ENDOCRINE SYSTEM

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Among the various systems in our body, the endocrine system acts as chemical messenger system comprising feedback loops of the hormones released by internal glands of an organism directly into the circulatory system, regulating distant target organs.

The endocrine system is the collection of glands that produce hormones that regulate metabolism, growth and development, tissue function, sexual function, reproduction, sleep, and mood, among other things.

Endocrine glands

The endocrine system can be differentiated to both exocrine glands, which secrete hormones to the outside of the body, and paracrine signalling between cells over a relatively short distance. Endocrine glands have no ducts, are vascular, and commonly have intracellular vacuoles or granules that store their hormones.

Endocrine glands secrete their products, hormones, directly into interstitial spaces and then absorbed into blood rather than through a duct. Some of the major endocrine glands (Fig. 1 and Table 1) in the body include:

1. Pituitary gland
2. Thyroid
3. Parathyroid
4. Thymus
5. Adrenal glands
6. Pancreas
7. Testes
8. Ovaries
9. Pineal gland

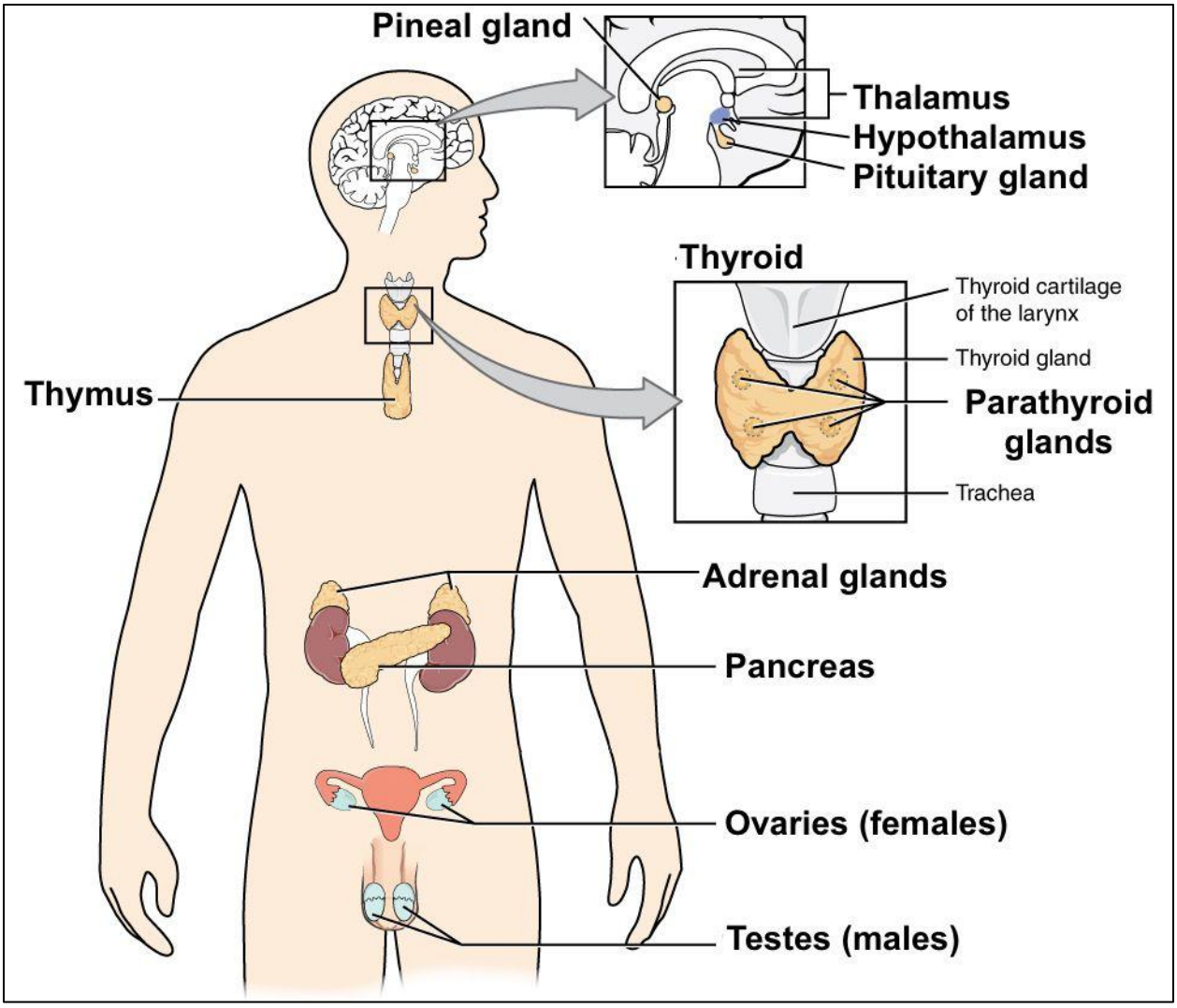

Fig. 1. Endocrine system in human

Hormones

Hormones are chemical messengers that are secreted directly into the blood, which carries them to organs and tissues of the body to exert their functions. There are many types of hormones that act on different aspects of bodily functions and processes. Some of these include:

- Development and growth
- Metabolism of food items
- Sexual function and reproductive growth and health
- Cognitive function and mood
- Maintenance of body temperature and thirst
- Endocrine glands and hormones

Hormones are secreted from the endocrine glands in the body. The glands are ductless, so hormones are secreted directly into the blood stream rather than by way of ducts.

These organs secrete hormone in microscopic amounts and it takes only very small amounts to bring about major changes in the body. Even a very slight excess of hormone secretion can lead to disease states, as can the slightest deficiency in a hormone.

Table 1. Various endocrine glands- hormones, chemical nature and functions

Endocrine gland	Hormone	Chemical nature	Functions
Anterior Pituitary/ Adenohypophysis	Growth hormone (GH)	Peptide	It promotes growth of the entire body by affecting protein formation, cell multiplication, and cell differentiation.
	Adrenocortico stimulating hormone (ACTH)	Peptide	It controls the secretion of some of the adrenocortical hormones, which affect metabolism of glucose, proteins, and fats.
	Thyroid stimulating hormone (TSH)	Peptide	It controls the secretion rate of thyroxine and triiodothyronine by the thyroid gland, and these hormones control the rates of most intracellular chemical reactions in the body.
	Follicle stimulating hormone (FSH)	Peptide	It controls the production of eggs and sperm.
	Luteinizing hormone (LH)	Peptide	It controls estrogen and testosterone production as well as ovulation.
	Prolactin	Peptide	It promotes mammary gland development and milk production.
Posterior Pituitary/ Neurohypophysis	Oxytocin	Peptide	It helps express milk from the glands and helps in the delivery of the baby at the end of gestation.
	Antidiuretic hormone (ADH)/ Vasopressin (AVP)	Peptide	It controls the rate of water excretion into the urine, thus helping to control the concentration of water in the body fluids.
Thyroid gland	Triiodothyronine (T3)	Amine	T3 helps maintain muscle control, brain function and development, heart and digestive functions. It also plays a role in the body's metabolic rate and the maintenance of bone health.
	Thyroxine (T4)	Amine	It is the main hormone secreted into the

			bloodstream by the thyroid gland. It plays vital roles in digestion, heart and muscle function, brain development and maintenance of bones.
	Calcitonin	Peptide	It promotes deposition of calcium in the bones and decreases extracellular fluid calcium ion concentration
Parathyroid gland	Parathyroid hormone (PTH)	Peptide	It controls serum calcium ion concentration by increasing calcium absorption by the gut and kidneys and releasing calcium from bones
Thymus gland	Thymosin	Peptide	It stimulates the maturation of T cells, which are derivatives of white blood cells that circulate our system.
Pancreas (Islets of Langerhans)	Insulin	Peptide	It promotes glucose entry in many cells, and in this way controls carbohydrate metabolism
	Glucagon	Peptide	It increases synthesis and release of glucose from the liver into the body fluids
Adrenal cortex	Cortisol (glucocorticoid)	Steroid	It has multiple metabolic functions for controlling metabolism of proteins, carbohydrates, and fats; also has anti-inflammatory effects
	Aldosterone (mineralocorticoid)	Steroid	It increases renal sodium reabsorption, potassium secretion, and hydrogen ion secretion
Adrenal medulla	Epinephrine	Amine	Epinephrine typically is released during acute stress, and its stimulatory effects fortify and prepare an individual for either “fight or flight” It functions primarily to increase cardiac output and to raise glucose levels in the blood.
	Norepinephrine	Amine	It acts to increase the force of skeletal muscle contraction and the rate and force of contraction of the heart. The actions of norepinephrine are vital to the fight-or-flight response, whereby the body prepares to react to or retreat from an acute threat.
Testes gland	Testosterone	Steroid	It promotes development of male reproductive system and male secondary sexual characteristics
	Estrogen	Steroid	It promotes growth and development of female reproductive system, female

Ovary gland			breasts, and female secondary sexual characteristics
	Progesterone	Steroid	It stimulates secretion of “uterine milk” by the uterine endometrial glands and promotes development of secretory apparatus of breasts
Pineal gland	Melatonin	Amine	It plays a central role in the regulation of circadian rhythm (the roughly 24-hour cycle of biological activities associated with natural periods of light and darkness).

References

Guyton, Arthur C and John E. Hall, 1998. Textbook of Medical Physiology, Ninth Edition, W.B. Saunders Company.