LESSON ASSIGNMENT

LESSON 10
The Human Endocrine System.

TEXT ASSIGNMENT
Paragraphs 10-1 through 10-18.

LESSON OBJECTIVES
After completing this lesson, you should be able to:

10-1. Define endocrine glands, hormones, target organs, and feedback mechanism.

10-2. Briefly describe three different control systems of the human body.

10-3. Briefly describe the endocrine system and name six better known endocrine organs.

10-4. Describe the pituitary body, including its location, its major subdivisions, and the origins and hormones of each subdivision.

10-5. Describe the location, structure, and hormone(s) for each of the following:
   a. The thyroid gland.
   b. The parathyroid glands.
   c. The pancreatic islets.
   d. The suprarenal glands.

10-6. Name the primary sex organs and the sex hormones for each gender.

SUGGESTION
After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 10
THE HUMAN ENDOCRINE SYSTEM

Section I. INTRODUCTION

10-1. DEFINITIONS

ENDO = internal
CRINE = secrete

a. The endocrine glands are glands of internal secretion (rather than external, as seen with the sweat glands and digestive glands).

b. This internal secretion results from the fact that these glands have no ducts. Thus, they are often referred to as the ductless glands.

c. The secretions produced by the endocrine glands are called hormones.

d. Hormones are carried by the bloodstream to specific organs or tissues, which are then called the target organs.

e. The activity of the target organ, in turn, affects the activity of the endocrine organ. Thus, it is a reverse or feedback mechanism.

10-2. GENERAL

a. Control "Systems" of the Human Body. The structure and function of the human body is controlled and organized by several different "systems."

(1) Heredity/environment. The interaction of heredity and environment is the fundamental control "system." Genes determine the range of potentiality and environment develops it. For example, good nutrition will allow a person to attain his full body height and weight within the limits of his genetic determination. Genetics is the study of heredity.

(2) Hormones. The hormones of the endocrine system serve to control the tissues and organs in general. (Vitamins have a similar role.) Both hormones and vitamins are chemical substances required only in small quantities.

(3) Nervous system. More precise and immediate control of the structures of the body is carried out by the nervous system.
b. **The Endocrine System.** In the human body, the endocrine system consists of a number of ductless glands producing their specific hormones. Because these hormones are carried to their target organs by the bloodstream, the endocrine organs (glands) are richly supplied with blood vessels.

c. **Better Known Endocrine Organs of Humans.** The better known endocrine organs are the:

1. Pituitary body.
2. Thyroid gland.
3. Parathyroid glands.
4. Pancreatic islets (islands of Langerhans).
5. Suprarenal (adrenal) glands.
6. Gonads (female--ovaries; male--testes).

In addition, there are several other endocrine organs, less well understood, and other organs suspected to be of the endocrine type. See figure 10-1, which shows the better known endocrine glands and their locations.

![Diagram of the endocrine system](image)

**Figure 10-1.** The endocrine glands of the human body and their locations.
Section II. THE PITUITARY BODY

10-3. GENERAL

a. Location. The pituitary body is a small pea-sized and pea-shaped structure. It is attached to the base of the brain in the region of the hypothalamus (see para 11-9). In addition, it is housed within a hollow of the bony floor of the cranial cavity. This hollow is called the sella turcica ("Turk's saddle").

b. Major Subdivisions. The pituitary body is actually two glands-- the posterior pituitary gland and the anterior pituitary gland. Initially separate, these glands join together during development of the embryo.

10-4. POSTERIOR PITUITARY GLAND

The posterior pituitary gland is the portion which comes from and retains a direct connection with the base of the brain. The hormones of the posterior pituitary gland are actually produced in the hypothalamus of the brain. From the hypothalamus, the hormones are delivered to the posterior pituitary gland, where they are released into the bloodstream. At present, we recognize two hormones of the posterior pituitary gland.

a. ADH (Antidiuretic Hormone). ADH is involved with the resorption or salvaging of water within the kidneys. ADH is produced under thirst conditions.

b. Oxytocin. Oxytocin is concerned with contractions of smooth muscle in the uterus and with milk secretion.

10-5. ANTERIOR PITUITARY GLAND

a. The anterior pituitary gland originates from the roof of the embryo's mouth. It then "attaches" itself to the posterior pituitary gland.

b. The anterior pituitary gland is indirectly connected to the hypothalamus by means of a venous portal system. By "portal," we mean that the veins carry substances from the capillaries at one point to the capillaries at another point (hypothalamus to the anterior pituitary gland).

c. In the hypothalamus, certain chemicals known as releasing factors are produced. These are carried by the portal system to the anterior pituitary gland. Here, they stimulate the cells of the anterior pituitary gland to secrete their specific hormones.

d. The anterior pituitary gland produces many hormones. In general, they stimulate the target organs to develop or produce their own products. This stimulating effect is referred to as trophic.
e. Of the many hormones produced by the anterior pituitary gland, we will examine:

(1) **Somatotrophic hormone (growth hormone).** The target organs of this hormone are the growing structures of the body. This hormone influences such structures to grow.

(2) **ACTH (adrenocorticotrophic hormone).** This hormone of the anterior pituitary gland stimulates the cortex of the suprarenal (adrenal) gland to produce its hormones. We will later see that the hormones of the suprarenal cortex are involved with anti-inflammatory reactions of the body.

(3) **Thyrotropin (TSH).** This hormone stimulates the thyroid gland to produce its hormones.

(4) **Luteinizing hormone (LH).** LH stimulates ovulation and luteinization of ovarian follicles in females and promotes testosterone production in males.

(5) **Follicle-stimulating hormone (FSH).** FSH stimulates ovarian follicle growth in females and stimulates spermatogenesis in males.

(6) **Prolactin.** Prolactin stimulates milk production and maternal behavior in females.

### Section III. THE THYROID GLAND

#### 10-6. LOCATION

The thyroid gland is in the neck region just below the larynx and surrounds the trachea.

#### 10-7. ANATOMY

a. The right and left thyroid lobes are the masses on either side of the trachea. The **isthmus** is found across the front of the trachea and connects the two lobes.

b. Each lobe of the thyroid gland is supplied by arteries from above and below (superior and inferior thyroid arteries).

#### 10-8. HORMONES

The primary hormone of the thyroid gland is **thyroxin.** Thyroxin affects the basal metabolic rate (BMR), the level of activity of the body. Since iodine is a necessary element in the production of thyroxin, one can observe malformations of the thyroid gland...
(called goiters) where there is little or no iodine available. A second hormone, calcitoni
nin, is produced by the thyroid gland and it is involved with calcium metabolism in the
body.

Section IV. THE PARATHYROID GLANDS

10-9. LOCATION AND STRUCTURE

Located on the posterior aspects of the thyroid lobes are two pairs of small round masses of tissue, known as the parathyroid glands.

10-10. HORMONE

The hormone produced by these glands is called parathyroid hormone, or parathormone. It is involved with calcium metabolism.

Section V. THE PANCREATIC ISLETS (ISLANDS OF LANGERHANS)

10-11. LOCATION AND STRUCTURE

Within the substance of the pancreas are distributed small groups of cells known as islets. Although the pancreas is a ducted gland of the digestive system, these isolated islets are, in fact, ductless glands.

10-12. HORMONES

Insulin and glucagon are the two most commonly recognized hormones of the islets. These hormones are involved with glucose metabolism.

Section VI. THE SUPRARENAL (ADRENAL) GLANDS

10-13. LOCATION AND STRUCTURE

Embedded in the fat above each kidney is a suprarenal gland. Both suprarenal glands have an internal medulla and an external cortex.

10-14. HORMONES OF THE SUPRARENAL MEDULLA

The medullary portion of each suprarenal gland produces a pair of hormones--epinephrine (adrenalin) and norepinephrine (noradrenalin). These
hormones are involved in the mobilization of energy during the stress reaction ("fight or flight").

10-15. HORMONES OF THE SUPRARENAL CORTEX

Each suprarenal cortex produces a variety of hormones which can be grouped into three categories:

a. **Mineralocorticoids** (for example, aldosterone), which are concerned with the electrolytes of the body.

b. **Glucocorticoids** (for example, cortisol), which are concerned with many metabolic functions and are anti-inflammatory in nature.

c. **Sex hormones**. Adrenal androgens and estrogens.

Section VII. THE GONADS

10-16. GENERAL

In humans, the primary sex organs are known as gonads (lesson 8). The gonads produce sex cells (gametes) and sex hormones. These sex hormones are in addition to those produced by the suprarenal cortex (see para 10-15c).

10-17. FEMALE SEX HORMONES

In the female, the ovaries produce two types of sex hormones during the menstrual cycle. During the first half of the cycle (days 1 - 14), the estrogens are produced. During the last half of the cycle (days 15 - 28), progesterone is produced. These hormones are concerned with female sexuality and with the preparation of female sex organs for reproduction.

10-18. MALE SEX HORMONES

In the male, certain cells of the testes produce the male sex hormones known as androgens (for example, testosterone). Androgens are concerned with male sexuality.

*Continue with Exercises*

*Return to Table of Contents*
EXERCISES, LESSON 10

REQUIREMENT. The following exercises are to be answered by completing the incomplete statement or by writing the answer in the space provided at the end of the question.

After you have completed all the exercises, turn to "Solutions to Exercises," at the end of the lesson and check your answers.

1. Endocrine glands are glands of _____ I secretion. These glands are also called _____ less glands. Hormones are the secretions produced by _____ glands. Target organs are the specific organs or tissues to which _____s are carried by the ________. This is a feedback mechanism because the activity of the target organ affects the activity of the ________.

2. The fundamental control "system" is the interaction of ________________ and __________________. Genes determine the range of ________________. Environment ___________s it. Controlling the tissues and organs in general are the __________s of the __________ system. Providing more precise and immediate control of the body structures is the ________________ system.

3. Why are endocrine organs (glands) richly supplied with blood vessels?

4. Name six of the better known endocrine organs.
   a. ____________________________.
   b. ____________________________.
   c. ____________________________.
   d. ____________________________.
   e. ____________________________.
   f. ____________________________.
5. The pituitary body is a small _____-sized and _____-shaped structure. It is attached to the base of the brain in the region of the h________. In addition, it is housed within a hollow of the bony floor of the _______ cavity. The pituitary body is actually two glands: the _______ pituitary gland and the _______ pituitary gland.

6. The posterior pituitary gland is that portion of the pituitary body which comes from and retains its connection with the __________________________. The hormones of the posterior pituitary gland are actually produced in the h________ of the brain. The two recognized hormones of the posterior pituitary gland are _______________ (a hormone) and _______________. The first is involved with the __________ of water within the kidneys; it is produced under _________ conditions. The second is concerned with contractions of smooth muscle in the __________ and with _________ production.

7. The anterior pituitary gland originates from the roof of the embryo's ____________. It then attaches itself to the __________________________ gland. By means of a venous portal system, the anterior pituitary gland is connected to the h__________. Here, certain chemicals known as r________ f________ are produced. These are carried to the anterior pituitary by the _______ _______ system. They stimulate the anterior pituitary gland's cells to secrete their specific _________. In turn, these hormones stimulate the target organs to produce their own products. This stimulating effect is referred to as ________________. Two hormones produced by the anterior pituitary gland are _______ trophic hormone and _______ (_________ trophic hormone). The target organs of the first are the ___________ structures of the body. The second stimulates the cortex of the _______ (_____ ) gland to produce its hormones.

8. The thyroid gland is in the ___________ region just below the _______ and surrounds the _______. The masses on either side of the trachea are the right and left thyroid _______. The tissue connecting the two lobes is called the _______. It is found across the front of the ____________. Each lobe of the thyroid gland is supplied by the superior and inferior ________ arteries. The primary hormone of the thyroid gland is ________________, which affects the _____ ___________ ____ (____), the level of activity of the body.

9. Where are the parathyroid glands located?

   The hormone produced by these glands is called ______________ hormone or ______________. It is involved with _________ metabolism.
10. Within the pancreas are distributed small groups of cells known as _______. The two most commonly recognized hormones of the islets are ____________ and ____________. These hormones are involved with __________________ metabolism.

11. The suprarenal glands are embedded in the fat above the ____________ on each side. Each suprarenal gland has an internal ____________ and an external ____________. The inner portion produces a pair of hormones: e__________ (__________) and n__________ (__________). These are involved in the mobilization of _______ during the stress reaction ("______" or "______"). Each suprarenal cortex produces hormones which can be grouped into three different categories:

   a. M____________s (for example, aldosterone), which are concerned with the ____________ of the body.

   b. G____________s (for example, cortisol), which are concerned with many metabolic functions and are anti-__________ in nature.

   c. ____ hormones.

12. In humans, the primary sex organs are known as ______s. These organs produce ____________ cells (_______) and sex ______s.

13. During the first half of the menstrual cycle, the ovaries produce _________. During the second half, they produce ________. These hormones are concerned with female _______________ and with the preparation of female sex ________s for reproduction.

14. The testes produce the male sex hormones known as ____________ (for example, ____________). These hormones are concerned with male ____________.

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 10

1. Endocrine glands are glands of internal secretion. These glands are also called ductless glands. Hormones are the secretions produced by endocrine glands. Target organs are the specific organs or tissues to which hormones are carried by the bloodstream. This is a feedback mechanism because the activity of the target organ affects the activity of the endocrine organ. (para 10-1)

2. The fundamental control "system" is the interaction of heredity and environment. Genes determine the range of potentiality. Environment develops it. Controlling the tissues and organs in general are the hormones of the endocrine system. Providing more precise and immediate control of the body structures is the nervous system. (para 10-2a)

3. Endocrine organs are richly supplied with blood vessels because hormones must be carried to their target organs by the bloodstream. (para 10-2b)

4. a. Pituitary body.  
b. Thyroid gland.  
c. Parathyroid glands.  
d. Pancreatic islets.  
e. Suprarenal (adrenal) glands.  
f. Gonads (female--ovaries, male--testes). (para 10-2c)

5. The pituitary body is a small pea-sized and pea-shaped structure. It is attached to the base of the brain in the region of the hypothalamus. In addition, it is housed within a hollow of the bony floor of the cranial cavity. The pituitary body is actually two glands: the posterior pituitary gland and the anterior pituitary gland. (para 10-3)

6. The posterior pituitary gland is that portion of the pituitary body which comes from and retains its connection with the base of the brain. The hormones of the posterior pituitary gland are actually produced in the hypothalamus of the brain. The two recognized hormones of the posterior pituitary gland are ADH (antidiuretic hormone) and oxytocin. The first is involved with the resorption or salvaging of water within the kidneys; it is produced under thirst conditions. The second is concerned with contraction of smooth muscle in the uterus and with milk production. (para 10-4)
7. The anterior pituitary gland originates from the roof of the embryo's mouth. It then attaches itself to the posterior pituitary gland. By means of a venous portal system, the anterior pituitary gland is connected to the hypothalamus. Here, certain chemicals known as releasing factors are produced. These are carried to the anterior pituitary by the venous portal system. They stimulate the anterior pituitary gland's cells to secrete their specific hormones. In turn, these hormones stimulate the target organs to produce their own products. This stimulating effect is referred to as trophic. Two of the hormones produced by the anterior pituitary gland are somatotrophic hormone and ACTH (adrenocorticotropic hormone). The target organs of the first are the growing structures of the body. The second stimulates the cortex of the suprarenal (adrenal) gland to produce its own hormones. (para 10-5)

8. The thyroid gland is in the neck region just below the larynx and surrounds the trachea. The masses on either side of the trachea are the right and left thyroid lobes. The tissue connecting the two lobes is called the isthmus. It is found across the front of the trachea. Each lobe of the thyroid gland is supplied by the superior and inferior thyroid arteries. The primary hormone of the thyroid gland is thyroxin, which affects the basal metabolic rate (BMR), the level of activity of the body. (paras 10-6--10-8)

9. The parathyroid glands are located on the posterior aspects of the thyroid lobes. The hormone produced by these glands is called parathyroid hormone or parathormone. It is involved with calcium metabolism. (paras 10-9, 10-10)

10. Within the pancreas are distributed small groups of cells known as islets. The two most commonly recognized hormones of the islets are insulin and glucagon. These hormones are involved with glucose metabolism. (paras 10-11, 10-12)

11. The suprarenal glands are embedded in the fat above the kidney on each side. Each suprarenal gland has an internal medulla and an external cortex. The inner portion produces a pair of hormones: epinephrine (adrenalin) and norepinephrine (noradrenalin). These are involved in the mobilization of energy during the stress reaction ("fight or flight"). Each suprarenal cortex produces hormones which can be grouped into three different categories:
   a. Mineralocorticoids (for example, aldosterone), which are concerned with the electrolytes of the body.
   b. Glucocorticoids (for example, cortisol), which are concerned with many metabolic functions and are anti-inflammatory in nature.
   c. Sex hormones. (paras 10-13--10-15)

12. In humans, the primary sex organs are known as gonads. These organs produce sex cells (gametes) and sex hormones. (para 10-16)
13. During the first half of the menstrual cycle, the ovaries produce estrogens. During the second half, they produce progesterone. These hormones are concerned with female sexuality and with the preparation of female sex organs for reproduction. (para 10-17)

14. The testes produce the male sex hormones known as androgens (for example, testosterone). These hormones are concerned with male sexuality. (para 10-18)

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