The Endocrine System

- The endocrine system acts with the nervous system to coordinate and integrate the activities of the body's cells.

- The nervous system uses electrochemical impulses for rapid control.

- The endocrine system uses hormones, or chemical "messengers", released into the blood for transport throughout the body.
  - Slower acting control than nervous system.

- Hormones (steroids or amino acid-based molecules) stimulate changes in the metabolic activity of the body's tissues.
  - Changes can lead to growth, development, and physiological homeostasis of body systems.

- Even though all hormones are bloodborne, they don't all affect the same organs.
  - Target organs are the organs that respond to a particular hormone.

Gross Anatomy

1. Pituitary Gland (Hypophysis)

It consists of two functional areas: The anterior pituitary (adenohypophysis) and the posterior pituitary (neurohypophysis).

Anterior Pituitary Hormones

The tropic hormones (act on other endocrine glands):

- **Follicle-stimulating hormone (FSH)** and **Luteinizing hormone (LH)** are both gonadotropins that regulate gamete productions and hormonal activity of the gonads (testes and ovaries).
- **Adrenocorticotropic hormone (ACTH)** that regulates the endocrine activity of the cortex portion of the adrenal gland.
- **Thyroid stimulating hormone (TSH)** that influences the thyroid gland's growth and activity.

The other hormones:

- **Growth hormone (GH)** affects the growth of muscle and the long bones of the body. Important in determining body size.

- Hyposecretion results in dwarfism in children.
- Hypersecretion results in gigantism in children and acromegaly in adults (overgrowth of hand, feet and face bones).

- **Prolactin (PRL)** stimulates breast development and maintains lactation after childbirth in women.

Posterior Pituitary Hormones

- **Oxytocin** stimulates strong uterine contractions during birth and causes milk ejection in the lactating mother.
- **Antidiuretic hormone (ADH)** causes the kidney tubules to reabsorb more water from the urine filtrate, resulting in less urine released and more conserved body water.

2. Thyroid Gland

- Thyroid hormone (TH) contains two hormones, **thyroxine (T_4)** and **triiodothyronine (T_3)**, that control body metabolism and cellular oxidation rates. It affects almost every cell in the body.
  - Hyposecretion of thyroxine leads to myxedema, mental and physical sluggishness, in adults.

- **Calcitonin** decreases blood calcium levels by stimulating calcium deposit in the bones. It acts antagonistically to parathyroid hormone.

3. Parathyroid Gland

- **Parathyroid hormone (PTH)** regulates calcium balance of the blood.
  - Hyposecretion increases neural excitability and can result in tetany, prolonged muscle spasms that can cause respiratory paralysis and death.

4. Adrenal Gland

The adrenal medulla:

- **Epinephrine** and **norepinephrine** act with the sympathetic nervous system to elicit the fight-or-flight response when stressed.

The adrenal cortex produces the following corticosteroids:

- **Aldosterone** regulates water and electrolyte balance in extracellular fluids.
- **Cortisone** increases blood glucose levels enabling the body to resist long-term stressors.
- **Sex hormones** that are mainly androgens or male sex hormones but some estrogens, female sex hormones, are formed.

- Hypersecretion leads to hirsutism, abnormal hairiness.

5. Pancreas
   - **Insulin** and **glucagons** are concerned with the regulation of blood sugar levels. Insulin decreases blood sugar levels. Glucagon helps increase blood sugar levels.
     - Hyposecretion of insulin leads to diabetes mellitus.
     - Hypersecretion of insulin leads to hypoglycemia, low blood sugar.

6. Ovaries
   - **Estrogen** is responsible for the maturation of the reproductive organs and breast development at puberty.
   - **Progesterone** acts with estrogen to bring on the menstrual cycle.

7. Testes
   - **Testosterone** promotes development of secondary sex characteristics, maturation of reproductive system structures, and is responsible for the libido.

8. Pineal Gland
   - **Melatonin** prevents precocious sexual maturation.