Endocrine System
Chapter 11

Introduction
• The endocrine system consists of cells, tissues, & organs that secrete hormones into the blood
• Hormone – an organic substance secreted by a cell that has an effect on the metabolic activity of another cell or tissue
• Target cells – cells that are affected by the hormone
  – Have specific receptors for the hormones

How Hormones Work
• Basic action
  – The hormone combines with a receptor
  – The new molecular structure causes cellular changes

How Hormones Work
• Activation of 2nd messengers
  – Involves a cell membrane receptor
• Activation of genes
  – Involves intracellular receptors

The Hypothalamus & Endocrine Regulation
• Controls the adrenal medulla
  – Adrenalin
• Releases hormones
  – Antidiuretic hormone (ADH)
  – Oxytocin
• Secretes substances that control the anterior pituitary gland
  – Releasing factors
  – Inhibiting factors

Overview of the Endocrine System
The Pituitary Gland

- Connected to the hypothalamus
  - Infundibulum
- Master gland of the endocrine system
- 2 parts
  - Posterior pituitary
    - Nervous tissue
  - Anterior pituitary
    - Glandular tissue

Posterior Pituitary Produces 2 Hormones

- **Antidiuretic hormone (ADH)**
  - Target – kidneys
  - Effect – reabsorption of water
- **Oxytocin**
  - Targets – reproductive organs
  - Effects – contractions of smooth muscles (labor contractions, milk ejection; ductus deferens, prostate gland – ejaculations)

Anterior Pituitary Hormones

- **Thyroid stimulating hormone (TSH)**
  - Target – thyroid gland
  - Effect – triggers the release of thyroid hormones
- **Adrenocorticotropic hormone (ACTH)**
  - Target – adrenal cortex
  - Effect – cells that produce steroid hormones

Anterior Pituitary Hormones

- **Follicle stimulating hormone (FSH)** stimulates gametes
  - Targets – follicle cells (females), testes (males)
  - Effects – follicle development & estrogen secretion (females), sperm maturation (males)
- **Luteinizing hormone (LH)**
  - Targets – follicle cells (females), interstitial cells of testes (males)
  - Effects – ovulation, formation of corpus luteum, secretion of progesterone (females), secretion of testosterone (males)
- **Prolactin**
  - Target - breast
  - Effect - stimulates milk production
- **Growth hormone**
  - Target – all cells
  - Effect - stimulates growth in general and the skeletal system in particular
- **Melanocyte stimulating hormone (MSH)**
  - Target - melanocytes
  - Effect – increases melanin production and distribution
Pituitary Hormones

The Thyroid Gland

- Location – anterior to larynx
- Thyroid hormones include iodine in their structure
- Target cells – most cells
- Effect of thyroid hormones
  - increase energy utilization, oxygen consumption, growth, development

The Parathyroid Glands

- Location – posterior surfaces of thyroid gland
- Produce parathyroid hormone (PTH)
- Target cells – bone, kidneys, intestines
- Effect
  - Increases blood calcium levels

The Thymus Gland

- Location – posterior to the sternum
- Hormones enhance lymphocyte production
- Development
  - Childhood – large
  - Puberty – largest
  - Adulthood – decreases in size

Human Anatomy, 3rd edition
Prentice Hall, © 2001
The Adrenal Glands
- Location – on top of the kidney
- Structure
  - Capsule
  - Cortex
  - Medulla

The Adrenal Medulla
- Secretes epinephrine & norepinephrine
- Target – most cells
- Effect - stimulates heart beat & tissue metabolism, increases alertness, prepares body to deal with emergencies

The Adrenal Cortex
- Secretes aldosterone
  - Target – kidneys
  - Effect – increases blood sodium, decreases blood potassium
- Secretes steroid hormones (cortisol, corticosterone)
  - Target – most cells
  - Effect – conserve blood glucose, anti-inflammatory effects

The Pancreas
- Location – between the spleen and the duodenum
- Functions – both exocrine and endocrine
- Endocrine cells are in the Islets of Langerhans

The Pineal Gland
- Location = epithalamus
- Secretes melatonin
  - Light inhibits production
  - Regulates circadian rythms
  - Target – hypothalamus
  - Effects – inhibits FSH & LH secretion

Islets of Langerhans
- Glucagon
  - Targets – liver, adipose tissues
  - Effect - increase blood sugar levels
- Insulin
  - Targets - most cells
  - Effect - decrease blood sugar levels
- Diabetes mellitus
The Testes

- Divided into internal compartments containing seminiferous tubules
  - Spermatogenesis

Seminiferous Tubules

- **Androgens** (male sex hormones)
  - **Testosterone** is the most important
- **Target** – most cells
  - Effects – maturation of sperm; protein synthesis in skeletal muscle; male secondary sex characteristics & behaviors

The Ovaries – Follicle Cells

- **Estrogen**
  - Targets – most cells
  - Effects – follicle maturation; female secondary sex characteristics and behaviors

The Ovaries – Corpus Luteum

- **Progesterone**
  - Targets – uterus, mammary glands
  - Effects – prepare uterus for implantation, mammary glands for secretion
- **Relaxin**
  - Targets – pubic symphysis, uterus
  - Effects – loosens pubic symphysis, relaxes cervical muscles

Hormonal Regulation of the Female Reproductive System

- **Corpora lutea**
  - Develop from ruptured follicles
  - Produce **estrogen** and **progesterone**