one pre-synaptic neuron is there?

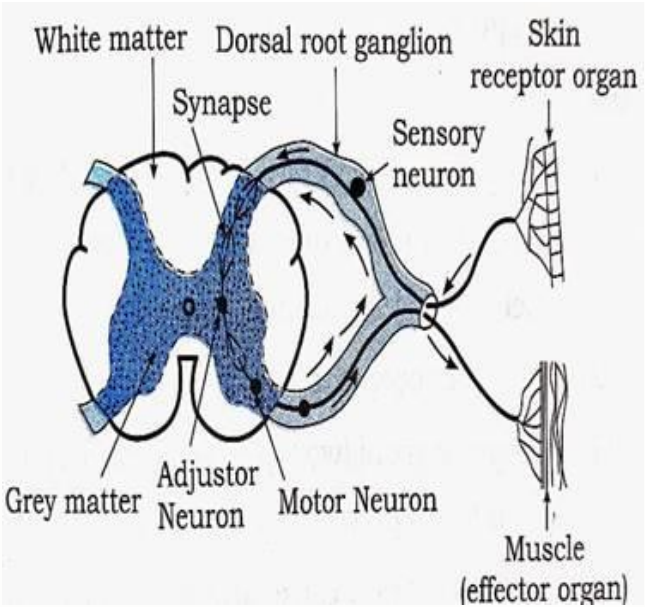
Ans. Yes. As far as impulse is transmitted by pre-synaptic neuron, it will be received
by post-synaptic neuron.

e. Can you name the channel responsible for their transmission?

Ans. Ca^{++} channel

4. Explain the Reflex Pathway with the help of a neat labelled diagram.

Ans.



1. Reflex action Reflex action is defined as a quick, automatic involuntary and often unconscious action brought about when the receptors are stimulated by external or internal stimuli.

2. Reflex arc: Reflex actions are controlled by CNS. Reflex arc is the structural or functional unit of reflex action. Simple reflex arc is formed of the following five components.

(1) Receptor organ: The sensory part that receives the stimulus is called receptor organ. It can be any sense organ that receives the stimulus and converts it into the impulse. e.g. skin, eye, ear, tongue, nasal epithelium, etc.

(2) Sensory neuron or afferent neuron: Sensory part carrying impulse from receptor organ to CNS is called sensory neuron. 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.

(3) Association, adjustor or intermediate neuron: It is present in the grey matter of spinal cord. Receiving impulse from sensory neuron, interpreting it and generating motor impulse are done by association neuron.

(4) Motor neuron (effector): The cyton of motor neuron 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.

(5) Effector organ: Effector organ 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 or glands. The path of reflex action is followed by the unidirectional impulse. It originates in the receptor organ and ends in effector organ through

CNS.

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

Ans. (i) The symptoms observed in Krishna were due to sympathetic nervous system Emergency conditions trigger sympathetic nervous system to stimulate adrenal medulla.

(ii) The cells of adrenal medulla secrete catecholamines like adrenaline and nor-adrenaline.

(iii) These hormones have direct effect on the pacemaker of the heart which causes increase in the heart rate and other associated symptoms.

(iv) This is a typical fright reaction caused by intervention of sympathetic nervous system.

6) What will be the effect of thyroid gland atrophy on the human body?

Ans. (i) Atrophy means degeneration. Atrophy of thyroid gland will result in deficient secretion of thyroid hormones leading to hypothyroidism. Deficiency of thyroid hormones [T_3 and T_4] and thyrocalcitonin will cause following effects on the body.

(ii) Decrease in BMR i.e. basal metabolic rate, decrease in the blood pressure, heart beat, body temperature, etc.

(iii) Occurrence of myxoedema in which there is abnormal deposition of fats under the skin giving puffy appearance in adults.

(iv) Irregularities in menstrual cycle in case of female patients.

(v) Hair become brittle and fall.

(vi) Calcium metabolism also disturbs due to lack of thyrocalcitonin.

7. Write the names of hormones and the glands secreting them for the regulation of following functions.

(a) Growth of thyroid and secretion of thyroxine.

Ans. TSH by adenohypophysis

(b) Helps in relaxing pubic ligaments to facilitate easy birth of young ones.

Ans. Relaxin by degenerating corpus luteum of the ovary.

(c) Stimulate intestinal glands to secrete interstinal juice.

Ans. secretin by duodenal mucosa.

(d) Controls calcium level in the blood.

Ans. Calcitonin [hypocalcemic hormone] by thyroid and parathormone [hypercalcemic hormone] by parathyroid glands.

(e) Controls tubular absorption of water in kidneys.

Ans. ADH by hypothalamus.

(f) Urinary elimination of water.

Ans. Atrial natriuretic factor by atria of heart.

(g) Sodium and potassium ion metabolism.

Ans. Aldosterone by adrenal cortex.

(h) Basal Metabolic rate.

Ans. T_3 and T_4 by thyroid gland.

(i) Uterine contraction.

Ans. Oxytocin by hypothalamus.

(j) Heart beat and blood pressure.

Ans. Adrenaline, nor-adrenaline [stimulation] and acetylcholine [inhibition] by adrenal medulla.

(k) Secretion of growth hormone.

Ans. GHRF by hypothalamus.

(l) Maturation of Graafian follicle.

Ans. FSH by anterior pituitary.

8.) Explain the role of hypothalamus and pituitary as a coordinated unit in maintaining homeostasis?

Ans. (i) Homeostasis is maintenance of constant internal environment of the

body.

(ii) When certain hormones from any endocrine glands are secreted in excess quantity, the inhibiting factors from hypothalamus. automatically exert negative feedback and stop the production of stimulating hormones from pituitary.

(iii) Similarly, if any hormone is in deficit, then the concerned gland is given message through releasing factor. This way the hormone production remains in a balanced state or homeostasis.

(iv) E.g. If thyroxine from thyroid gland is secreted in excess, the secretion of TSH from pituitary is stopped by stopping the production of TRF from hypothalamus.

(v) Though most of the endocrine glands are under the influence of pituitary gland. it is in turn controlled by hypothalamus.

(vi) Hypothalamus secretes releasing factors and inhibiting factors and hence regulate the secretions of pituitary (hypophysis).

(vii) There is negative feedback mechanism in controlling the secretions of the endocrine glands.

(viii) Hypothalamus forms the hypothalamo-hypophyseal axis which transportation of neurohormones place.

Following are the releasing and inhibiting factors produced by hypothalamus:

(1) Somatotropin/GHRF: It stimulates release of growth hormone.

(2) Somatostatin/GHRIF: It inhibits the release of growth hormone.

(3) Adrenocorticotropin Releasing Hormone /CRF: It stimulates the release of ACTH by the anterior pituitary gland.

(4) Thyrotropin Releasing Hormone /TRF: It stimulates the release of TSH by anterior pituitary gland.

(5) Gonadotropin Releasing Hormone (GnRH): It stimulates pituitary to secrete gonadotropins.

(6) Prolactin Inhibiting Hormone (Prolactostatin): It inhibits prolactin released by anterior pituitary gland.

(7) Gastrin Releasing Peptide (GRP).

(8) Gastric Inhibitory Polypeptide (GIP).

9) What is adenohypophysis? Name the homones secreted by it?

Ans. (1) Adenohypophysis is the large anterior lobe of pituitary gland.

(2) It is derived from embryonic ectoderm in the form of Rathke's pouch which is a small outgrowth from the roof of embryonic stomodaeum.

(3) It is made up of epitheloid secretory cells.

(4) It secretes following hormones :

i. GH: [Growth Hormone/ STH: Somatotropic Hormone]

ii. TSH/TTH - [Thyroid Stimulating Hormone/ Thyrotropic Hormone]

iii. ACTH - [adrenocorticotropic hormone]

iv. PRL - [prolactin]

v. Gonadotropins -

(a) FSH [follicle stimulating hormone]

(b) LH/ICSH - [leutinizing hormone/ interstitial cells stimulating hormone]

10) Describe in brief, an account of disorders of adrenal gland.

Ans. (1) Adrenal medulla originates from embryonic neuro-ectoderm.

(2) It consists of rounded group of large granular cells called chromaffin cells. They are modified post-ganglionic cells of sympathetic nervous system which have lost normal processes and acquired glandular function.

(3) These cells are connected with pre-ganglionic fibres of sympathetic nervous system.

(4) Hence adrenal medulla is an extension of sympathetic nervous system.

(5) Thus adrenal medulla and sympathetic nervous system functions as a closely integrated system.

11) Explain action of steroid hormones and proteinous hormones.

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

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

I. Steroid hormones :

1. The steroid hormones are lipid soluble and can easily cross the lipoproteinous plasma membrane.

2. The hormone receptors for steroid hormones are present in cytoplasm or in nucleus.

3. Hormone-receptor complex formed in cytoplasm enters the nucleus and regulate the gene expression function.

4. In some cases the receptors are present inside the nucleus where hormone receptor complex is formed.

5. These complexes interact with the genome to evoke blochemical changes that result in physiological and developmental functions.

II. Protein hormones :

1. The hormone receptors for protein hormones are present on the cell membrane (i.e. membrane bound receptors).

2. When the hormone binds to its receptor, it forms hormone-receptor complex Each receptor is specific to a specific hormone.

3. The hormones which interact with membrane bound receptors normally do not enter the target cell but generate second messengers. Such as cyclic AMP Ca++ or IP (Inositol triphosphate), etc.

4. This leads to certain biochemical changes in the target tissue.

5. Thus, the tissue consequently the physiological functions are regulated by hormones.

12) Describe in brief an account of disorders of the thyroid.

Ans. Disorders of thyroid gland are of three types, viz. hypothyroidism, hyperthyroidism and simple goitre.

(1) Hypothyroidism : Hypothyroidism is deficien secretion of thyroxine. This hyposecretion causes two types of disorders, viz. cretinism in children and myoxedema in adults.

(i) Cretinism: Hyposecretion of thyroxine in childhood causes cretinism. The symptoms of cretinism are retardation of physical and mental growth.

(ii) Myxoedema: Deficiency of thyroxine in adults causes this disorder. It is also referred to as Gull's disease. Symptoms are thickening and puffiness of the skin and subcutaneous tissue particularly of face and extremities. Patients with low BMR. It also causes mental dullness, loss of memory, slow action.

(2) Hyperthyroidism : Excessive secretion of thyroxine goitre or Grave's disease. There is slight enlargement of thyroid gland. It increases BMR, heart rate, pulse rate and BP. Reduction in body weight due to rapid oxidation, nervousness, irritability. Peculiar symptom is exophthalmos, i.e. bulging of eyeballs with staring look and less blinking. This is caused by deposition of fats behind the eye balls in eye sockets. There is muscular weakness and loss of weight.

(3) Simple goitre (Iodine deficiency goitre): Simple goitre occurs due to deficiency of iodine in diet or drinking water. Simple goitre causes enlargement of thyroid gland. Thyroid gland in an attempt to get more iodine from the blood, swells due to increased blood supply. Prevention of goitre can be done by administering iodized table salt. It is also called endemic goitre as it is common in hilly areas.