

BIOLOGY

SHORT STUDY NOTES

ENDOCRINE SYSTEM

CLASS 11

BY LEARNINGMANTRAS.COM

Endocrine System

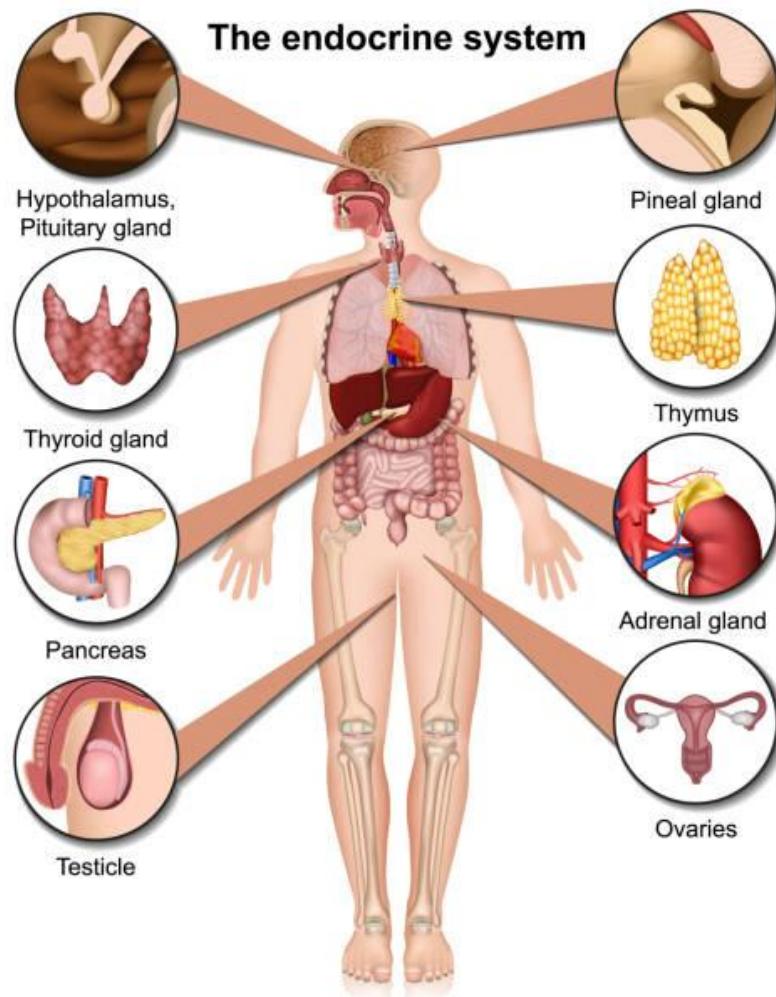
An endocrine system is a group of ductless glands where the secretory cells diffuse the hormones directly into the bloodstream. The endocrine system acts through chemical messengers called hormones that influence growth, development, and metabolic activities. The action of the endocrine system is measured in minutes, hours, or weeks and is more generalized than the action of the nervous system.

- The glands of the endocrine system are termed endocrine glands and are defined by the lack of ducts for the passage of their secretions.
- The endocrine system is considered to work together in coordination with the nervous system.
- The endocrine system also depends on the cardiovascular system for the distribution of their products. As a result, the endocrine glands are some of the most vascular tissues in the body.
- The hormones secreted by endocrine glands are effective in very small amounts; thus, the circulating levels of these hormones are typically low.

Functions of Endocrine System

- The most important function of the endocrine system is to maintain the homeostasis of the body in order to ensure that the biochemical processes of different organs operate in a stable setting.
- The hormones of the endocrine system are responsible for balancing the growth and differentiation of the body cells in order to enable the development of the individual.
- The endocrine system also enhances the ability of the body to respond to different stressful internal and external factors.
- Since the endocrine system consists of the reproductive organs of the body, these are essential for the development of reproductive behavior in individuals.
- The endocrine system also performs different integrative functions of balancing the functions of different systems.
- Endocrine glands like the thyroid gland are essential for the proper working of different metabolic processes.
- The endocrine system remains in a close association with the nervous system and thus helps in maintaining a balanced relationship.

Glands of Endocrine System



Hypothalamus & Pituitary Gland

- The hypothalamus is a small organ situated in the brain below the thalamus, which controls the secretion of the pituitary gland.
- The hypothalamus is attached to the pituitary gland by a small stalk called the infundibulum, and it is considered the connecting link between the endocrine system and the nervous system.
- The cells of the hypothalamus alone secrete about nine different hormones, out of which seven hormones are involved in the regulation of the pituitary gland.
- The hormones produced in the hypothalamus are termed inhibiting or releasing hormones.
- The pituitary gland is a small pea-shaped organ measuring about 1-1.5 cm in diameter, which occurs in the hypophyseal fossa of the sphenoid bone in the skull.
- The pituitary gland can be differentiated into two anatomically and functionally separate parts; anterior pituitary and posterior pituitary.
- The anterior pituitary, also called adenohypophysis, is composed of epithelial cells and accounts for about 70% of the total pituitary gland.

- The anterior pituitary is supplied with a portal system that ensures the circulation of hormones produced by the gland.
- The secretion of the anterior pituitary is influenced by the releasing hormone produced by the hypothalamus.
- The posterior pituitary is composed of neural tissue, which is triggered by an action potential that originates in the cell body of the hypothalamus.
- The hormones of the posterior pituitary are synthesized in the nerve cell bodies and are transported along the axons to be stored in the axon terminals. The nerve stimuli from the hypothalamus regulate exocytosis of the vesicles to release the hormones into the bloodstream.
- The overall secretion of hormones by the pituitary is regulated by a negative feedback mechanism.

Some of the important hormones of the hypothalamus and pituitary gland are:

- **Growth Hormone:** It is the most abundant hormone secreted by the anterior pituitary that stimulates the growth of body cells.
- **Thyroid-stimulating hormone:** The thyroid-stimulating hormone stimulates the growth and activity of thyroid hormone, which itself is stimulated by the thyrotropin releasing hormone from the hypothalamus. Thyroid-stimulating hormone is responsible for the regulation of the secretion of thyroid hormones, thyroxine (T4) and tri-iodothyronine (T3).
- **Adrenocorticotrophic hormone:** It influences the adrenal cortex, which releases steroid hormones like cortisol.
- **Prolactin:** Prolactin is a hormone secreted during pregnancy that stimulates the mammary glands to produce milk.
- **Gonadotrophin:** Gonadotrophins are also known as sex hormones. The sex hormones in males and females that are involved in the proper functioning of the reproductive system are follicle-stimulating hormone and luteinizing hormone.
- **Oxytocin:** Oxytocin is released by the pituitary during childbirth as these affect the uterine smooth muscles and the muscles of the lactating breasts. Oxytocin is released by the posterior pituitary during childbirth to stimulate the sensory stretch receptors of the uterine cervix.
- **Antidiuretic Hormone (ADH):** Antidiuretic hormone or vasopressin is released by the posterior pituitary and is involved in the regulation of urine output. The release of ADH is regulated by the osmotic pressure of the blood circulating and the osmoreceptors in the hypothalamus.

Thyroid Gland

- The thyroid glands can be found at the front of the neck.
- The two lobes of the gland are connected by a narrow piece of tissue called the isthmus.
- It sits low in the throat, between the windpipe. Brownish red, it has blood vessels coursing through it.
- The thyroid gland is the only endocrine gland that can store large quantities of its secretory products, lasting up to 100 days.
- Thyroxine and tri-iodothyronine are the two hormones secreted by the thyroid hormone in response to the thyroid-stimulating hormone secreted by the pituitary gland.
- The most prominent are T₃ and T₄, which influence the body's rate of metabolism.

Parathyroid Gland

- Parathyroid glands occur as four small glands embedded in the posterior side of either lobe of the thyroid gland.
- All four glands function as a unit producing parathyroid hormone (PTH) that targets the cells of the bones and kidneys.
- The primary function of the hormone is to regulate the levels of calcium, magnesium, and phosphates in the blood.

Thymus

- The thymus is a lymphoid organ that is present in the crest between the lungs and is involved in the synthesis of white blood cells.
- The thymus gland is distinct from other endocrine glands in that it is active only before puberty. The gland grows the largest at puberty, after which the gland is slowly replaced by adipose tissue.
- The thymus gland is a critical organ of the immune system as it serves as a defense mechanism against different pathogens, tumors, and antigens.
- The blood supply to the thymus gland is provided by the inferior thyroid, internal thyroid, and intercostals arteries.
- Thymosin is the most important hormone produced by the thymus gland, which influences the immune response as well as stimulates the secretion of the pituitary gland.

Adrenal Gland

- Adrenal glands occur at the upper surface of each kidney which can be further divided into two distinct parts with different structures and functions.
- The glands occur as flattened structures with a crescent moon shape, and the size varies with the age and physiological condition of the person.
- In other words, this is also known as stress hormones.

Pancreas

- The pancreas is exocrine as well as an endocrine gland that sits behind the stomach.
- It is roughly 6 inches long and rather flat.
- The pancreatic islets consist of three different types of cells; α cells, β cells, and δ cells.
- The hormone glucagon is produced by α cells of the pancreas and it helps the body to prevent the glucose levels from dropping too low.
- Insulin is produced by the β cells in the pancreas and it helps in regulating the blood glucose levels in the body from getting too high.

Pineal Gland

- The pineal gland is located between the two halves of the brain.
- It produces a hormone known as melatonin which influences the body's internal clock.
- Melatonin is the primary hormone secreted by the pineal gland, which is regulated by daylight and darkness.

Gonads

- The gonads, the primary reproductive organs, are the testes in the male and the ovaries in the female.
- These organs are responsible for producing the sperm and ova, but they also secrete hormones and are considered to be endocrine glands.
 - **Testes:** Male sex hormones, as a group, are called androgens. The principal androgen is testosterone, which is secreted by the testes. A small amount is also produced by the adrenal cortex. Production of testosterone begins during fetal development, continues for a short time after birth, nearly ceases during childhood, and then resumes at puberty. This steroid hormone is responsible for:
 - The growth and development of the male reproductive structures
 - Increased skeletal and muscular growth
 - Enlargement of the larynx accompanied by voice changes
 - Growth and distribution of body hair
 - Increased male sexual drive
 - **Ovaries:** Two groups of female sex hormones are produced in the ovaries, the estrogens and progesterone. These steroid hormones contribute to the development and function of the female reproductive organs and sex characteristics. At the onset of puberty, estrogens promotes:
 - The development of the breasts
 - Distribution of fat evidenced in the hips, legs, and breast
 - Maturation of reproductive organs such as the uterus and vagina

Endocrine System Disorders

- **Acromegaly:** Sometimes the pituitary gland makes too much growth hormone and your bones get bigger. It usually affects your hands, feet, and face. It usually starts in middle age.
- **Adrenal insufficiency:** When you have this, your adrenal glands don't make enough of certain hormones, like cortisol, which controls stress.
- **Cushing's disease:** In this, your body makes too much cortisol. You could gain weight, get stretch marks, bruise easily at first, then get weakened muscles and bones and possibly develop a hump on your upper back.
- **Hyperthyroidism:** This is when your thyroid gland makes more hormones than your body needs. You might hear it called overactive thyroid. It makes your system run fast and you might feel nervous, lose weight, and have a rapid heartbeat or trouble sleeping.
- **Hypothyroidism:** When your body doesn't make enough thyroid hormone, your system slows down. You might feel tired, gain weight, have a slow heartbeat, and get joint and muscle pains.

- **Hypopituitarism:** Sometimes your pituitary gland doesn't make enough of certain hormones and your adrenal and thyroid glands can't work right.
- **Multiple endocrine neoplasia:** This is a group of disorders that affect your endocrine system. It causes tumors on at least two endocrine glands or in other organs and tissues.
- **Polycystic ovary syndrome:** An imbalance of reproductive hormones can cause your ovaries to either not make an egg or not release it during ovulation. This can throw off your periods, cause acne, and make hair grow on your face or chin.
- **Precocious puberty:** When glands that control reproduction don't work properly, some kids start puberty abnormally early - around 8 in girls and 9 in boys.

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