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PART A

The Endocrine System

PowerPoint® Lecture Slide Presentation by Jerry L. Cook, Sam Houston University



ESSENTIALS OF HUMAN ANATOMY & PHYSIOLOGY

EIGHTH EDITION

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The Endocrine System

- Second messenger system of the body
- Uses chemical messages (hormones) that are released into the blood
- 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

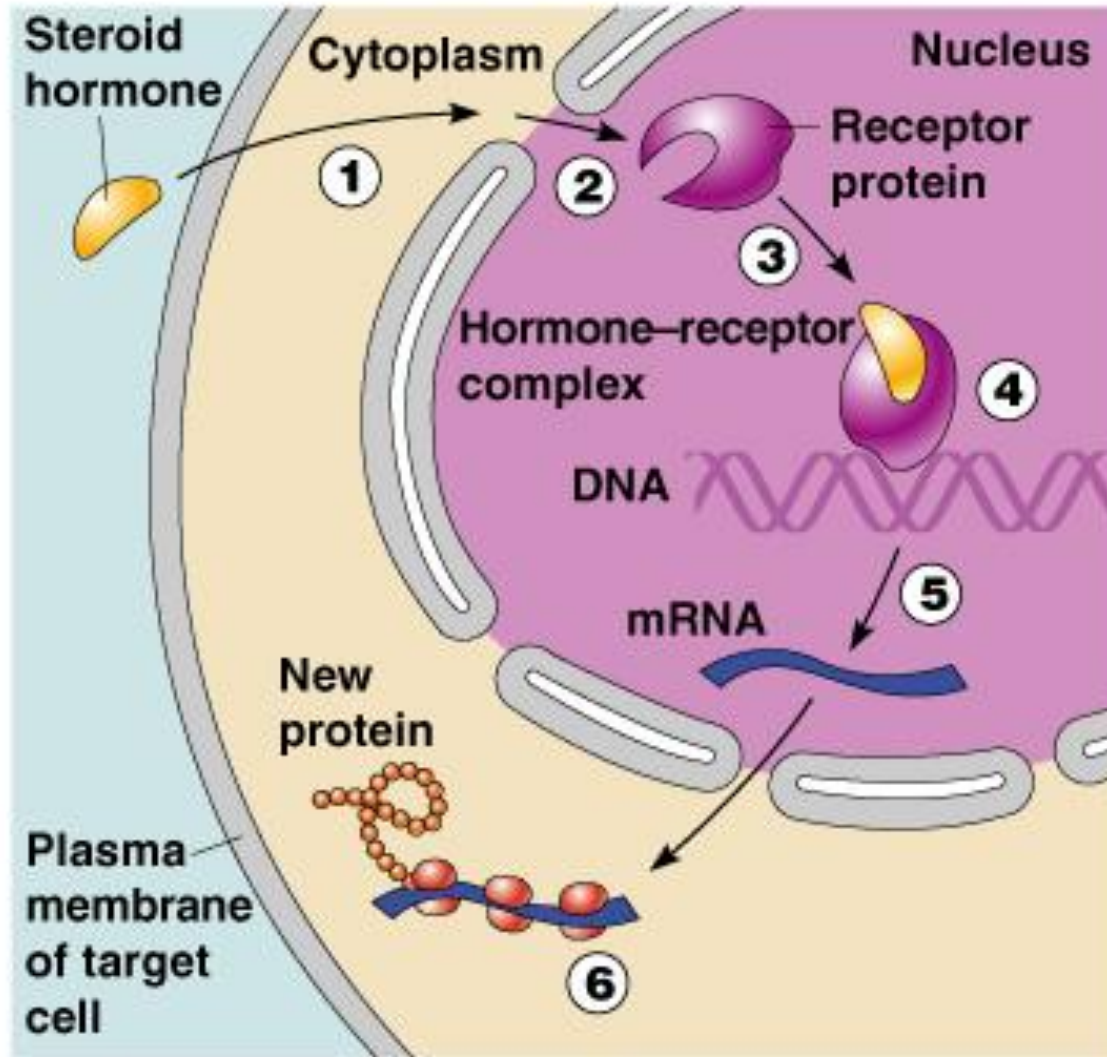
Effects Caused by Hormones

- 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



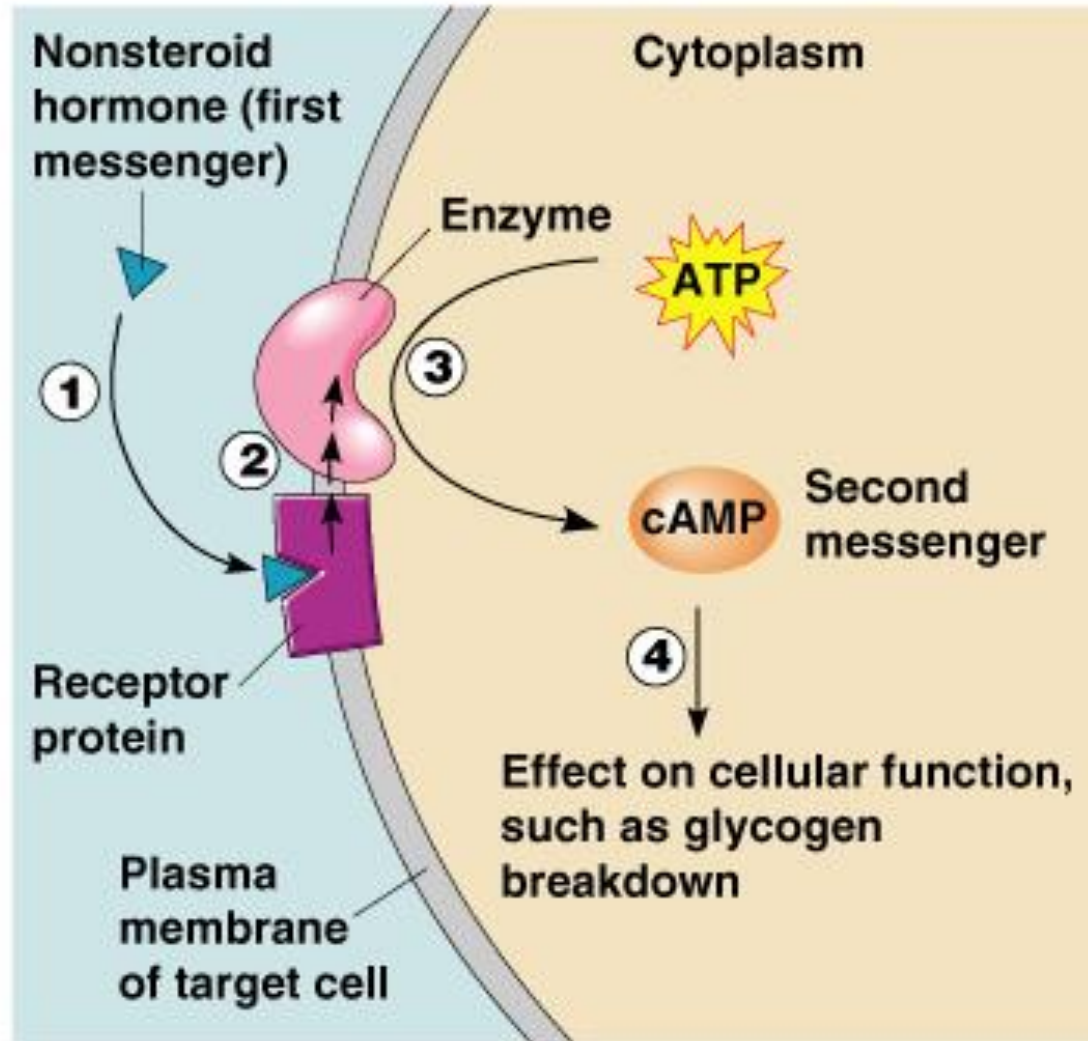
(a) Steroid hormone action

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 Action



(b) Nonsteroid hormone action

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

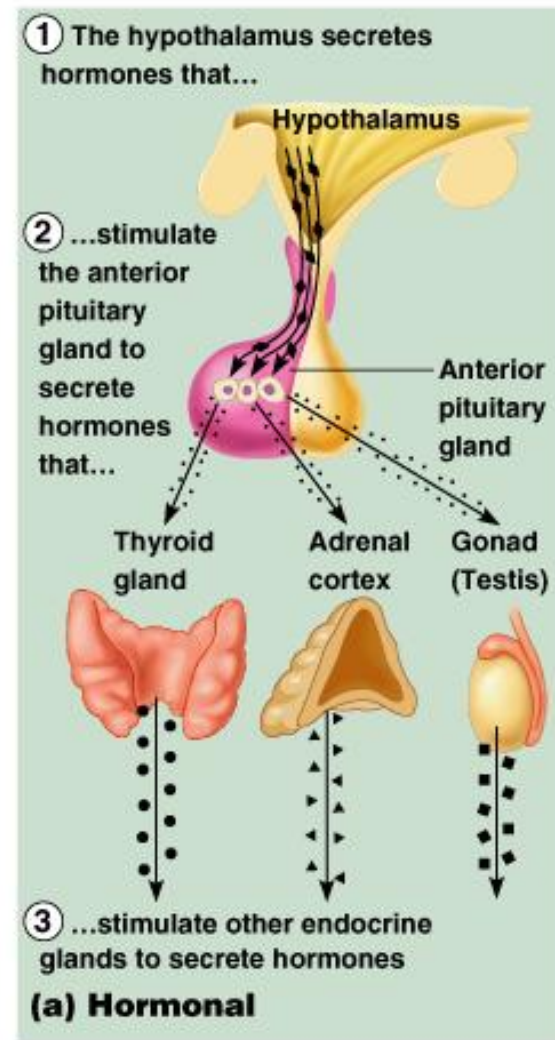


Figure 9.2a

Humoral Stimuli of Endocrine Glands

- Changing blood levels of certain ions stimulate hormone release

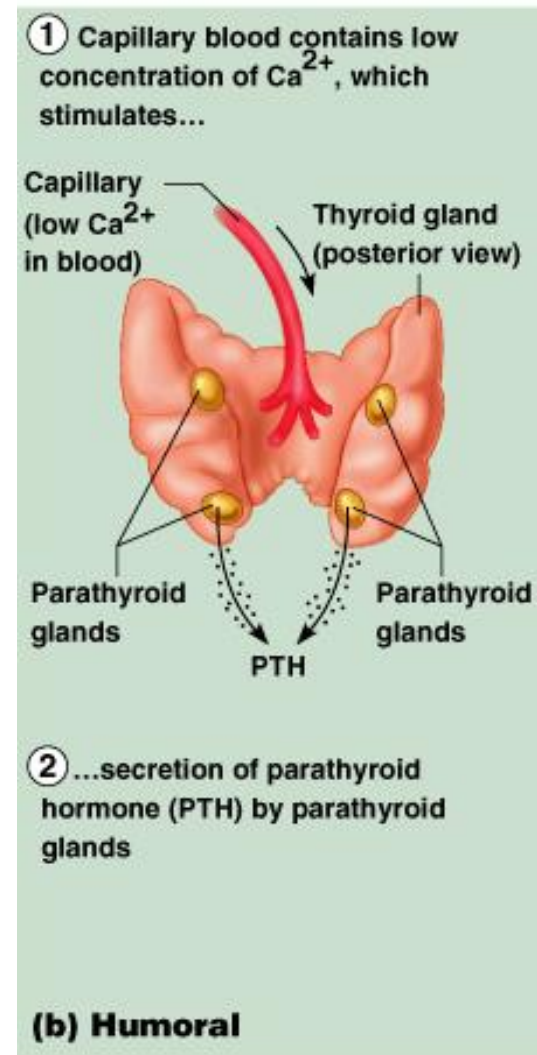


Figure 9.2b

Neural Stimuli of Endocrine Glands

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

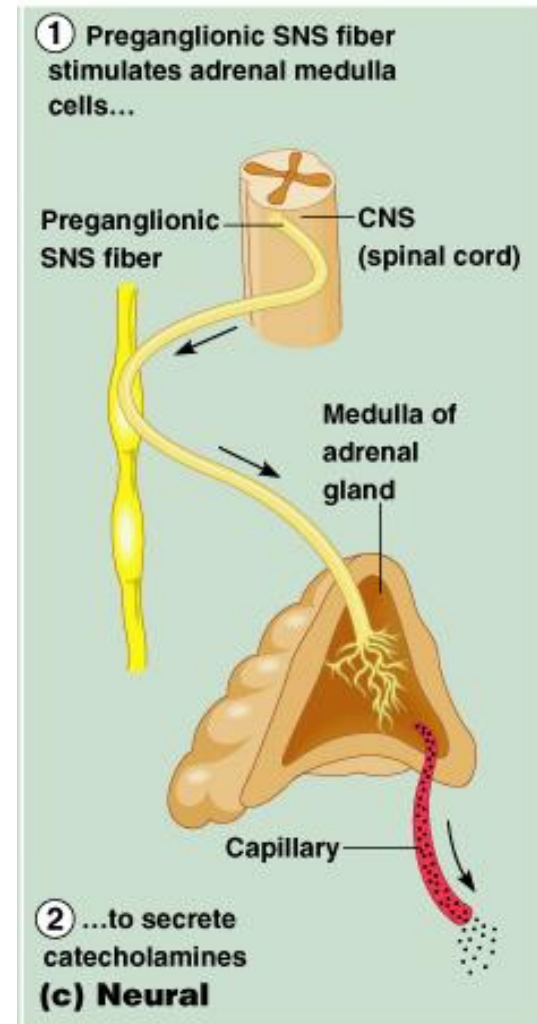



Figure 9.2c



Pituitary Gland

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



Chemicals which are secreted into extracellular fluid travel through the blood stream and regulate metabolic function of target cells are known as:

- a. hormones.
- b. antibodies.
- c. enzymes.
- d. antibiotics.

Location of Major Endocrine Organs

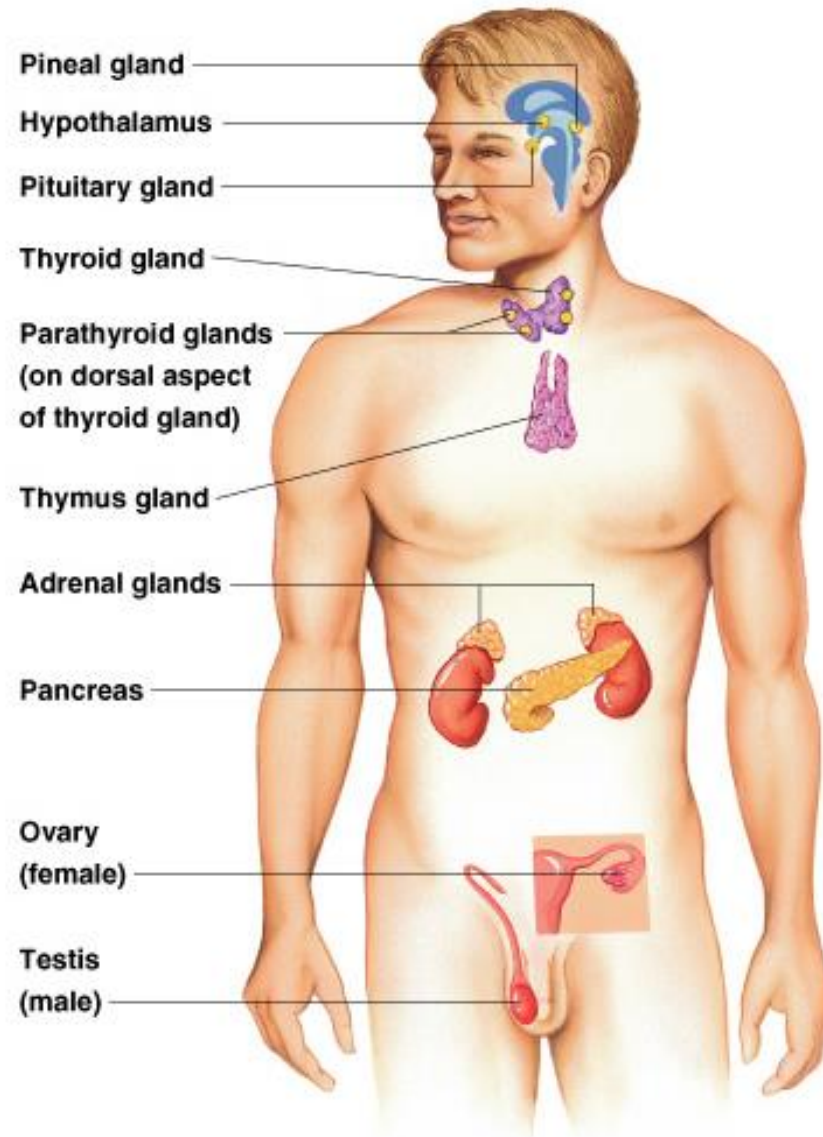


Figure 9.3

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

The anterior pituitary stimulates other endocrine organs by secreting a group of hormones called _____.

a. releasing factors

b. tropic hormones

c. relay proteins

d. target hormones



Which area of the brain regulates the endocrine system?

- a. Cerebral cortex
- b. Thalamus
- c. Hypothalamus
- d. Neurohypophysis

Hormones of the Anterior Pituitary

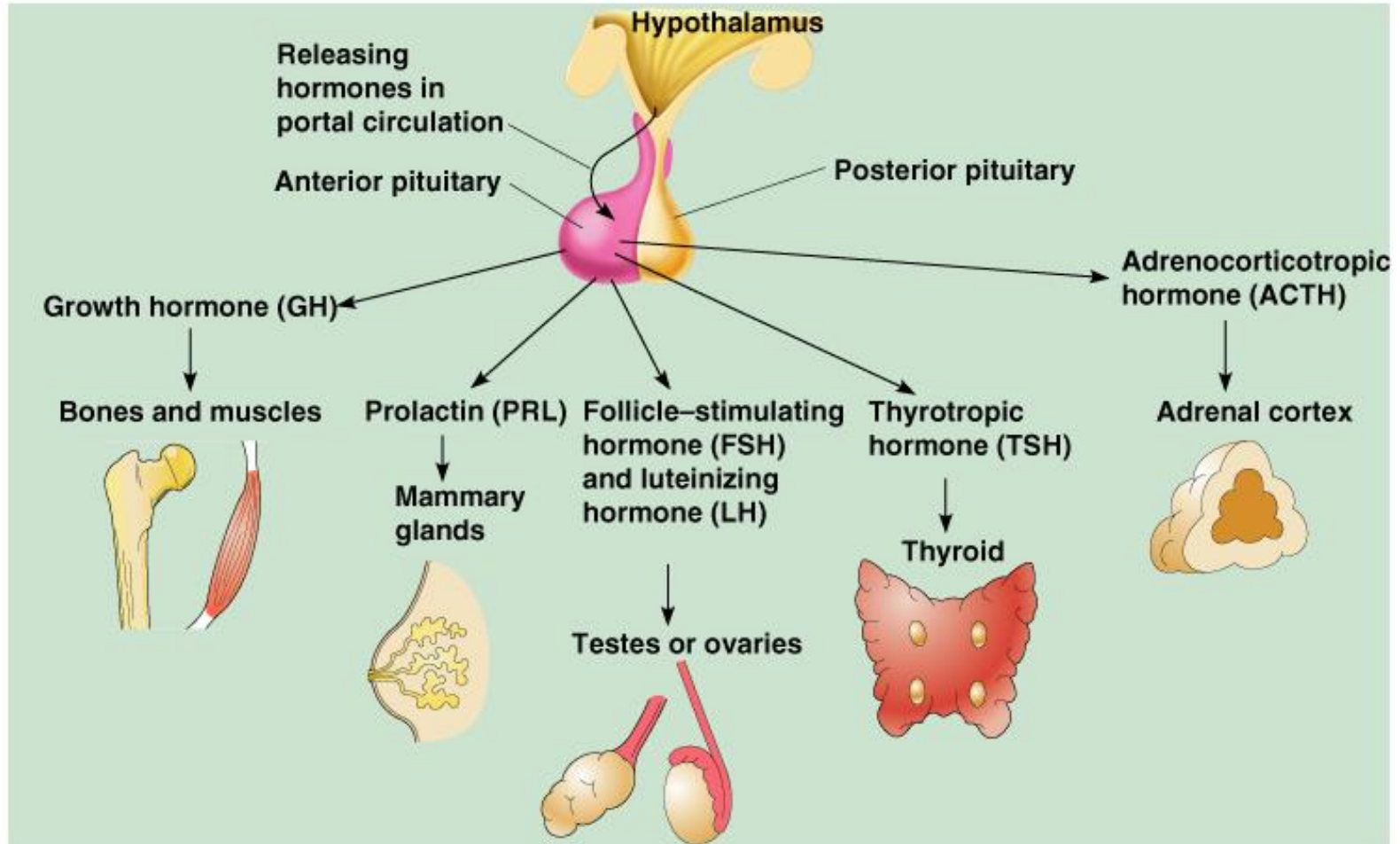


Figure 9.4

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
- Adrenocorticotrophic hormone (ACTH)
 - Regulates endocrine activity of the adrenal cortex
- 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)



The epiphyseal plate is the target organ of this hormone.

a. GH

b. ACTH

c. Parathormone

d. Glucagon

Pituitary - Hypothalamus Relationship

- Release of hormones from pituitary 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 (doesn't make hormones), but does store and 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

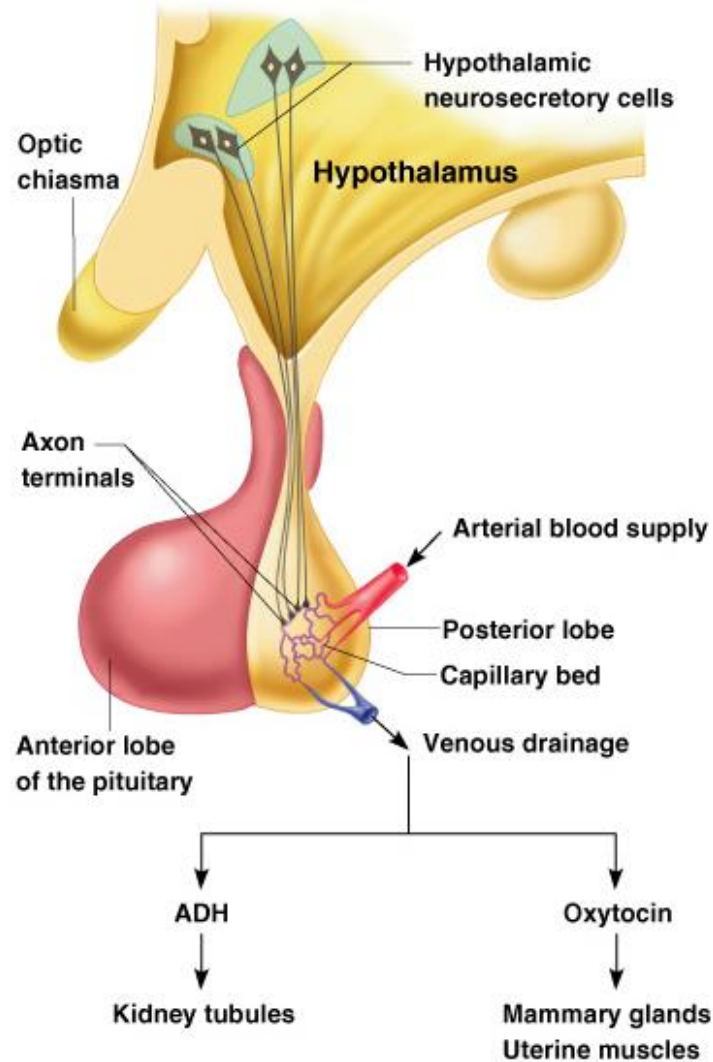


Figure 9.5



Oxytocin is produced here.

- a. Anterior pituitary gland
- b. Posterior pituitary gland
- c. Hypothalamus
- d. Ovary