Endocrine System

What is a gland?
Organs that secrete hormones that move through the bloodstream to target cells

What is a Hormone?
A chemical signal that communicates regulatory messages within the body

Possible effects of hormones

1) Release of products previously manufactured in target cells
   - Example: Parathyroid hormone produced in parathyroid glands (neck) increases blood calcium by accelerating bone recycling

2) Synthesis of molecules or changes in the target cell: metabolic activities
   - Example: ADH produced in the brain induces water reabsorption in the cells of the kidneys

3) Division and growth of target cells
   - Example: LH and FSH produced in the anterior pituitary (brain) induce the menstrual cycle in females
   - Example: Growth hormone have effects in the entire body

How many types of hormones?
- There are four (4) general types of hormones, three of them endocrines (having effects inside the body)...

Prostaglandins
- Lipid hormones derived from fatty acids
- Are local hormones affect neighboring cells and thus are not carried in the bloodstream

Peptide hormones
- Small chains of aminoacids (proteins units)
- Bind to a receptor in the plasma membrane causing the formation of cAMP which activates a cascade of enzymes reactions

Steroid hormones
- Steroid lipids that enter a cell and affect gene activity and thus protein synthesis
- Example: sex hormones: testosterone and progesterone
What is a target cell?
- A cell that has a specific receptor on the (cell) membrane in order to “understand” the “message” carried by a hormone

Peptide hormones action
- Hormones binds to a receptor in the membrane
  - hormones do not enter the cell
  - Binding activates a protein inside the cell
    - that in time triggers a cascade of enzyme reaction via a “second” messenger
  - cAMP
Steroid hormones action

- Hormones are lipids, so they can diffuse across cell membrane
  
  - Hormone binds to a receptor in the nuclear membrane
  
  - Activating the transcription (RNA synthesis) of a particular gene that in time determines the production of a specific protein inside the cell

One hormone can have different effects

- Depending on...
  - Different receptors for the hormone
  - Different signal transduction pathways inside target cells
  - Different proteins for carrying out the response

- The hormone epinephrine or adrenaline
  - Has multiple effects in mediating the body’s response to short-term stress, and rapidly prepares the body for action in emergency situations
  - Increases heart rate and stroke volume, dilates the pupils, and constricts arterioles in the skin and gastrointestinal tract while dilating arterioles in skeletal muscles, elevates the blood sugar level
**Major human endocrine glands**
(releases two hormones that are stored in the posterior pituitary and regulates the anterior pituitary)

Also located in the **brain**, is the **main gland** in the body. Hormones released here are involved in many processes:
- Growth
- Blood pressure
- Some aspects of pregnancy and childbirth including stimulation of uterine contractions during childbirth
- Breast milk production
- Sex organ functions in both women and men
- Thyroid gland function
- The conversion of food into energy (metabolism)
- Water and osmolarity regulation in the body

**Integration of Endocrine and Nervous Systems**

**Anterior Pituitary**
- Located at the base of the brain
  - permanently receives information from the brain

**Posterior pituitary** is directed connected to the brain
- Used to storage of hormones produced in the hypothalamus
How is hormone production controlled?

- **Negative feedback control**
  - Too much product activates one hormone, and deactivates the one that has the opposite effect
  - Glands interact and control production of hormones

  - **Too little glucose in blood**
    - Activates glucagon production

  - **Too much glucose in blood**
    - Activates the insulin production