

Endocrine System (fig. 17.1)

- **Endocrine System:** a system of ductless glands
 - Secrete messenger molecules called **hormones**
 - Interacts closely with the nervous system
 - Scattered throughout the body
- Pure endocrine organs: pituitary, pineal, thyroid, parathyroid, and adrenal glands
- Organs containing endocrine cells: pancreas, thymus, gonads, and the hypothalamus
- Hypothalamus is a neuroendocrine organ: produces hormones and has nervous functions

Hormones

- Classes of hormones:
 - **Amino-acid based** and **steroids** (made from cholesterol)
- Circulate throughout the body in blood vessels
- Influence only specific tissues—**target cell**
 - Can have different effects on different target cells
- Secretion is always controlled by feedback loops
- Secretion is triggered by three major types of stimuli:
 - **Humoral:** indirect response to changing ion or nutrient levels in the blood (simplest feed back loops)
 - **Neural:** nerve fibers stimulate secretion (fast)
 - **Hormonal:** Stimuli received from other glands
 - Hormones signal secretion of other hormones
 - Example: hypothalamus secretes hormones (arrow) stimulate pituitary (arrow) stimulate other hormones

Types of Endocrine Gland Stimuli (fig. 17.2)

Pituitary Gland

- Secretes 9 major hormones
- Attached to the hypothalamus
- Two basic divisions
 - **Adenohypophysis** (anterior lobe)
 - **Neurohypophysis** (posterior lobe)

Hormones of the Anterior Lobe (Table 17.1)

Tropic hormones: regulate hormone secretion by other glands

- **Thyroid-stimulating hormone (TSH)**
 - Signals thyroid gland secrete thyroid hormone
- **Adrenocorticotrophic (ACTH)**

- Stimulates the adrenal cortex to secrete stress hormones
- Two **gonadotropins** (affect the reproductive system):
 - **Follicle Stimulating Hormone (FSH)**
 - Ovarian follicle maturation & estrogen production; sperm production
 - **Luteinizing Hormone (LH)**
 - Triggers ovulation & estrogen production; stimulates testosterone production

KNOW EFFECTS OF HYPER- AND HYPO-SECRETION OF ALL PITUITARY HORMONES EXCEPT MSH

Non-tropic hormones of the Anterior Lobe

- **Growth hormone (GH)**
 - Stimulates growth of epiphyseal plates
 - Stimulates growth directly and indirectly by the liver's secretion of insulin-like growth factor-1
- **Prolactin (PRL)**
 - Stimulates milk production
- **Melanocyte-stimulating hormone (MSH: not in table 17.1)**
 - Appetite suppression

Hypothalamic Control of Hormone Secretion from the Anterior Lobe

- The hypothalamus controls secretion of anterior lobe hormones by secreting:
 - **Releasing hormones**—prompt anterior lobe to release hormones
 - **Inhibiting hormones**—turn off secretion of anterior lobe hormones

The Posterior Lobe

- Does not make the hormones
- Stores and releases two peptide hormones made in the hypothalamus
- **Antidiuretic hormone (ADH; vasopressin)**
 - Stimulates kidneys to resorb water
- **Oxytocin**
 - Includes smooth muscle contraction of reproductive organs: lactation; uterine contraction

Thyroid Gland (fig. 17.5a)

- Located in the anterior neck
- Largest pure endocrine gland
- Produces two hormones:

- **Thyroid Gland**
 - Regulates metabolism
- **Calcitonin**
 - Reduces blood calcium

Parathyroid Gland (fig. 17.6a)

- Posterior surface of the thyroid gland
- Two types of endocrine cells:
 - **Chief cells**
 - Produces parathyroid hormone (PTH)
 - Increases blood concentration of calcium
 - **Oxyphil cells**
 - Function unknown

The Adrenal (Suprarenal) Glands

- Located on the superior surface of each kidney
- **Adrenal medulla** (inside; larger)
 - Secretes **amino acid-based hormones**: epinephrine and norepinephrine
 - They enhance “fight-or-flight” responses
- **Adrenal Cortex** (outside)
 - Secretes steroid hormones of two classes:
 - **Mineralocorticoids** (e.g., aldosterone)
 - **Aldosterone**—secreted in response to decline in blood volume or blood pressure
 - **Glucocorticoids** (e.g., cortisol)
 - **Cortisol** (hydrocortisone)—helps the body deal with stressful situations (increases glucose production; reduces inflammation)

FIG. 17.8 KNOW THE SHORT AND LONG RESPONSES INVOLVED IN STRESS

The Pineal Gland

- Located on the roof of diencephalon
- Secrete melatonin
 - A hormone that regulated cardiac rhythms

The Pancreas

- Located in the posterior abdominal wall
- Contains endocrine and exocrine glands
 - Endocrine cells are located in about 1 million pancreatic islets
 - **Alpha cells** secrete **glucagon**
 - Signal liver to transform glycogen into glucose