NEUROENDOCRINE SYSTEM

- **GLAND**:- Definition and Types (exocrine gland and endocrine gland)
- **EXOCRINE GLAND**:- Definition, also known as ductile glands, examples.
- **ENDOCRINE GLAND**:- Definition, also known as ductless glands, examples.

HORMONES: definitions and examples

- It should be noted that hormonal influence upon behavior do not exist independently of the central nervous system. There is a close association between endocrine glands and the brain. So ,here comes the concept of **"NEUROENDOCRINE SYSTEM**".

- **NEUROENDOCRINE SYSTEM:-**

- Definition and Function
- Concept of neuroendocrine cells.

- **FUNCTIONS OF NEUROENDOCRINE SYSTEM**:-
- The interconnectivity and interdependency of nervous system and endocrine system in maintaining bodily functions and the state of internal equilibrium i.e., homeostasis.

- **Other functions of neuroendocrine cells are following**:

✓ Control the release of digestive enzyme to break down food.
✓ Control how fast food moves through the GI tract.
✓ Control the air and blood flow through lungs.
✓ Influences blood pressure and heart rate.
✓ Control the blood glucose level.
✓ Control Bone and muscle growth.
✓ Control sleep wake cycle.

THE MAJOR ENDOCRINE GLANDS UNDER STUDY, THEIR HORMONES AND GENERAL FUNCTIONS

GLAND	HORMONES	GENERAL FUNCTION
Thyroid	Thyroxin	Increases metabolism
Adrenal cortex	a. Glucocorticoids b. Mineral corticoids	Increases carbohydrate metabolism. Control of body minerals.
Adrenal medulla	a. epinephrine/ adrenaline. b. Norepinephrine/ noradrenalin.	Stimulates ACTH secretion. Increases sympathetic arousal.

GLAND	HORMONES	GENERAL FUNCTION
Anterior pituitary	a. Growth hormone. b. Thyrotropin. c. Adrenocorticotropic hormone(ACTH). d. Follicle stimulating hormone(FSH). e. Luteinizing hormone(LH). f. Prolactin.	a. Stimulation of growth. b. Stimulation of thyroid. c. Stimulation of adrenal cortex. d. Development of germ cells. e. Stimulation of sex hormone. f. Increases in milk production.
Posterior pituitary	a. vasopressin. b. Oxytocin.	a. Water control. b. Uterine contractions & increases in milk production.
Gonads	a. Estrogen(female). b. Androgen(male).	a. Primary/ secondary sex characteristics. b. Primary/ secondary sex characteristics.

Each gland can be studied with respect to the following points

- The site or location
- The physical structure
- Hormones released and their general functions
- Abnormalities of gland functions i.e.
- HYPER (over) and
- HYPO (under) secretion of those hormones

THE PITUITARY GLAND

- **LOCATION** Pituitary gland is located just below the pineal gland and hypothalamus.

- **STRUCTURE OF PITUITARY GLAND**:- shape, size, weight, structural division., concept of anterior and posterior pituitary.

- **PITUITARY AS MASTER GLAND**: The pituitary gland is frequently referred to as master gland because most of its hormones are tropic hormones, which influence the release of hormones from other glands.

- **RELEASED HORMONES WITH THEIR GENERAL FUNCTIONS**

ANTERIOR PITUITARY

- **Growth hormone - Stimulation of growth.**
- **Thyrotropin - Stimulation of thyroid.**
- **Adrenocorticotropic hormone(ACTH) - Stimulation of adrenal cortex.**
- **Follicle stimulating hormone(FSH)- Development of germ cells.**
- **Luteinizing hormone(LH) - Stimulation of sex hormone.**
- **Prolactin - Increases in milk production.**

POSTERIOR PITUITARY

Vasopressin - regulator of water balance in the body, also known as antidiuretic hormone(ADH).

Oxytocin - a. It stimulates the contractions of uterus during labor.
b. it helps to increase milk production after child birth.

- **ABNORMALITIES OF GROWTH HORMONE :**

HYPERSECRETION: 1.Gigantism.
2.Acromegali.

HYPOSECRETION: Pituitary Dwarfism.

- **ABNORMALITIES OF THYROTROPIN:**

HYPERSECRETION: Grave's disease.

HYPOSECRETION: Cretinism, Goiter

- **ABNORMALITIES OF ACTH:**

HYPERSECRETION: Cushing's syndrome.

HYPOSECRETION: Addison's disease.

- **ABNORMALITIES OF VASOPRESSIN:**

HYPOSECRETION: Diabetes insipidus.

THYROID GLAND

- **LOCATIONS:-** Thyroid gland lying on the sides of the throat about at the level of larynx.

- **STRUCTURE:-** It generally consists of two lobes which is connected by a strip of thyroid tissue, known as isthmus.

- **HORMONES OF THYROID GLAND**:- With the help of iodine, thyroid gland makes 3 hormones.

- **FUNCTIONS OF THYROID HORMONES**:-

A. Effect on BMR.
B. Effect on metabolism.
C. Effect on heart rate.
D. Effect on body growth.
E. Effect on heat regulations.
F. Effect on blood corpuscles
G. Effect on mammary gland.

ABNORMALITIES OF THYROID HORMONE:

1. **HYPOSECRETION:** Cretinism.
2. **HYPERSECRETION** :Grave's disease.

ADRENAL GLAND

- **LOCATION**:- It is located on the top of the kidney, within the renal fascia, thus it is referred to as suprarenal gland.

- **STRUCTURE**:- Adrenal glands are paired structures. The two parts of adrenal gland are:

  a. Adrenal cortex (external part) b. Adrenal medulla (inner part)

- **HORMONES OF ADRENAL CORTEX WITH THEIR FUNCTIONS**:-

A. GLUCOCORTICOIDS: Promote the conversion of stored protein and fat into glucose.
B. MINERALCORTICOIDS: Regulate levels of minerals in the body.
C. ANDROGENS: Helps in the development of gonads.
   Influence primary and secondary sex characteristics.

- **ABNORMALITIES OF THESE HORMONES:**

  HYPOSECRETION: Addison's disease.
  HYPERSECRETION: Cushing's syndrome.

- **HORMONES OF ADRENAL MEDULLA WITH THEIR FUNCTIONS:**

A. Epinephrine/adrenalin: Stimulate anterior pituitary to secret ACTH.
B. Nor epinephrine/ noradrenalin: increases sympathetic arousal.

GONADS

- **CLASSIFICATION OF GONADS**:

- MALE GONAD :testis.
- FEMALE GONAD ovaries.

- **LOCATION OF GONADS:**
- located behind the penis in a pouch of skin called the scrotum(MALE GONAD).
- they are located in the pelvis, one on each side of the uterus(FEMALE GONAD).

- **STRUCTURE OF GONADS:**
- Ovaries are oval shaped, pinkish-gray in color, Connected to the uterus by the fallopian tubes.
- Testes are oval organs about the size of large olives.

- **HORMONES RELEASED FROM GONADS WITH THEIR FUNCTIONS:**

1. **ANDROGEN**:-
- Testosterone plays most important role in the development of primary and secondary male sexual characteristics

- It influences the production of sperm cells.

- **ESTROGENS**:-
- It helps in the development of primary and secondary sex characteristics.
- It also initiates the development of ovum from ovary.
- It regulates menstrual cycle.

- **PROGESTERONE**:-
- It prepares the uterus for the possible reception of a fertilized ovum.
- It also helps in the production of placenta.
- It stimulates uterine contractions during labor.

THE HYPOTHALAMUS

- **LOCATION:** Hypothalamus is located just below the anterior thalamus.
- **STRUCTURE :** It is a small cone shaped structure that projects downward from the brain, ending in the pituitary stalk.
- **HYPOTHALAMUS AS A REGUALTOR:**
- Hypothalamus synthesizes and secrets certain neurohormones, which regulate the secretion of tropic hormones from anterior pituitary. Thus controlling the hormonal balance.

TABLE SHOWING HYPOTHALAMIC HORMONES AND THEIR FUNCTIONS:-

HYPOTHALAMIC HORMONES	INFLUENCES ON ANTERIOR PITUITARY
Corticotropin- releasing hormone(CRH)	Increases ACTH level
Thyrotropin- releasing hormone(TRH)	Increases thyrotropin level.
Growth hormone releasing hormone(GRH)	Increases growth hormone level.
Somatostatin (growth hormone release inhibiting hormone GIH)	Reduce growth hormone level
FSH releasing hormone	Increases FSH level
LH releasing hormone	Increases LH level
Prolacting releasing hormone	Increase prolactin levels

Concept of HPA AXIS