



Types of "Controls":

- **Nervous System:** Causes effects at post-synaptic cleft. Uses neurotransmitters. Effects are **immediate, targeted, short-lived**.
- **Autocrine:** Hormones released that only affect the releasing cell.
- **Paracrine:** Hormones released to neighboring cells. **Targeted/narrow effects**.
- **Endocrine:** Hormone released to blood stream. **Systemic effects based on target cells**.
- **All *-crines:** Produce hormones. Varying onset & duration.
- **Exocrine:** Glands that produce non-hormonal substances (e.g., sweat, hair, etc)

What is a Hormone?

- Chemical molecule that regulates body functions through actions on receptors, interactions with other hormones, and altering enzymes & proteins.
- Includes **steroids** (and other lipid soluble), **amines**, **peptides**, and **proteins** (all made from protein or amino acids).
 - Steroids** work by going inside cell, binding to target protein, and activating specific mRNA transcribing activity to cause specific protein construction.
 - Amines, peptides, and proteins** work by binding to receptors on cellular membrane and then altering enzymes or membrane transport. Most work using a **secondary messenger** such as **cAMP**.

Hormone Effects Determined By:

- **Concentration level in blood**
- **Affinity** (sensitivity/resistance)
- **# of Receptors** (can be up/down regulated)

Hormones Triggered By:

- **Humoral Stimuli** (blood levels)
- **Neural Stimuli** (Nervous System)
- **Hormonal Stimuli** (Releasing/Inhibiting)
- Control via **negative feedback loops** (-)

Hormonal Interactions

- **Permissiveness**
- **Synergism**
- **Antagonism**

Key Hormonal Systems

- **Hypothalamus - Pituitary - Adrenal (HPA axis)**
Drives resistance stress response
- **Hypothalamus - Pituitary - Gonadal (HPG axis)**
Drives development, reproduction, and aging.
- **Hypothalamus - Pituitary - Thyroid (HPT)**
Drives metabolic control → master thermostat
- **Hypothalamus - Posterior pituitary**
Drives oxytocin & ADH release
- **Renin - Angiotensin - Aldosterone**
Manages long-term blood volume & SUR
- **Insulin/Glucose/Glucagon**
Regulates blood sugar levels
- **Calcium System**
Regulates blood Ca^{++} and bone formation
- **Sympathetic - Adrenal Medullary (SAM)**
Drives alarm stress response
- **Digestive System**
Regulates appetite & digestion

Endocrine System Notes • CCEMS Paramedic Course

How does the body control itself?

- **Nervous System:** Electrical depolarization travels down nerves and cause effects at post-synaptic cleft. Post-synaptic cleft releases neurotransmitters to accomplish actions in target receptors. Effects are **immediate, targeted, and short in duration**.
- **Autocrine:** Hormones released that only affect the releasing cell (*auto-* means “self”)
- **Paracrine:** Hormones released to neighboring cells, with **targeted, narrow effects**. (*para-* means “with”)
- **Endocrine:** Hormones released into blood stream; **systemic effects** based on **target receptors**.
-crines refers to glands that excrete substances, typically hormones. Except for:
- **Exocrine:** Glands that produce non-hormonal substances (e.g., sweat, hair, etc.)

What is a hormone?

- Chemical molecule that regulates bodily functions through **1) actions on receptors, 2) interactions with other hormones, and/or 3) altering enzymes and proteins**.
- Includes lipid-soluble hormones (mostly **steroids**) and **amines, peptides, and proteins**, made from amino acids.
- **Steroids** work by going inside cell, binding to a target protein, and then activating specific mRNA transcribing activities to cause specific protein construction inside a cell.
- **Amines, peptides, and proteins** work by binding to receptors outside cell on cellular membrane and then altering enzymes and membrane transports. Most work using a secondary messenger (a secondary messenger substance inside the cell) such as cAMP.

Hormone effects are determined by:

- **Concentration** level in blood
- **Affinity** of receptors (sensitivity or resistance)
- **Number/density** of receptors (can be up/down regulated)

Hormones are triggered by:

- **Humoral** stimuli (blood levels of chemicals such as electrolytes).
- **Neural** stimuli (nervous system)
- **Hormonal** stimuli (other hormones triggering or inhibiting release)

Most hormones are controlled using **negative feedback loops**.

Hormones interactions:

- **Permissiveness** (allowing/releasing)
- **Synergism** (increasing or supporting actions)
- **Antagonism** (blocking/inhibiting)

Key Hormonal Systems

A hormonal system is often referred to as an “axis”

Hypothalamus-Pituitary-Adrenal (HPA Axis)

Drives resistance stress response.

Hypothalamus-Pituitary-Gonadal (HPG Axis)

Drives development, reproduction, and aging.

Hypothalamus-Pituitary-Thyroid (HPT Axis)

Drives metabolic control (master thermostat)

Hypothalamus-Posterior Pituitary System

Drives oxytocin and ADH release.

Renin-Angiotensin-Aldosterone System

Manages long-term blood volume, systemic vascular resistance.

Insulin/Glucose/Glucagon System

Regulates blood sugar levels.

Calcium System

Regulates blood Ca^{++} and bone formation.

Sympathetic-Adrenal Medullary (SAM Axis)

Drives alarm stress response (fight or flight)

Digestive System

Regulates appetite and digestion.