

# Basic Human Anatomy

## Lesson 10: Endocrine System

Welcome to Lesson 10 of the Basic Human Anatomy Course. Today, we'll be studying the Human Endocrine System.

I have 6 goals for you in this lesson:

1. Define endocrine glands, hormones, target organs, and feedback mechanism.
2. Briefly describe three different control systems of the human body.
3. Briefly describe the endocrine system and name six better known endocrine organs.
4. Describe the pituitary body, including its location, its major subdivisions, and the origins and hormones of each subdivision.
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.
  - e. Name the primary sex organs and the sex hormones for each gender.

## INTRODUCTION

### 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.

### 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.

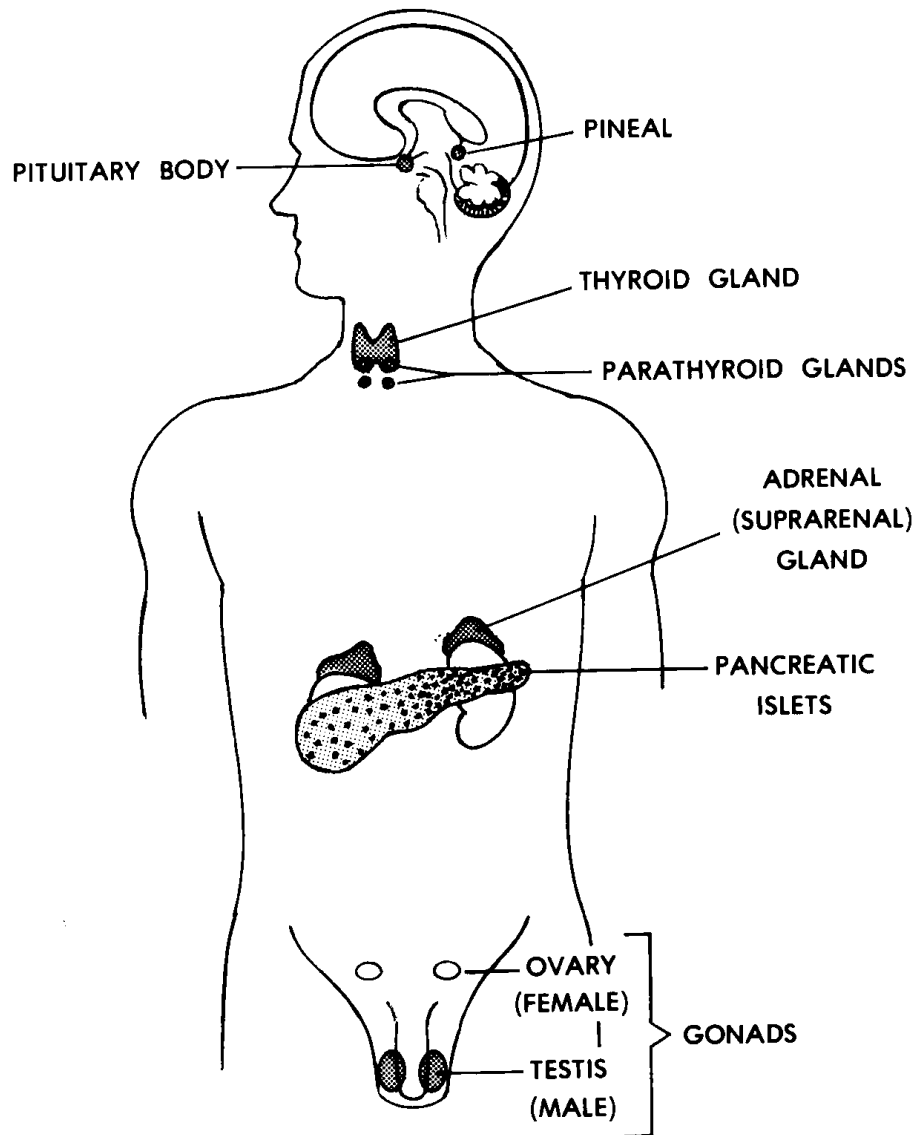


Figure 10-1. The endocrine glands of the human body and their locations.

## THE PITUITARY BODY

### 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 Lesson 11). 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.

### 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.

## 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.

## **THE THYROID GLAND**

### **LOCATION**

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

### **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).

### **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, calcitonin, is produced by the thyroid gland and it is involved with calcium metabolism in the body.



## **THE PARATHYROID GLANDS**

### **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.

### **HORMONE**

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

## **THE PANCREATIC ISLETS (ISLANDS OF LANGERHANS)**

### **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.

### **HORMONES**

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

## THE SUPRARENAL (ADRENAL) GLANDS

### 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.

### 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").

### 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.

## **THE GONADS**

### **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.

### **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.

### **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.

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