

Endocrine Glands

Chapter 18

PITUITARY GLAND AND HYPOTHALAMUS

1. The pituitary gland secretes nine major hormones that regulate many body functions.
2. The pituitary gland was once considered the "master" gland because hormones released from the pituitary control other endocrine glands and many body functions. It is now known that the regulation of release of hormones from the pituitary is controlled by the hypothalamus. Thus the endocrine system and the nervous system are intimately related.

Structure of the Pituitary Gland

FIGURES 18.1 and 18.2

1. The pituitary gland is connected to the hypothalamus by the **infundibulum**.
2. The pituitary gland is divided into two parts.
 - A. **Posterior pituitary = neurohypophysis** (G. neuro, nerve; hypophysis, undergrowth).
 - B. **Anterior pituitary = adenohypophysis** (G. adeno, gland; hypophysis, undergrowth).

Posterior Pituitary

1. The posterior pituitary is derived from the floor of the brain, that is, nervous tissue.
2. The posterior pituitary consists of **neurosecretory cells**, which are neurons specialized to produce hormones (technically neurohormones).
3. Hormones are produced in the cell bodies of the neurons. The hormones move along axons to the axon endings, where the hormones are stored as granules in the axon endings.

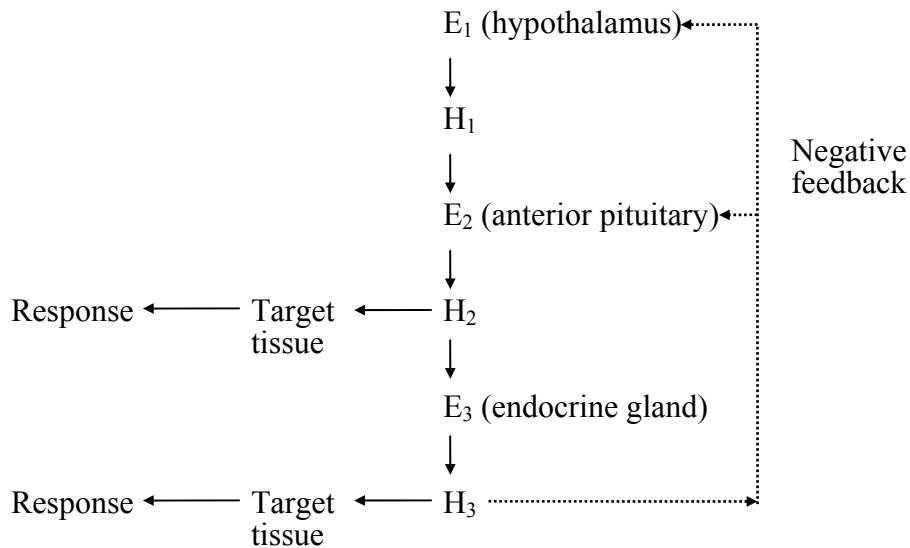
Anterior Pituitary

1. The anterior pituitary is derived from the roof of the mouth from epithelial tissue.
2. The anterior pituitary consists of typical glandular cells that can secrete hormones.
3. Hormones are produced in the cell bodies of the glandular cells. The hormones are stored as granules in the cell bodies.

Relationship of the Pituitary to the Brain

FIGURE 18.3

1. A portal system consists of two capillary beds connected together. The **hypothalamohypophyseal portal system** consists of a capillary bed in the hypothalamus connected to a capillary bed in the anterior pituitary.



2. Release of hormones from the anterior pituitary is regulated by the hypothalamus.
 - A. Neurosecretory cells in the hypothalamus produce hormone H_1 (blue balls), which enters the first capillary bed and is carried to the anterior pituitary.
 - B. H_1 leaves the second capillary bed in the anterior pituitary and stimulates the glandular cells to release hormone H_2 (yellow squares). All of the hormones released from the anterior pituitary are controlled (at least in part) by hypothalamic hormones.
 - C. Hormone H_1 is called a **releasing hormone** because it can cause the release of another hormone from the anterior pituitary. Some of the hypothalamic hormones can inhibit hormone release from the anterior pituitary and are called **inhibiting hormones**.
 - D. H_2 enters the second capillary bed and is carried to the general circulation, where it can affect target tissues. For example, certain anterior pituitary hormones can affect the production of sperm cells by the testes and oocytes by the ovaries.

- E. In addition, hormones (H_2) released from the anterior pituitary can affect endocrine glands (E_3), causing the release of hormones (H_3).
- 1) For example, certain anterior pituitary hormones stimulate the testes to produce male sex hormones (testosterone) and the ovaries to produce female sex hormones (estrogen, progesterone).
 - 2) The sex hormones affect target tissues, causing many of the differences between the sexes.
 - 3) The sex hormones have a negative feedback effect on the release of hormones from the hypothalamus and anterior pituitary.
3. The **hypothalamohypophyseal tract** consists of axons extending from the hypothalamus through the infundibulum into the posterior pituitary. The cell bodies of the neurons that form the hypothalamohypophyseal tract are located in the hypothalamus.

FIGURE 18.4

4. Release of hormones from the posterior pituitary is regulated by the hypothalamus.
- A. Hormone H_4 (red balls) is produced in the hypothalamus, is transported within axons of the hypothalamohypophyseal tract, and is stored in the axon ending in the posterior pituitary.
 - B. Stimulation of the neuron in the hypothalamus results in action potentials that travel down the hypothalamohypophyseal tract, causing the release of hormone H_4 from the axon endings. The hormone enters a capillary and is carried to the general circulation.
- ☞ Surgical removal of the posterior pituitary in experimental animals results in marked symptoms associated with hormone shortage. However, these symptoms are temporary. Explain.