

HUMAN ANATOMY & PHYSIOLOGY

UNIT 4

- ① Define Endocrine System and Classify Hormones also describe the mechanism of Hormone action?
- 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.
 - Hormone regulates the metabolic processes of the body.
 - The secretion of hormones by other endocrine glands is mostly controlled by pituitary gland. Hence it is called master gland of the body.
 - Endocrinology is the branch of science that deals with the study of structure and function of 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, reproduction and metabolism.

- Classification of Hormones
Based on the chemical nature, hormones are classified into three types -
 - ① Steroid hormone,
 - ② Protein hormone,
 - ③ Derivatives of the amino acid called Tyrosine.

- 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 glands, pancreas and placenta.

③ Derivatives of the amino acids called Tyrosine

Two types of hormones, namely thyroid hormone and adrenal medullary hormones are derived from the amino acid tyrosine.

• STEROIDS

- Ⓐ Aldosterone,
- Ⓑ 11-Deoxycorticosterone,
- Ⓒ Cortisol,
- Ⓓ Corticosterone,
- Ⓔ Testosterone,
- Ⓕ Dihydrotestosterone,
- Ⓖ Dihydroepiandrosterone,
- Ⓗ Estrogen,
- Ⓘ Androstenedione,
- Ⓝ Progesterone.

• PROTEIN

- Ⓐ Growth Hormone (GH)
- Ⓑ Thyroid Stimulating Hormones (TSH)
- Ⓒ Adrenocorticotropic Hormones (ACTH)
- Ⓓ Follicle-Stimulating Hormones (FSH)
- Ⓔ Luteinizing Hormones (LH)
- Ⓕ Prolactin (PRL)
- Ⓖ Antidiuretic Hormone (ADH)
- Ⓗ Oxytocin
- Ⓘ Parathormone
- Ⓝ Calcitonin
- Ⓖ Insulin
- Ⓗ Glucagon
- Ⓝ Somatostatin
- Ⓝ Human Chorionic Gonadotropin

• Derivatives of amino acids called Tyrosine

- Ⓐ Thyroxine (T₄)
- Ⓑ Triiodothyronine (T₃)
- Ⓒ Adrenaline [Epinephrine]
- Ⓓ Noradrenaline [Nor-epinephrine]
- Ⓔ Dopamine

• Mechanism of action of Hormones

- 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 anyone of the following mechanisms -
 - By altering permeability of Cell Membrane
 - By activating Intracellular Enzymes
 - By acting on Genes.

➔ By altering permeability of Cell membrane

- Neurotransmitter in Synapse or Neuromuscular junction act by changing the permeability of post synaptic membrane.
- For example, in a neuromuscular junction act by changing the permeability of postsynaptic membrane.
For example, in a neuromuscular junction, when an impulse reaches the axon terminal of the motor nerve, Acetylcholine is released from the vesicles.
- Acetylcholine increases the permeability of the post synaptic membrane for sodium, by opening the ligand-gated sodium channels.
- So sodium ions enter the neuromuscular junction from ECF through the channels and cause the development of Endplate potential.

➔ By activating Intracellular Enzymes

Protein Hormones and Catecholamines act by activating the intracellular enzymes.

- First messenger The hormone which acts on a target cell, is called first messenger or chemical mediator. It combines with the 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 or Intracellular Hormonal mediators.
- ③ By acting on Genes
- Thyroid and Steroid Hormones execute thier functions by acting on Genes in the Target Cells.
- Sequences of events during activation of Genes
- ① Hormone enters the Interior of Cell and binds with receptor in Cytoplasm [Steroid Hormone] or in nucleus [Thyroid Hormone] and forms Hormone receptor Complex.
 - ② Hormone receptor Complex moves towards the DNA and binds with DNA.
 - ③ This increases Transcription of mRNA.
 - ④ The mRNA move out of nucleus and reaches ribosomes and activates them.
 - ⑤ Activated Ribosomes produce large quantities of protiens.
 - ⑥ These protiens produce physiological responcees in the Target Cell.

2. MASTER GLAND

- It's also known as Hypophysis is a small endocrine system.
- It's situated in a depression called 'Sella Turcica' present in the sphenoid bone at the base of the skull.
- It's connected with the hypothalamus by a stalk like structure called the infundibulum.

⇒ Division of pituitary gland

There are two divisions of pituitary gland

- ① Anterior pituitary or Adenohypophysis.
- ② Posterior pituitary or Neurohypophysis.

• Anterior Pituitary

Anterior pituitary is also known as the Master Gland because it regulates many other endocrine glands through its hormone.

Anterior pituitary consist of 3 parts -

- ① Pars Distalis
- ② Pars Tuberalis
- ③ Pars Intermedia

→ Hormones secreted by Anterior pituitary and their function

- ① Growth Hormone - Important for normal growth and development of the body.
or Somatotrophic Hormones

2. Thyroid Stimulating Hormone [TSH] - Regulates the synthesis of Thyroid Hormone in Thyroid Gland.
Thyrotrophic Hormones

④ Explain Thyroid Disorders

- Thyroid is an Endocrine Glands Situated at the root of the neck on either Side of 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 Glands

Thyroid Gland Secretes Three Hormones :

- ① TetraiodoThyronine or T₄ [Thyroxine]
- ② Triiodothyronine or T₃
- ③ Calcitonin

→ Disorders of Thyroid Glands

① HYPERTHYROIDISM

Increase Secretion of Thyroid Hormones is Called Hyperthyroidism.

② HYPOTHYROIDISM

- Decreased Secretion of Thyroid Hormone is Called Hypothyroidism.
- Hypothyroidism leads to myxedema in adults and Cretinism in Children.

③ GOITER

- Goiter means enlargement of Thyroid Gland.
- It occurs both in Hypo → Hyperthyroidism.

⇒ Functions of Thyroid Gland

1. Increase in Basal Metabolic rate.
2. Effect on Growth

- ③ Effects on Carbohydrates, fat, protein and Metabolism.
- ④ Effects on Cardiovascular System.
- ⑤ Effects on CNS.
- ⑥ Action on Skeletal muscles
- ⑦ Action on GIT.

③ Define function and structure of Adrenal Gland and pineal Gland?

① **ADRENAL GLAND**

Adrenal Glands are called the life saving glands or essential endocrine glands. It's because the absence of adrenocortical hormone causes death within 3 to 15 days.

Absence of adrenomedullary hormones, drastically decreases the resistance to mental and physical stress.

• Parts of Adrenal Glands

- ① Adrenal Cortex [Outer portion]
- ② Adrenal Medulla [Central portion]

• Layers of Adrenal Cortex

- Zona Glomerulosa - An outer layer
- Zona Fasciculata - A middle layer
- Zona Reticularis - an inner layer

• Hormones of Adrenal Cortex

- ① Mineralo Corticoids
- ② Glucocorticoids
- ③ Sex Steroids

• Hormones of Adrenal Medulla

- ① Adrenaline
- ② Nor Adrenaline

- Functions of Adrenalin and Nor Adrenaline
- ① Vasoconstriction and rise in blood pressure,
- ② Contraction of Splenic Capsule and release of RBC.
- ③ Dilatation of pupil
- ④ Relaxation of Intestine
- ⑤ Erection of the Hair.

⑧ **PINEAL GLANDS**

- 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 13mm.

• Structure

Pineal Gland has two types of Cells -

1. Large epithelial Cells Called parenchymal Cells.
2. Neuroglial Cells.

• Function

- ① It Controls the sexual activities in animals by regulating the Seasonal fertility.
- ② The pineal Gland plays a little role in regulating the sexual functions in Human being.

③ It secretes the Hormonal Substance Called Melatonin.

- Alzheimer's Disease is the Disorder of pineal Gland.