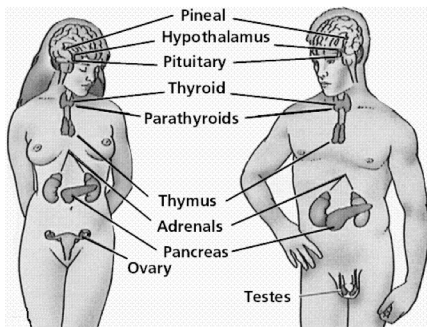
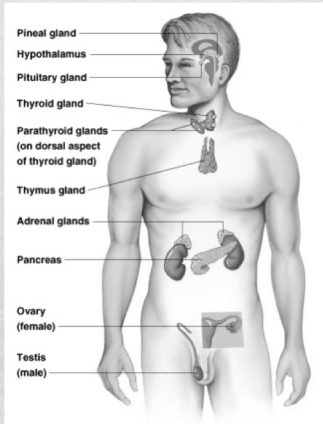


The Endocrine System



Endocrine System

- ♦ The endocrine system is a collection of glands that secrete hormones directly into the circulatory system to be carried toward a distant target organ. These hormones will be received by specific receptors on the target cells in the organism. The major endocrine glands include the pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland, hypothalamus, and adrenal glands.



The Endocrine System

- ♦ Second messenger system of the body
- ♦ Uses chemical messages (hormones) that are released into the blood from glands
- ♦ Hormones control several major processes
 - ♦ Reproduction
 - ♦ Growth and development
 - ♦ Mobilization of body defenses
 - ♦ Maintenance of much of homeostasis
 - ♦ Regulation of metabolism

Hormone Overview

- ♦ Hormones are produced by specialized cells
- ♦ Cells secrete hormones into extracellular fluids
- ♦ Blood transfers hormones to target sites
- ♦ These hormones regulate the activity of other cells

The Chemistry of Hormones

- ♦ Amino acid-based hormones
 - ♦ Proteins
 - ♦ Peptides
 - ♦ Amines
- ♦ Steroids – made from cholesterol
- ♦ Prostaglandins – made from highly active lipids

Mechanisms of Hormone Action

- ♦ Hormones affect only certain tissues or organs (target cells or organs)
- ♦ Target cells must have specific protein receptors
- ♦ Hormone binding influences the working of the cells

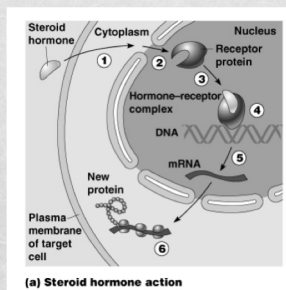
Effects Caused by Hormones

- ♦ Changes in plasma membrane permeability or electrical state
- ♦ Synthesis of proteins, such as enzymes
- ♦ Activation or inactivation of enzymes
- ♦ Stimulation of mitosis

Steroid Hormone Action

- ♦ Diffuse through the plasma membrane of target cells
- ♦ Enter the nucleus
- ♦ Bind to a specific protein within the nucleus
- ♦ Bind to specific sites on the cell's DNA
- ♦ Activate genes that result in synthesis of new proteins

Steroid Hormone Action



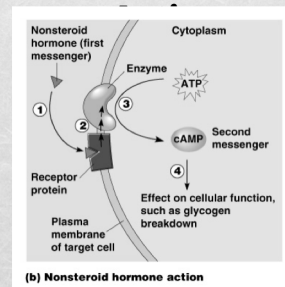
PRESS TO PLAY STEROID HORMONE ANIMATION

Figure 9.1a

Nonsteroid Hormone Action

- ♦ Hormone binds to a membrane receptor
- ♦ Hormone does not enter the cell
- ♦ Sets off a series of reactions that activates an enzyme
- ♦ Catalyzes a reaction that produces a second messenger molecule
- ♦ Oversees additional intracellular changes to promote a specific response

Nonsteroid Hormone



PRESS TO PLAY NONSTEROID HORMONE ANIMATION

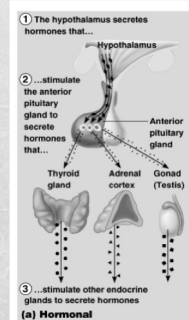
Figure 9.1b

Control of Hormone Release

- ◆ Hormone levels in the blood are maintained by negative feedback
- ◆ A stimulus or low hormone levels in the blood triggers the release of more hormone
- ◆ Hormone release stops once an appropriate level in the blood is reached

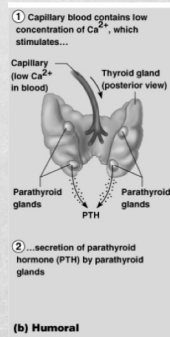
Hormonal Stimuli of Endocrine Glands

- ◆ Endocrine glands are activated by other hormones



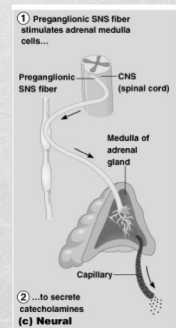
Humoral Stimuli of Endocrine Glands

- ◆ Changing blood levels of certain ions stimulate hormone release



Neural Stimuli of Endocrine Glands

- ◆ Nerve impulses stimulate hormone release
- ◆ Most are under control of the sympathetic nervous system



Location of Major Endocrine

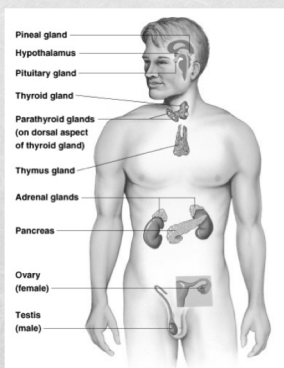


Figure 9.3

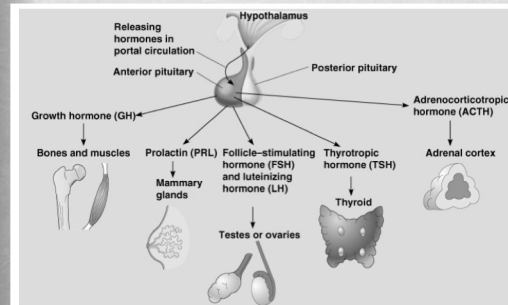
Pituitary Gland

- ◆ Size of a pea
- ◆ Hangs by a stalk from the hypothalamus
- ◆ Protected by the sphenoid bone
- ◆ Has two functional lobes
 - ◆ Anterior pituitary – glandular tissue
 - ◆ Posterior pituitary – nervous tissue

Hormones of the Anterior Pituitary

- ♦ Six anterior pituitary hormones
- ♦ Two affect non-endocrine targets
- ♦ Four stimulate other endocrine glands (tropic hormones)
- ♦ Characteristics of all anterior pituitary hormones
 - ♦ Proteins (or peptides)
 - ♦ Act through second-messenger systems
 - ♦ Regulated by hormonal stimuli, mostly negative feedback

Hormones of the Anterior Pituitary



Growth Hormone (GH)

- ♦ General metabolic hormone
- ♦ Major effects are directed to growth of skeletal muscles and long bones
- ♦ Causes amino acids to be built into proteins
- ♦ Causes fats to be broken down for a source of energy

Functions of Other Anterior Pituitary Hormones

- ♦ Prolactin (PRL)
 - ♦ Stimulates and maintains milk production following childbirth
 - ♦ Function in males is unknown
- ♦ Adrenocorticotropic hormone (ACTH)
 - ♦ Regulates endocrine activity of the adrenal cortex to release cortisol in times of stress.
- ♦ Thyroid-stimulating hormone (TSH)
 - ♦ Influences growth and activity of the thyroid

Functions of Other Anterior Pituitary Hormones

- ♦ Gonadotropic hormones
 - ♦ Regulate hormonal activity of the gonads
 - ♦ Follicle-stimulating hormone (FSH)
 - ♦ Stimulates follicle development in ovaries
 - ♦ Stimulates sperm development in testes

Functions of Other Anterior Pituitary Hormones

- ♦ Gonadotropic hormones (continued)
 - ♦ Luteinizing hormone (LH)
 - ♦ Triggers ovulation
 - ♦ Causes ruptured follicle to become the corpus luteum
 - ♦ Stimulates testosterone production in males
 - ♦ Referred to as interstitial cell-stimulating hormone (ICSH)

Pituitary - Hypothalamus Relationship

- ♦ Release of hormones is controlled by releasing and inhibiting hormones produced by the hypothalamus
- ♦ Hypothalamus produces two hormones that are transported to neurosecretory cells of the posterior pituitary
- ♦ The posterior pituitary is not strictly an endocrine gland, but does release hormones

Hormones of the Posterior Pituitary

- ♦ Oxytocin
 - ♦ Stimulates contractions of the uterus during labor
 - ♦ Causes milk ejection
- ♦ Antidiuretic hormone (ADH)
 - ♦ Can inhibit urine production
 - ♦ In large amounts, causes vasoconstriction leading to increased blood pressure (vasopressin)

Hormones of the Posterior Pituitary

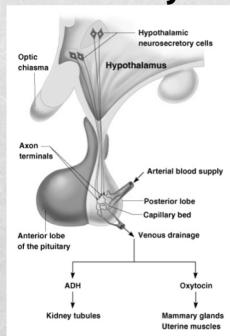


Figure 9.5