ENDOCRINOLOGY
Endocrine Glands

• Endocrine glands
  • Produce substances called **hormones**.
  • Ductless glands, i.e., they release hormones directly into the bloodstream
  • Hormones only act at their **target tissue** where there are receptors for the hormone
  • By definition, the target tissue is far from the gland that produces the hormone.
Estrogens - Estradiol

• **Target tissue**: every cell of the body.

• Reproductive system effects include:
  
  • Proliferation of endometrial cells during the follicular phase of the monthly cycle.
  
  • Build up of mammary tissue in the breast during the luteal phase and during pregnancy.
  
  • Proliferation of muscle cells to the uterus during pregnancy.
Estrogens - Estradiol

• Non-reproductive system actions:
  • Control fat storage
    • Puberty: directs fat to female appropriate sites
    • Adult: decreases the rate of storage of calories as fat
  • Increases general activity level
  • Suppresses food intake and appetite
  • Softens skin, maintains skin thickness and resilience
Estrogens - Estradiol

• Non-reproductive system actions:
  • Affects bone development
    • Puberty: initiates and, later, stop the adolescent bone growth spurt
    • Adulthood: helps retain calcium in bones
  • Blood pressure – natural estrogens prevent marked increases and marked decreases of blood pressure (synthetic estrogens raise blood pressure)
Progesterone

- **Target Tissue** – all cells of the body.
- Some effects similar to estrogen; some effects are the exact opposite of estrogen.
Progesterone – Reproductive System Effects

- Stimulate the secretion of fats and glycogen into the endometrial cells in the luteal phase.
- Stimulate mammary gland development during the luteal phase and during pregnancy.
- Prevents coordinated contractions of the uterus during pregnancy.
Progesterone – Non-Reproductive Actions

• **Controls fat storage**: Reverses the effect of estrogen and increases the rate of storage of excess calories as fat.
• **Stimulates food intake and appetite.**
• **Prevents coordinated contractions of smooth muscle** throughout the body (basis of diarrhea or constipation during the luteal phase and during pregnancy)
Progesterone – Non-Reproductive Actions (con’t)

- **Blood pressure effects**: Like estrogen, prevents marked increases or decreases of blood pressure.
- **Central nervous system depressant** – causes somnolence.
Hypothalamus-Pituitary System

Hypothalamus

Pituitary (Hypophysis)
Hypothalamic-Pituitary Connection

Hypothalamus

Anterior Pituitary

Posterior Pituitary

Infindibulum
Hypothalamus-Posterior Pituitary Connection

Hypothalamus

Infindibulum

Anterior Pituitary

Posterior Pituitary (Neurohypophysis)
Neuron

Dendrites (Input)

Cell Body (soma)

Axon (Output)

Axon Terminals
Hypothalamus-Posterior Pituitary Connection

The posterior pituitary DOES NOT PRODUCE any hormones!

Posterior Pituitary contains terminals of axons from cells in the paraventricular and supraoptic hypothalamus.
Hypothalamus-Posterior Pituitary Connection

Paraventricular Nucleus of the Hypothalamus

Produces mostly oxytocin
Oxytocin

• Stimulates milk let-down during breast feeding.
  • Primary stimulus for oxytocin release is suckling at the breast.
  • Oxytocin production and release can be conditioned to occur to stimuli related to suckling such as a crying baby.
Oxytocin

- Stimulates contractions of the uterus.
  - Levels are high during labor.
  - Administration of synthetic oxytocin (Pitocin) can stimulate labor.
- Tend and Befriend; emotional attachment to others (mother:child; pair bonding)
Hypothalamus-Posterior Pituitary Connection

Supraoptic Nucleus of the Hypothalamus

Produces mostly Antidiuretic Hormone (ADH) - also called Vasopressin
Antidiuretic Hormone (ADH) (Vasopressin (AVP))

• Promotes retention of water by blocking water loss in urine.
• Increases blood pressure.
• Attachment/bonding in males?????
HYPOTHALAMUS - ANTERIOR PITUITARY CONNECTION
Hypothalamus

Median Eminence

Anterior Pituitary (Adenohypophysis)

Infindibulum

Posterior Pituitary
Hypothalamus-Anterior Pituitary Connection

Produces hormones called **Releasing Hormones** and transports them to the **median eminence**
Hypothalamus-Anterior Pituitary Connection

Nucleus at the base of the hypothalamus where Releasing Hormones enter the hypothalamo-hypophysial portal system.

Median Eminence
Hypothalamus-Anterior Pituitary Connection

Specialized blood vessel system which transports Releasing Hormones through the infundibulum from the Median Eminence to the Anterior Pituitary

Hypothalamo-Hypophysial Portal System
Hypothalamus-Anterior Pituitary Connection

Anterior Pituitary (Adenohypophysis) produces and releases Tropic Hormones in response to Releasing Hormones.
Tropic Hormones

1. Adrenocorticotropic Hormone (ACTH)
   • ACTH stimulates the production and release of hormones by the adrenal cortex.

2. Thyroid-Stimulating Hormone (TSH)
   • TSH stimulates the production and release of hormones by the thyroid gland.

3. Growth Hormone (aka Somatotropin)
   • GH acts stimulates growth of muscle (directly) and bones (through its action on the liver).
Tropic Hormones

4. Melanocyte-Stimulating Hormone (MSH)
   • MSH acts at skin to increase pigmentation. Involved in increased pigmentation of skin during pregnancy.

5. Beta-Lipotropic Hormone (BLPH)
   • Precursor of endorphins

6-8. The 3 gonadotropic hormones
(All gonadotropic hormones are also tropic hormones.)
Tropic Hormones

Gonadotrophic Hormones
6. **Follicle-Stimulating Hormone (FSH)**
   1. Works with LH to stimulate ovulation.
   2. Stimulates growth of the ovarian follicle(s).
Gonadotropic Hormones

7. **Luteinizing Hormone (LH)**
   1. Stimulates estrogen production by the ovarian follicle.
   2. Works with FSH to stimulate ovulation.
   3. Stimulates the formation of the corpus luteum.
   4. Stimulates estrogen production by the corpus luteum.
Gonadotropic Hormones

8. **Prolactin (PRL)**
   1. Stimulates progesterone production.
   2. Stimulates milk production by mammary glands.