

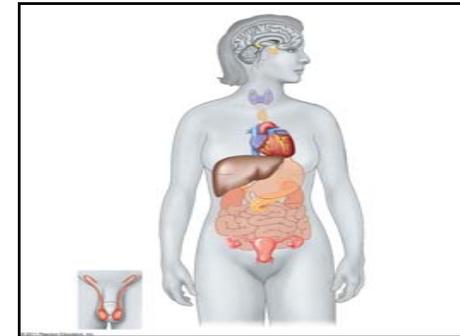


**Endocrine & Cell Communication Part II:
The Endocrine System**



Endocrine System

- The human endocrine system is composed of a collection of glands that secrete a variety of hormones.
- These chemicals use long distance communication to control the daily functioning of the cells of the body.

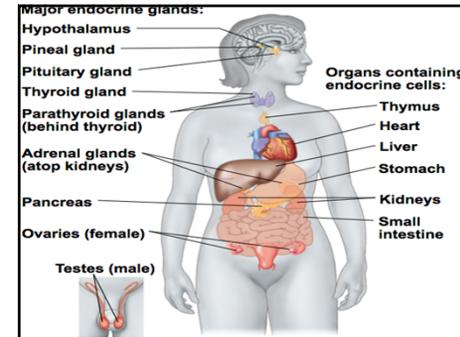
AP Biology Curriculum Frameworks

- EK 3.D.1 Cell communication processes share common features:
 - d. In multicellular organisms, signal transduction pathways coordinate the activities within individual cells.
- EK 3D.2 Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.
 - c. Signals released by one cell type can travel long distances to target cells of another cell type.
 - 1. Endocrine signals are produced by endocrine cells that release signaling molecules, which are specific and can travel long distances through the blood to reach all parts of the body.



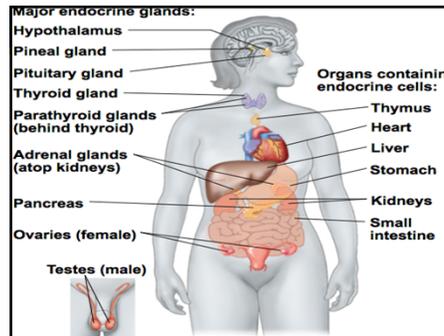
Endocrine System

- The endocrine system produces more than 30 different chemicals used by your body to maintain homeostasis and promote normal body function.
- This system contains 9 primary glands as well as endocrine cells found within major organs.
- The endocrine system is a ductless system that employs the circulatory system when delivering chemical signals over long distances.

To trust or not to trust? Ask Oxytocin

- Some people trust others easily while others require additional time to decide if a person is trustworthy.
- A recent article in Scientific American indicates that the hormone **oxytocin** known for its role in social attachment and interaction may also play an important role in our ability to trust.

The Endocrine System works with the Nervous System

- Two systems coordinate communication throughout the body: the endocrine system and the nervous system.
- The endocrine system secretes hormones that coordinate slower but longer-acting responses including reproduction, development, energy, metabolism, growth, and behavior.
- The nervous system conveys high-speed electrical signals along specialized cells called neurons; these signals regulate other cells.



Coordination of Endocrine and Nervous Systems in Vertebrates

- The **hypothalamus** receives information from the nervous system and initiates responses through the endocrine system.
- Attached to the hypothalamus is the **pituitary gland**, composed of the anterior pituitary and the posterior pituitary.
- The **anterior pituitary** makes and releases hormones under regulation of the hypothalamus.
- The **posterior pituitary** stores and secretes hormones that are made in the hypothalamus.

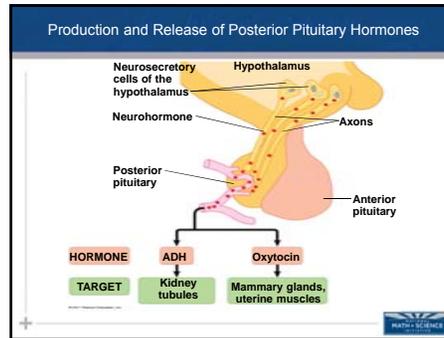
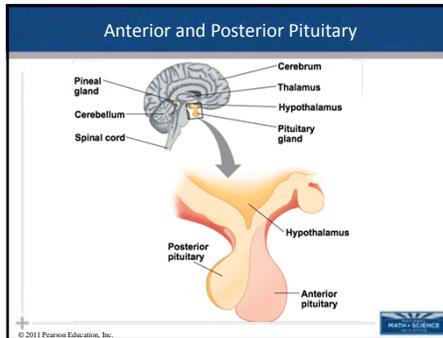


Table 45.1 Major Human Endocrine Glands and Some of Their Hormones

Gland	Hormone	Chemical Class	Representative Actions	Regulated By
Hypothalamus	Hormones released from the posterior pituitary and hormones that regulate the anterior pituitary (see below)			
Posterior pituitary gland (stores neurohormones made in hypothalamus)	Oxytocin	Peptide	Stimulates contraction of uterus and mammary gland cells	Nervous system
	Antidiuretic hormone (ADH)	Peptide	Promotes retention of water by kidneys	Water/salt balance
Anterior pituitary gland	Growth hormone (GH)	Protein	Stimulates growth (especially bones) and metabolic functions	Hypothalamic hormones
	Prolactin	Protein	Stimulates milk production and ejection	Hypothalamic hormones
	Follicle-stimulating hormone (FSH)	Glycoprotein	Stimulates production of sex and germ cells	Hypothalamic hormones
	Luteinizing hormone (LH)	Glycoprotein	Stimulates ovaries and testes	Hypothalamic hormones
	Thyroid-stimulating hormone (TSH)	Glycoprotein	Stimulates thyroid gland	Hypothalamic hormones
	Adrenocorticotropic hormone (ACTH)	Peptide	Stimulates adrenal cortex to secrete glucocorticoids	Hypothalamic hormones
Thyroid gland	Thyroxine (T ₄) and triiodothyronine (T ₃)	Amino acids	Stimulate and maintain metabolic processes	Type
Parathyroid glands	Calcitonin	Peptide	Lowers blood calcium level	Calcium in blood
	Parathyroid hormone (PTH)	Peptide	Raises blood calcium level	Calcium in blood



Anterior Pituitary Hormones

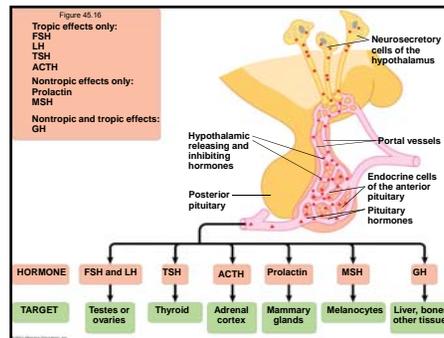
- Hormone production in the anterior pituitary is controlled by releasing and inhibiting hormones from the hypothalamus.
- For example, prolactin-releasing hormone from the hypothalamus stimulates the anterior pituitary to secrete **prolactin (PRL)**, which has a role in milk production and secretion.
- Another example is **Thyroid Stimulating Hormone (TSH)**, which stimulates the thyroid gland to produce thyroxine which stimulates and maintains metabolic processes.

Table 45.1 Major Human Endocrine Glands and Some of Their Hormones (continued)

Gland	Hormone	Chemical Class	Representative Actions	Regulated By
Pancreas	Insulin	Protein	Lowers blood glucose level	Glucose in blood
	Glucagon	Protein	Raises blood glucose level	Glucose in blood
Adrenal glands				
Adrenal medulla	Epinephrine and norepinephrine	Amines	Raise blood glucose level; increase metabolic activities; constrict certain blood vessels	Nervous system
Adrenal cortex	Glucocorticoids	Steroids	Raise blood glucose level	ACTH
	Mineralocorticoids	Steroids	Promote reabsorption of Na ⁺ and excretion of K ⁺ in kidneys	K ⁺ in blood, angiotensin II
Gonads				
Testes	Androgens	Steroids	Support sperm formation; promote development and maintenance of male secondary sex characteristics	FSH and LH
Ovaries	Estrogens	Steroids	Stimulate uterine lining growth; promote development and maintenance of female secondary sex characteristics	FSH and LH
	Progesterone	Steroids	Promote uterine lining growth	FSH and LH
Pineal gland	Melatonin	Amine	Involved in biological rhythms	Light/dark cycles

Posterior Pituitary Hormones

- The two hormones released from the posterior pituitary act directly on nonendocrine tissues.
 - Oxytocin** regulates milk secretion by the mammary glands and stimulates contraction of the uterus.
 - Antidiuretic hormone (ADH)** promotes retention of water by the kidneys.



Thyroid Regulation: A Hormone Cascade Pathway

- A hormone can stimulate the release of a series of other hormones, the last of which activates a *nonendocrine* target cell; this is called a hormone cascade pathway.
- The release of thyroid hormone results from a hormone cascade pathway involving the hypothalamus, anterior pituitary, and thyroid gland.
- Hormone cascade pathways typically involve negative feedback.

An Example of Negative Feedback

The Hypothalamic-Pituitary-Endocrine Axis

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MATH + SCIENCE INITIATIVE

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