

UNIT-IV

* Endocrine System :-

- The endocrine system is the collection of glands that secrete hormones directly into the circulatory system to be carried to a distant target organ.
- The endocrine system consists of ductless glands which secrete hormones.
- Hormones regulate the metabolic process of the body.
- The secretion of hormones by other endocrine glands is mostly controlled by the pituitary gland. Hence, it is called the master gland of the body.
- Endocrinology is the branch of science that deals with the study of structure and functions of the endocrine glands, their disorders and their treatment.

* Hormones :-

- They are mediator molecules that are released in one part of the body but regulate the activity of cells in other parts of the body.
- They regulate important body processes and functions including ~~Growth~~ Growth, reproduction and metabolism.

★ Classification of hormones :-

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— Based on chemical nature, hormones are classified into three types.

① Steroid hormones

② Protein hormones

③ Derivatives of Amino acid Called Tyrosin.

① Steroid hormones :-

- Steroid hormones are the hormones synthesized from cholesterol or its derivatives.
- Steroid hormones are secreted by adrenal cortex, gonads and placenta.

② Protein hormones :-

- Protein hormones are large or small peptides.
- Protein hormones are secreted by pituitary gland, parathyroid gland, parathyroid glands, pancreas and placenta.

③ Derivatives of the amino acid Called Tyrosin :-

- Two type of hormones, namely Thyroid hormones and adrenal medullary hormones are derived from the amino acid tyrosin.

Example :-

- | | |
|------------------------------|----------------------------|
| — Thyroxine (T_4) | — Adrenaline (epinephrine) |
| — Triiodothyronine (T_3) | — Noradrenaline |
| | — Dopamine |



Steroids

- Aldosterone
- 11-deoxy corticosterone
- Cortisol
- Corticosterone
- Testosterone
- Estrogen
- progesterone

Proteins

- Growth hormone (GH)
- Thyroid-Stimulating hormone
- Adrenocorticotrophic hormone
- Follicle Stimulating hormone (FSH)
- Luteinizing hormone (LH)
- Antidiuretic hormone (ADH)
- oxytocin
- Calcitonin
- Insulin
- Colicagen

★ Mechanism of hormone Action:

- Hormone does not act on the target cell directly.
- It combines with receptor to form hormone-receptor complex.
- This complex executes the hormonal action by any one of the following mechanism.

① By Altering permeability of cell membrane:

- Neurotransmitters in synapse or neuromuscular junctions act by changing the permeability of postsynaptic membrane.

- For Example, in a neuromuscular junction when an impulse (action potential) reaches the axon terminal of motor nerve, acetylcholine is released from the vesicles.

② By Activating Intracellular Enzyme:-

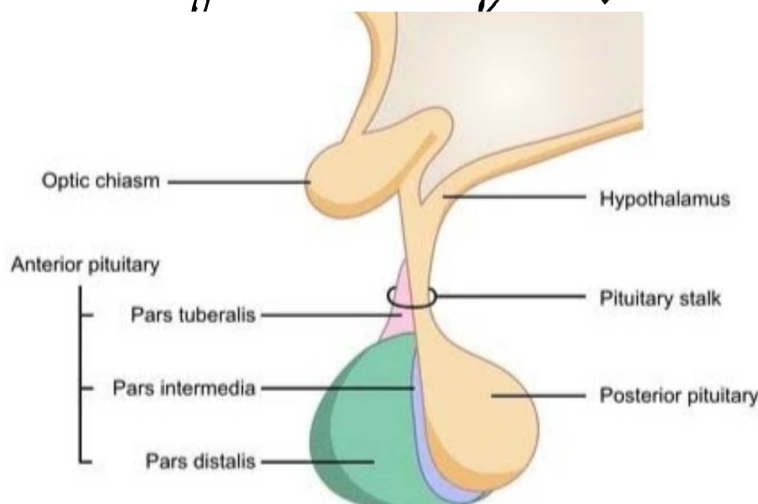
- Protein hormone and the catecholamines act by activating the intracellular enzyme.
- First Messenger: The hormone which acts on a target cell, is called first messenger or chemical mediator.
- It combine with receptor and forms hormone-receptor complex.
- Second messenger: Hormone-receptor complex activates the enzymes of the cell and causes the formation of another substance called the second messenger.

③ By Acting on Genes:-

- Thyroid and Steroid hormones execute their function by acting on genes in the target cells.

★ Pituitary Gland:

- It is also known as hypophysis, is a small endocrine gland.
- It is situated in a depression called 'sella Turca' present in the sphenoid bone at the base of skull.
- It is connected with the hypothalamus by a stalk like structure called infundibulum.
- Pituitary gland divide into two part:-
 - ① Anterior pituitary or Adenohypophysis
 - ② posterior pituitary or Neurohypophysis



① Anterior pituitary :

- Anterior pituitary is also known as the Master gland because it regulates many other endocrine glands through its hormones.

Parts —

- ① pars distalis
- ② pars tuberalis
- ③ pars intermedia.

② Posterior pituitary :-

- posterior pituitary does not synthesize hormones but it stores and release two hormones which are synthesized by the hypothalamus.
- The axon terminal is the posterior pituitary. are associated with specialized neuroglia called pituicytes.
- Parts - ① pars nervosa or infundibular process
② Neural stalk or infundibular stem.
③ median eminence.

Disorder of pituitary gland:-

1. Gigantism:-

- It is characterized by excess growth of the body.

2. Acromegaly:-

- It is the disorder characterized by the enlargement, thickening and broadening of bones, particularly in the extremities of the body.

③. Acromegalic Gigantism:-

- It is a rare disorder with symptoms of both gigantism and acromegaly.

★ Thyroid Gland :-

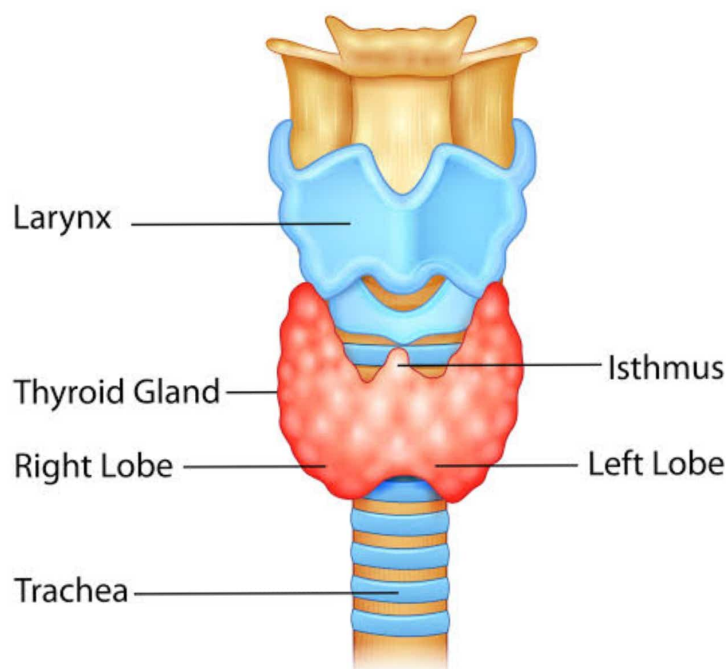
- Thyroid is an endocrine gland situated at the root of the neck on either side of the trachea.
- It has two lobes, which are connected in the middle by an isthmus.
- Thyroid is larger in females than in males.

Hormones of thyroid gland:-

Thyroid gland secretes three hormones.

1. Tetraiodothyronine or T_4 (Thyroxine)
2. Tri-iodothyronine or T_3
3. Calcitonin.

THYROID GLAND



Functions of thyroid Gland:-

- Increase in basal metabolic rate
- Effect on growth.
- T₃ and T₄ promote the physical growth in children
- It promotes growth and development of brain during fetal life.
- Effect on Carbohydrate, fat and protein metabolism.
- Thyroid hormone increase heart rate, Cardiac Contractility and Cardiac output.
- Effect on Central nervous System.

Disorder of thyroid gland:-

1. Hyperthyroidism:-

- Increased Secretion of thyroid hormone is called hyperthyroidism.

2. Hypothyroidism:-

- Decreased Secretions of thyroid hormone is called hypothyroidism.
- Hypothyroidism leads to Myxedema in adult and cretinism in children.

3. Goiter:-

- Goiter means enlargement of the thyroid gland
- It occurs both in hypothyroidism and hyperthyroidism.



★ Parathyroid gland:-

- Human beings have four parathyroid gland.
- They are situated on the posterior surface of upper and lower poles of thyroid gland.
- Parathyroid glands are very small in size with the dark brown color.
- Parathyroid gland have two type of cell.
1. Chief cell (2) Oxyphil cells
- The Chief cells secrete the parathyroid hormone (PTH)

Function of parathyroid gland:-

- PTH increase Calcium level of plasma and extracellular fluid.
- The effect of is produce by the parathyroid hormone following mechanism.
 - Mobilization of Calcium of bone into the extracellular.
 - Increase reabsorption of Calcium in the renal tubules.
 - Increase absorption of Calcium in the gastrointestinal tract.

Disorder of parathyroid gland:-

① Hypoparathyroidism - Hypocalcemia:-

- Hyposecretion of PTH is called hypoparathyroidism.
- It leads to hypocalcemia (↓ in blood Calcium level).

② Hyperparathyroidism - Hypercalcaemia:-

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- Hypersecretion of PTH is called hyperparathyroidism. This results in Hypercalcaemia.

* Adrenal Gland:-

- Adrenal glands are called the 'Life-Saving Glands' or 'Essential Endocrine Glands'.
- It is because the absence of adrenocortical hormones causes death within 3 to 15 days.
- Absence of adrenomedullary hormones drastically decreases the resistance to mental and physical stress.

Parts of Adrenal Gland:-

- Adrenal Cortex: Outer portion
- Adrenal medulla: Central portion

① Adrenal Cortex:-

Layers of Adrenal Cortex: three distinct layers.

- (i) Zona glomerulosa - an outer layer (Mineralocorticoids)
- (ii) Zona fasciculata - a middle layer (Glucocorticoids)
- (iii) Zona reticularis - an inner layer (Sex Steroids)

② Adrenal Medulla:-

- (i) Adrenaline
- (ii) Noradrenaline

Kataria Pharmacy

Function of Adrenaline :-

- Vasoconstriction and rise in blood pressure.
- Contraction of Splenic Capsule and release of RBC.
- Dilation of pupil
- Contraction of nictitating membrane in animals.
- Relaxation of the intestine

Disorder of Adrenal Gland:-

Hypersecretion of adrenocortical hormones leads to the following conditions.

1. Cushing Syndrome:-

- Cushing Syndrome is a disorder characterized by obesity.

2. Hyperaldosteronism:-

- Increased secretion of aldosterone is called hyperaldosteronism.

3. Adrenogenital Syndrome:-

- Secretion of abnormal quantities of adrenal androgen develops adrenogenital syndrome.

4. Pheochromocytoma:-

- It is a condition characterized by hypersecretion of catecholamines.

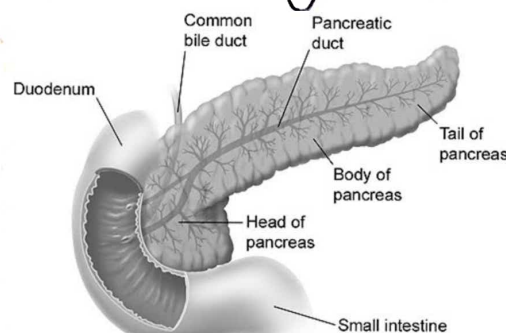
* Pancreas :-

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- It is a composite gland that acts as both exocrine and endocrine glands. Such glands are called heterocrine gland.
- The pancreas lies on the posterior abdominal wall in front of abdominal aorta and lumbar vertebrae.

Structure of pancreas :-

- The bulk of pancreas contains exocrine cells called acini. It secretes the pancreatic juice which is digestive in function.
- In between the acini, there are some endocrine cells called Islets of Langerhans.
- Islets of Langerhans contains two types of cells:
 - **Alpha Cells** : which secretes glucagon
 - **Beta cells** : secretes insulin



① Glucagon :-

- Increase in blood sugar level by mobilizing glycogen from liver.
- mobilization of stored fat
- Release of insulin from pancreas

① Insulin :-

- The important action of insulin is to decrease the level of glucose in blood. This effects are:
 - Increasing glycogen synthesis but preventing glycogen breakdown in the liver.
 - By preventing fresh synthesis of glucose.

Disorder of pancreas :-

① Hypoactivity - Diabetes Mellitus :-

Diabetes mellitus is a metabolic disorder characterized by high blood glucose level, associated with other manifestations.

Type I Diabetes Mellitus :-

- It is due to deficiency of insulin because of destruction of β -cells in islets of Langerhans.
- This type of diabetes mellitus may occur at any age of life.
- But, it usually occurs before 40 years of age.

Type II Diabetes Mellitus :-

- It is due to insulin resistance (failure of insulin receptor to give response to insulin). So the body is unable to use insulin.
- About 90% of diabetes patients have type-II diabetes mellitus. It usually occurs after 40 years.

② Hyperactivity - Hyperinsulinism :-

- Hyperinsulinism is the hypersecretion of insulin.
- Hyperinsulinism occurs due to the tumor of β -cells in the islets of Langerhans.

★ Pineal Gland.

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- Pineal gland or epiphysis is located in the diencephalic area of brain above the hypothalamus.
- It is a small cone shaped structure with a length of about 10 mm.
- Pineal gland has two types of cells
 - ① Large epithelial cells called parenchymal cells.
 - ② Neuroglial cells.

Functions :-

- ① It controls the sexual activities in animals by regulating the seasonal fertility.
- ② The pineal gland plays little role in regulating the sexual functions in human being.
- ③ It secretes the hormonal substance called Melatonin.

Disorder of pineal gland :-

① Alzheimer's disease (AD) -

- Common neurodegenerative disease.
- It is accompanied by Alteration to various lifestyle patterns, such as sleep disturbance.
- The pineal gland is the primary endocrine organ that secretes hormones, such as melatonin, and control the circadian rhythms.
- The decrease in pineal gland volumes and pineal calcification leads to the reduction of melatonin production.



A Thymus Gland:-

- Thymus is situated in front of trachea, below the thyroid gland.
- Thymus is small in newborn infants and gradually enlarges till puberty and then decrease in size.

Functions:-

- Thymus has lymphoid function and endocrine function.
- It plays an important role in development of immunity in the body.
- Thymus has two function.

① processing the T-Lymphocytes:-

Thymus plays an essential role in the development of immunity by processing the T lymphocytes.

② Endocrine function of thymus:-

① Thymosin

② Thymic.

Disorder of Thymus:-

① Myasthenia gravis:-

- It occurs when the thymus is abnormally large and produces antibodies that block or destroy the muscles' receptor sites.