

Key Concepts

Homeostasis - the maintenance of a stable internal environment despite external changes

Components of a homeostatic system - Sensor (Receptor): Detects changes in the environment (e.g., thermoreceptors).

-Integrator (Control Center): Compares the detected change to a set point (e.g., hypothalamus).

-Effector: Produces a response to correct deviations (e.g., sweat glands, muscles).

Negative Feedback loops - Counteracts changes from the set point.

- Example: Thermoregulation – if body temp rises, mechanisms lower it.

Positive Feedback Loops - Amplify changes rather than reverse them.

- Example: Childbirth, oxytocin increases contractions.

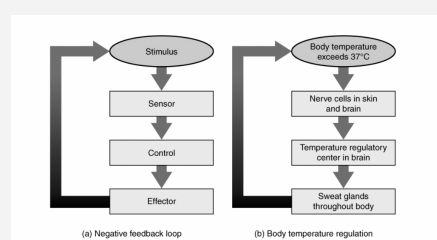
Set Points - Optimal values for physiological parameters (e.g., 98.6°F for body temperature).

- Can be influenced by circadian rhythms, age, or disease.

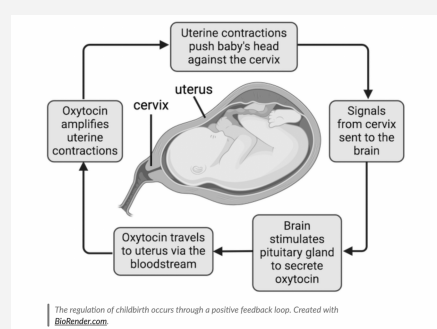
Intrinsic Control Systems

Intrinsic (local) control systems are "built in" to an organ or tissue. e.g., Increased CO₂ production by exercising skeletal muscle leads to relaxation of smooth muscle and dilation of blood vessels, increased blood flow brings more O₂

Negative Feedback Loop



Positive feedback Loop



Extrinsic Control Systems

Extrinsic control systems are contained outside of an organ or system, permitting coordinated regulation of several organs. **Example:** Low blood pressure is detected by the nervous system, which causes an increase in heart rate and constriction of blood vessels

Extrinsic Control Systems (cont)

Example: high blood glucose is detected by the endocrine system which exerts hormonal control [insulin]

Fluid Exchange

In order to maintain homeostasis, cells exchange materials from the intracellular fluid, with the interstitial fluid and blood (specifically plasma)

Plasma- Makes up about 55% of total blood volume, holds the blood cells in suspension.

Plasma is about 90–92% water, the rest includes:

- proteins
- electrolytes
- nutrients
- hormones
- waste products
- clotting factors

Physiological Parameters

Parameter	Normal Range	Regulated by
Body Temperature	~37°C (98.6°F)	Nervous + Integumentary
Blood pH	7.35–7.45	Respiratory + Renal
Blood glucose	70–110 mg/dL	Endocrine
Blood Pressure	~120/80 mmHg	Cardiovascular + Nervous
Plasma Osmolarity	~300 mOsm/L	Renal + Endocrine
Calcium	8.5–10.5 mg/dL	Parathyroid hormone, Calcitonin

Ex. Cardiocascular System

Thermoregulation

Receptors Thermoreceptors and Hypothalamus

Control Center Preoptic area of hypothalamus

Effectors Blood vessels, sweat glands, muscles.

Vasoconstriction → heat retention.

Vasodilation → heat loss.

Definitions

Afferent Signal Sends the information from the sensor to the control center / integrator (sometimes it is not needed if the sensor and control center are the same cell)

Efferent Signal Used to send information from the control center to the effectors (cells/organs) that need to perform an action to help restore homeostasis

Dynamic Equilibrium The state of constant adjustment to maintain homeostasis, acknowledging that internal conditions fluctuate within a normal range.



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