Chapter 17  The Endocrine System, Part 1

1. An overview of hormones and the endocrine system
2. Describe the structural and functional organization of the hypothalamus and the pituitary and explain their relationship
3. Discuss the locations and structures of the thyroid and parathyroid glands.
4. List the hormones (and their function) produced by these glands.
5. Briefly review some examples of abnormal hormone production
Endocrine System Overview

- Ductless glands produce hormones
- Secreted directly into the bloodstream (endocrine)
  - Except the thyroid
- Gland may be entire organ:
  - Pituitary, thyroid, parathyroid, pineal, adrenal
- or bits of tissue interspersed within an organ
  - Gonads, kidneys, many others

Fig 17.1
Classes of Hormones (p 516)

- Chemical classification of hormones
  - Amino Acid Derivatives
    - Proteins (longer)
    - Peptides (shorter)
    - Amines (derived from a single amino acid)
  - Steroids (from cholesterol)
    - Glucocorticoids, mineralocorticoids, sex hormones
  - Eicosanoids (from arachidonic acid)
- Target tissues are identified by specific receptors (on target cells). The effects may be stimulatory or inhibitory, depending on the receptors.
Control of Hormone Secretion

- **Humoral**
  - BP and the kidney’s JG apparatus

- **Neural**
  - Recall the adrenal medulla
  - Hypothalamic Releasing Factors

- **Hormonal**
  - Pituitary Releasing Hormones, e.g., FSH
Hypothalamus

Control Center for environment

Regulates nervous and endocrine systems via 3 mechanisms:

1. ANS centers exert nervous control on adrenal medulla
2. ADH and Oxytocin production
3. Regulatory hormone production (RH and IH) controls pituitary gland directly and all other endocrine glands indirectly

1. These regulatory hormones are released from neurons, thus we have neuroendocrine cells.

Fig 17.3
Pituitary Gland (= Hypophysis) p 518

- **Structure:**
  - Located at the base of the brain, surrounded by the Circle of Willis
  - Infundibulum - connection to the hypothalamus
  - In the sella turcica of the sphenoid bone
  - Two parts with separate embryonic origins:
    - Anterior Pituitary
    - Posterior Pituitary

A Turkish saddle
Anterior Pituitary (= adenohypophysis)
- AKA pars distalis
- Production of 7 peptide hormones
  - 4 are tropic hormones, stimulating other endocrine glands
  - Pars intermedia and pars tuberalis secrete MSH and some gonadotropins.
Posterior Pituitary (= neurohypophysis)
- AKA pars nervosa
- Storage reservoir for ADH and Oxytocin (produced in ?)
Pituitary Gland (= Hypophysis)

Review
Table 25.1
Anterior Pituitary: Portal System

- **Portal systems**: two capillary networks in serial arrangement

- Three sites of capillary portal systems: liver, kidney, and pituitary

- **Portal veins**: blood vessels that link two capillary networks
Anterior Pituitary: Control

- Hypothalamus has neurons that produce
  - Releasing, e.g., GnRH, or
  - Inhibiting Hormones
- Into the first capillary plexus
- Down the *infundibulum* in portal veins
- Into the second capillary plexus
  - Receptors in pituitary
- Hormones then released into the circulation

Fig 17.4 (a)
Neurohypophysis = PP

- Neurons originate in the Supraoptic and Paraventricular Nuclei
- Their axons extend down the infundibulum
- Release Oxytocin and ADH (vasopressin) into the circulation

Fig 17.4 (b)
(b) Anterior and posterior pituitary tissues (LMx77)

- **Anterior pituitary**
  - Pars distalis
  - Pars intermedia

- **Posterior pituitary (pars nervosa)**

- Secretes other anterior pituitary hormones
- Secretes MSH
- Releases ADH and oxytocin
Pituitary MRI, contrast enhanced
Thyroid Gland p 523

- Anterior surface of trachea just inferior of thyroid cartilage (or Adam’s apple)
- Two lobes connected by isthmus
More Thyroid

- **Thyroid follicular cells** (simple cuboidal epithelium) produce and store thyroglobulin in **thryoid follicles**
  - Iodine then added to produce thyroxine (T₄) and triiiodothyronine (T₃) inside the follicles
  - The thyroglobulin is reabsorbed by the follicular cells, cleaved, and the thyroid hormone (T₃ and T₄) are released into the bloodstream
  - Note that this is the only extracellular storage of hormones

- **C (chief) Cells**: (AKA parafollicular cells) produce **calcitonin**
  - Interspersed between thyroid follicles
  - Lower blood Calcium
C-Cells

Simple cuboidal epithelium
Thyroid Disease

- **Hyper-**
  - Cardiovascular
    - Increased BP
    - Tachycardia
    - Palpitations
  - Neuromuscular
    - Emotional lability
    - Insomnia
    - Weakness
    - Hand Tremor

- **Hypo-**
  - Weakness
  - Dry, coarse Skin
  - Lethargy, Slow Speech
  - Feel cold
  - Less Sweat
  - Eyelid and Facial Edema
Parathyroid Glands

4 tiny glands embedded in the posterior aspect of the thyroid (superior and inferior)

- **Parathyroid hormone** (PTH; sometimes also called parathormone)

- **Function:**
  - raises blood $[\text{Ca}^{2+}]$
  - antagonist to Calcitonin
(b) Thyroid and parathyroid tissues (LM × 116)

(c) Parathyroid gland (LM × 850)

- Connective tissue capsule of parathyroid gland
- Red blood cells in blood vessel
- Principal cells