Major Endocrine Organs

Pineal gland
Hypothalamus
Pituitary gland
Thyroid gland
Parathyroid glands (on dorsal aspect of thyroid gland)
Thymus gland
Adrenal glands
Pancreas

Ovary (female)
Testis (male)

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3. Effects in the target cells caused by hormone action

- a. A change in cell membrane permeability (e.g. insulin causes muscle cells to have a higher permeability for glucose).

- b. A change in chemical reaction rate (e.g. growth hormone stimulates higher chemical reaction rates in muscle and bone cells).

- c. Enzyme activation (e.g. epinephrine increases enzyme action in muscle cells).

- d. Activation of cell secretion (e.g. melanocyte-stimulating hormone activates more melanin secretion from the melanocytes).
Sequence of steroid hormone action - Summary

1. Endocrine glands secrete steroid hormone.
2. Steroid hormone diffuses through target cell membrane.
3. Hormone combines with a receptor molecule.
4. Steroid hormone-receptor complex binds to DNA and promotes synthesis of mRNA.
5. mRNA enters the cytoplasm and directs protein synthesis.
6. Newly synthesized protein produce hormone’s specific effects.
7. The new protein causes a specific effect to occur within the target cells.
4. The product of these reactions is a substance known as the “secondary messenger” (usually cyclic adenosine monophosphate or cAMP), which acts on behalf of the protein hormone, causes a potent effect in the target cell (usually within the cytoplasm).

5. Since protein hormones never diffuse to the DNA of target cells, no new proteins or enzymes are made at the end.
- Follicle-stimulating hormone (FSH) -- stimulates the production of egg cells and sperm in the gonads. [Hypersecretion causes no known effects, while hyposecretion can cause failure of sexual maturation]

- Luteinizing hormone (LH) -- triggers ovulation and stimulates the production of estrogens and progesterone in female, and promotes testosterone production in male. [Disorders are similar to those for FSH].

- Prolactin (PRL) or Lactogenic hormone (LTH) -- stimulates milk production in the mammary glands. [Hypersecretion can disrupt normal menstrual cycles in female and causes impotence in male; and hyposecretion causes poor milk production in female].

- Melanocyte-stimulating hormone (MSH) -- stimulates melanocytes in the epidermis and hair follicles to release melanin pigment. [Hypersecretion causes abnormally dark skin pigment, and hyposecretion causes abnormally light skin pigment].
Thyroid gland

- a) located inferior to the larynx (voice box) and attached to the trachea.
- b) divided into two lateral lobes.
- c) thyroid follicles utilize iodine and synthesize thyroglobulin (TGB) to be stored in the colloids.
- d) upon stimulation of TSH, TGB is converted into two hormones -- Triiodothyronine (T₃) and Thyroxine (T₄) to promote normal metabolism. [Hypossecretion causes hypothyroidism, similar to cretinism and myxedema, and hypersecretion causes hyperthyroidism that results in a goiter or in Graves’ disease].
- e) also secretes Calcitonin to lower blood calcium and phosphate levels and regulate digestive hormones. [Both hypossecretion and hypersecretion would affect normal balances of calcium and phosphate].
Adrenal gland

- **B. Adrenal Medulla**: inner portion of the adrenal gland.

- Made of modified nerve tissue that is under direct regulation of sympathetic nerves of the autonomic nervous system.

- Contains glandular cells called chromaffin cells which secrete 2 closely related hormones -- **Epinephrine** (or adrenaline) and **Norepinephrine** (or noradrenaline).

- Effects of these hormones resemble sympathetic stimulation, where body activities such as cardiac actions, blood pressure, and breathing rate are increased, while digestive processes are decreased. [No known effects are due to hyosecretion of these, but hypersecretion can caused hypertension, increased blood glucose level, and high heart rate].
5. ACTH stimulates release of **Cortisol** by the adrenal cortex.

6. Cortisol increases the conc. of blood amino acids, releases fatty acids, and forms glucose from non-carbohydrate sources.

7. Secretion of **glucagons** from the pancreas and **growth hormone** from the anterior pituitary increase.

8. Glucagons and growth hormone aid mobilization of energy sources and stimulate uptake of amino acids by cells.

9. Secretion of **ADH** from post. Pituitary increases.

10. ADH promotes the retention of **H₂O** by the kidneys, which increases blood volume.

11. **Renin** increases blood level of angiotnsin II, which acts as a vasoconstrictor and also stimulates **Aldosterone** secretion by the adrenal cortex. Aldosteron increase Na⁺ retention by the kidneys.