LEARNING OUTCOMES

20.1 Endocrine Glands and Hormones
1. List the major endocrine glands of the human body.
2. Compare the mechanism of action of peptide hormones and steroid hormones.
3. Differentiate between first messengers and second messengers.

20.2 Hypothalamus and Pituitary Gland
1. Describe the relationship between the hypothalamus and the pituitary gland.
2. Name two hormones released by the posterior pituitary and six produced by the anterior pituitary.
3. Recognize which three pituitary hormones act on other endocrine glands.

20.3 Thyroid and Parathyroid Glands
1. Identify the anatomical location of the thyroid and parathyroid glands.
2. Distinguish between the functions of T3, T4, calcitonin, and parathyroid hormone.

20.4 Adrenal Glands
1. Describe the location of the adrenal glands in the body.
2. List two hormones produced by the adrenal medulla and two produced by the adrenal cortex.
3. Review the role of the kidneys in regulating secretion of aldosterone.

20.5 Pancreas
1. Explain how the pancreas has both endocrine and exocrine functions.
2. Contrast the functions of insulin, glucagon, and somatostatin.

20.6 Other Endocrine Glands
1. Discuss the role of the testes and ovaries in the development of male and female secondary sex characteristics.
2. Describe the functions of thymosin, melatonin, leptin, and prostaglandins.
3. Define and list two examples of growth factors.

20.7 Pheromones
1. Define pheromone.
2. Provide a specific example that suggests human behavior may be influenced by pheromones.

20.8 Disorders of the Endocrine System
1. Identify the cause of each of the following conditions: diabetes insipidus, pituitary dwarfism, acromegaly, Cushing syndrome, and Addison disease.
2. Describe two potential causes of hyperthyroidism.
3. Distinguish between the specific cause of type 1 versus type 2 diabetes mellitus.

LECTURE OUTLINE

20.1 Endocrine Glands and Hormones
The endocrine system consists of glands and tissues that secrete hormones. Hormones are chemicals that affect the behavior of other glands or tissues. Endocrine glands have no ducts. They secrete their hormones into tissue fluid.

Hormones and Homeostasis
Homeostasis requires close cooperation between the endocrine and nervous systems. The endocrine system works by eliciting a slower but more prolonged response than the
nervous system. The production of hormones is usually controlled by negative feedback and by the action of other hormones.

**The Action of Hormones**

Hormones fall into two basic chemical classes: 1) peptide hormones are either peptides, proteins, glycoproteins, or modified amino acids; and 2) steroid hormones always have the same complex of four carbon rings but with different side chains.

**20.2 Hypothalamus and Pituitary Gland**

The hypothalamus helps regulate the internal environment through the autonomic system and through the glandular secretions of the pituitary gland.

**Posterior Pituitary**

Neurons in the hypothalamus produce the hormones antidiuretic hormone and oxytocin that pass through axons into the posterior pituitary where they are stored in axon terminals.

**Anterior Pituitary**

The hypothalamus controls the anterior pituitary by producing hypothalamic-releasing and hypothalamic-inhibiting hormones. These stimulate the anterior pituitary to secrete hormones such as thyroid-stimulating hormone, adrenocorticotropic hormone, gonadotrophic hormones, prolactin, melanocyte-stimulating hormone, and growth hormone.

**20.3 Thyroid and Parathyroid Glands**

The thyroid gland is located in the neck. The parathyroid glands are embedded in the posterior surface of the thyroid gland.

**Thyroid Gland**

The thyroid gland produces hormones that increase the metabolic rate and control the blood calcium levels.

**Parathyroid Gland**

Parathyroid hormone causes the blood phosphate level to decrease and the blood calcium level to increase.

**20.4 Adrenal Glands**

The adrenal glands sit atop the kidneys.

**Adrenal Medulla**

The adrenal medulla produces epinephrine and norepinephrine. These provide a short-term response to stress.

**Adrenal Cortex**

The hormones produced by the adrenal cortex provide a longer-term response to stress. These include the mineralocorticoids and the glucocorticoids.

**Glucocorticoids**

Cortisol is a glucocorticoid. Cortisol raises the blood glucose level and counteracts the inflammatory response that leads to the pain and swelling of joints.

**Mineralocorticoids**

Aldosterone is the most important of the mineralocorticoids. It targets the kidney where it helps regulate blood volume and blood pressure.

**20.5 Pancreas**

The pancreatic islets produce and secrete insulin and glucagon that help regulate the blood glucose level.

**20.6 Other Endocrine Glands**

**Testes and Ovaries**

The testes produce androgens, which are the male sex hormones. The female sex hormones, estrogen and progesterone, are produced by the ovaries.

**Thymus Gland**

The thymus gland secretes thymosins, which aid in the differentiation of T lymphocytes.
**Pineal Gland**
The pineal gland produces melatonin that is involved in our daily sleep-wake cycle.

**Hormones from Other Tissues**
Other organs not considered endocrine glands do secrete hormones.

- **Leptin**
  Leptin is produced by adipose tissue and it signals satiety.

- **Growth Factors**
  A number of different types of organs and cells produce peptide growth factors.

- **Prostaglandins**
  Prostaglandins are potent chemical signals that act locally, quite close to where they were produced.

**20.7 Pheromones**
Chemical signals that act between individuals are called pheromones.

**20.8 Disorders of the Endocrine System**
An increase or decrease in the product of most hormones can cause significant disease.

- **Disorders of the Pituitary Gland**
  Disorders of the pituitary gland can have dramatic effects on the body. These disorders include diabetes insipidus, pituitary dwarfism, acromegaly, and Cushing syndrome.

- **Disorders of the Thyroid, Parathyroid, and Adrenal Glands**
  These include hypothyroidism, cretinism, myxedema, simple goiter, hyperthyroidism, exophthalmia, tetany, and Addison disease.

- **Diabetes Mellitus**
  This is a condition that affects the ability to regulate glucose metabolism. People with diabetes either do not produce enough insulin (type 1) or cannot properly use the insulin they produce (type 2).