Understanding Homeostasis: The Body's Balancing Act

Principles, Mechanisms, and Real-World Applications

Besir Zeneli

28.01.2025

Objectives

Define homeostasis and its significance.

Explain key components: receptors, control centers, effectors.

Compare negative and positive feedback loops.

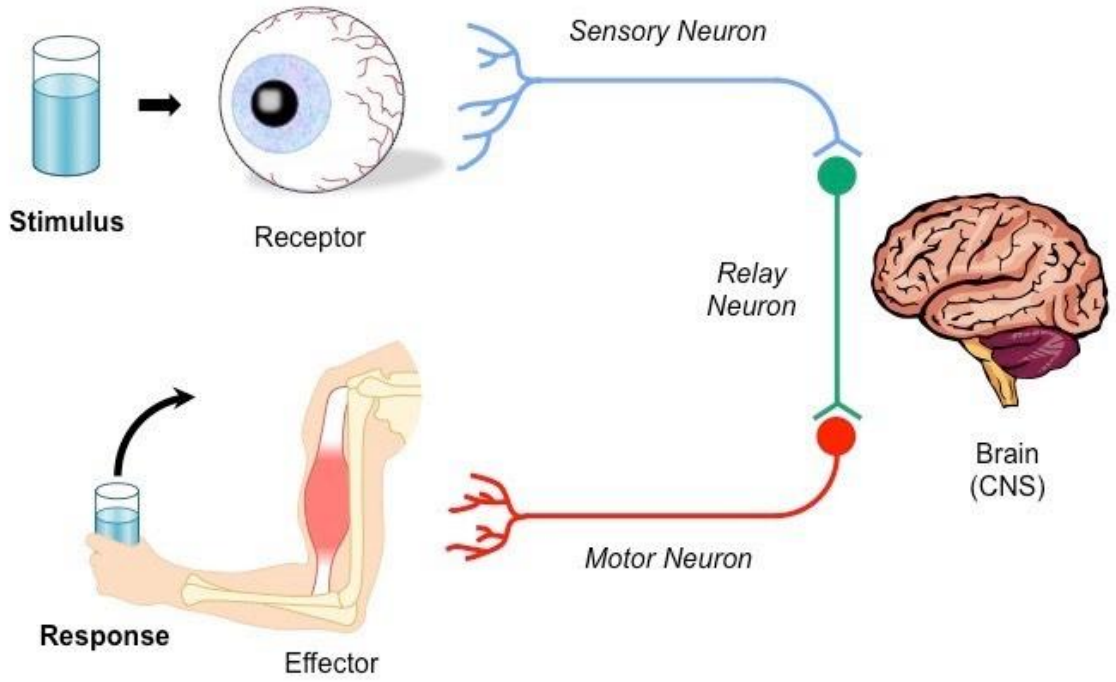
Apply concepts to real-life scenarios (e.g., diabetes, thermoregulation).

What is Homeostasis?

Definition: Maintenance of a stable internal environment despite external changes.

Examples: Body temperature (37°C), blood glucose (~90 mg/dL), pH balance.

Visual: Simple flowchart showing stimulus → response.

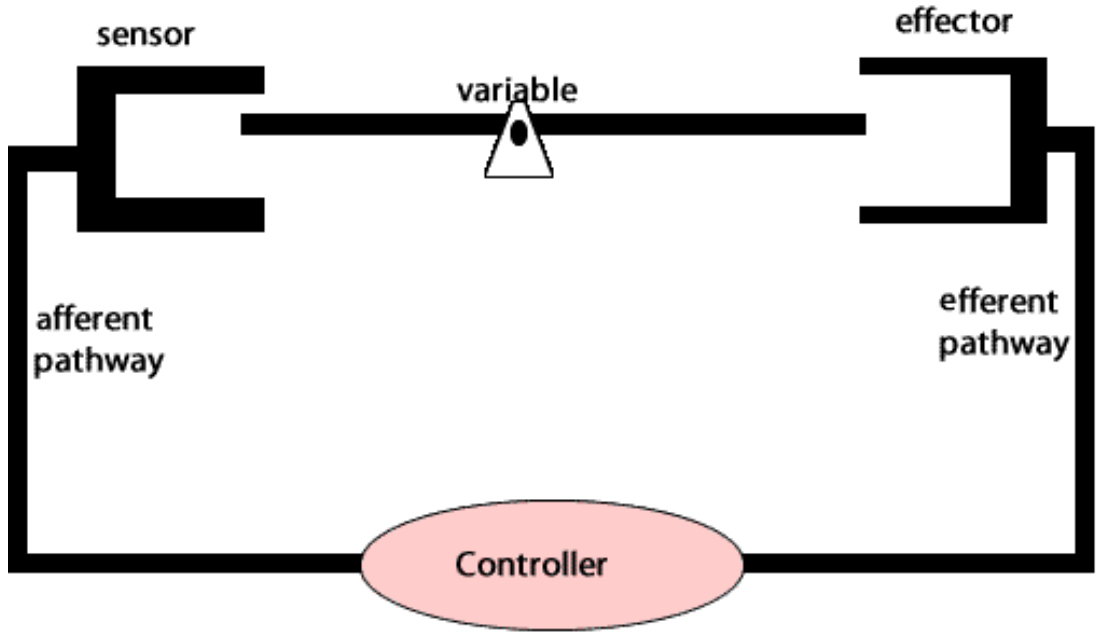


Core Principles

Walter Cannon’s Contributions: "Fight or Flight" and homeostasis terminology.

Key Components:

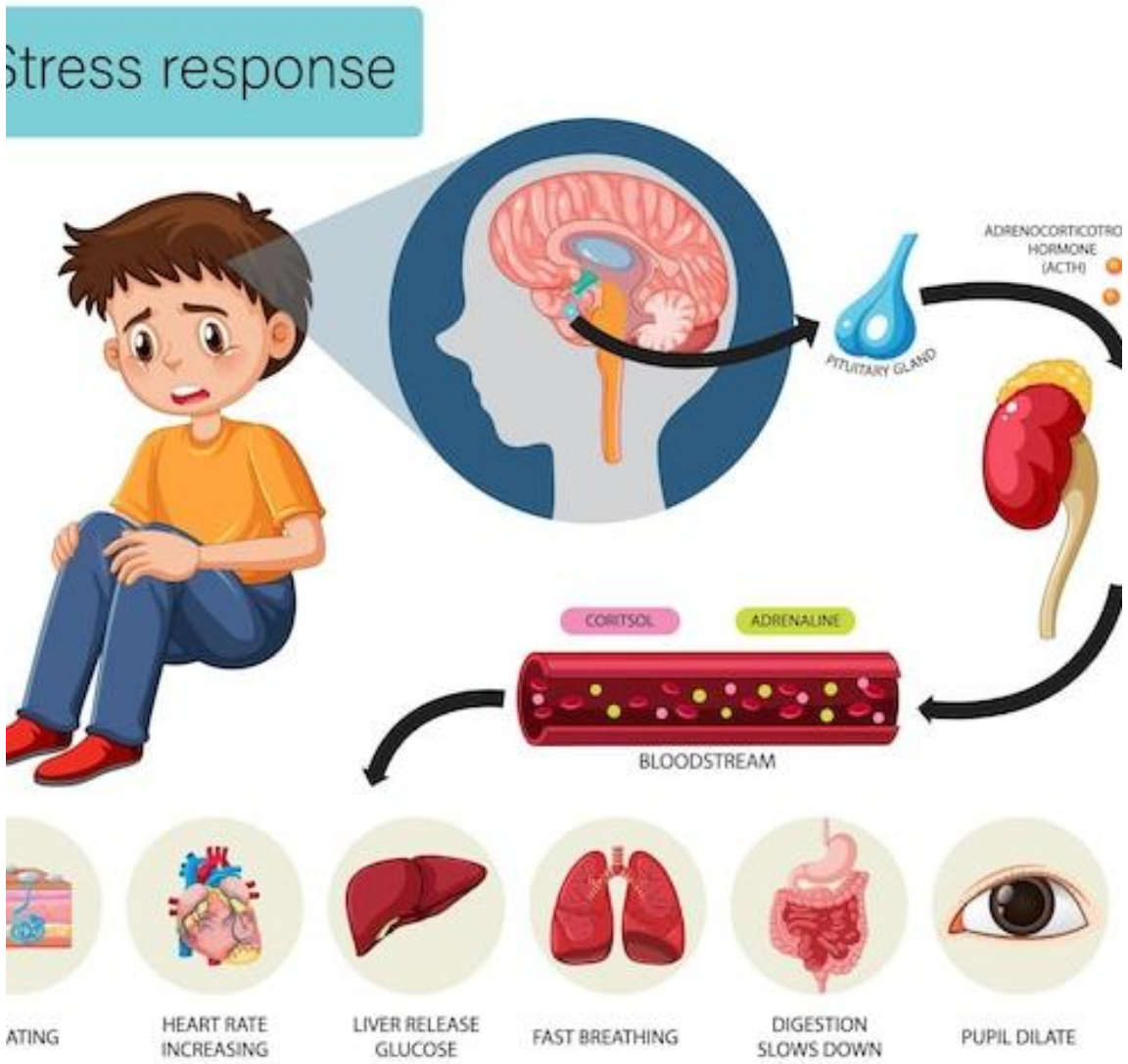
- **Receptors** (detect changes).
- **Control Center** (processes info, e.g., hypothalamus).
- **Effectors** (execute responses, e.g., muscles, glands).



Fight or Flight Response - Examples

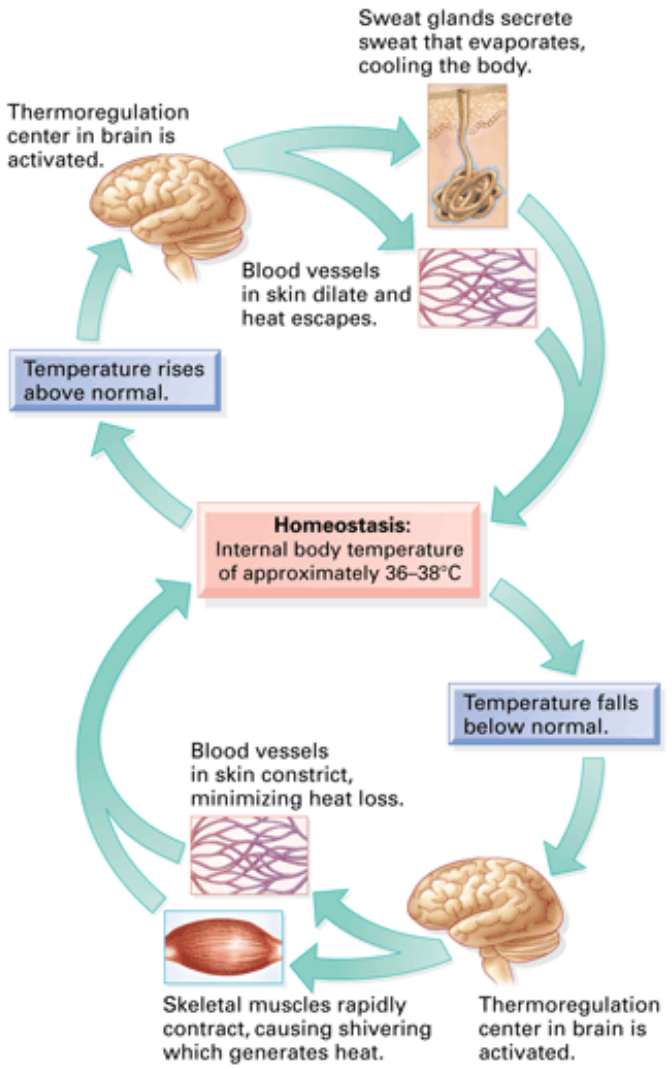
Stressor -> pituitary gland -> ADH hormone -> Adrenal Gland -> Cortisol and Adrenaline -> Response (like sweating, heart rate increasing, fast breathing)

Stress responses (e.g., exams) trigger similar pathways to "fight or flight."



Homeostasis - Examples

Temperature rises -> Thermoregulation center in brain -> blood vessels dilate and sweat glands produce sweat -> temperature returns back to normality



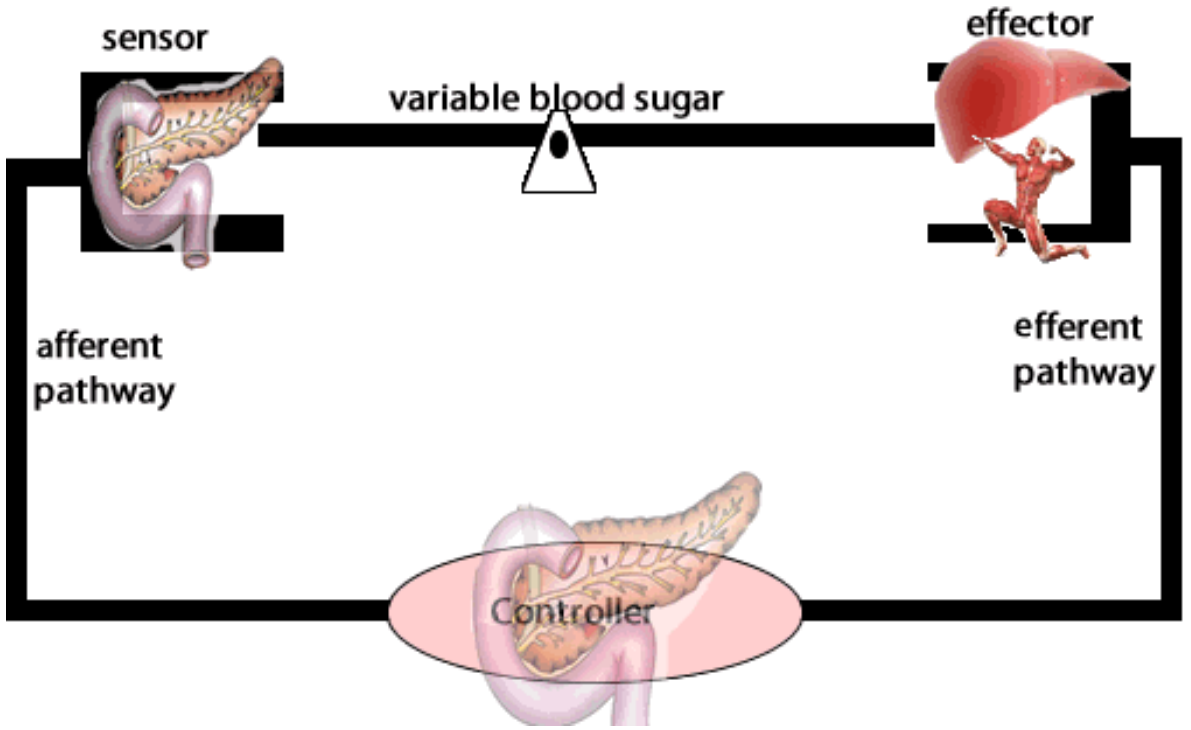
Negative Feedback Loops

Definition: Reduces deviations from set points (most common).

Example: Blood sugar level

Stimulus: High blood sugar level → sensor in pancreas.

Response: Sugar level drops → Normal bood sugar level.



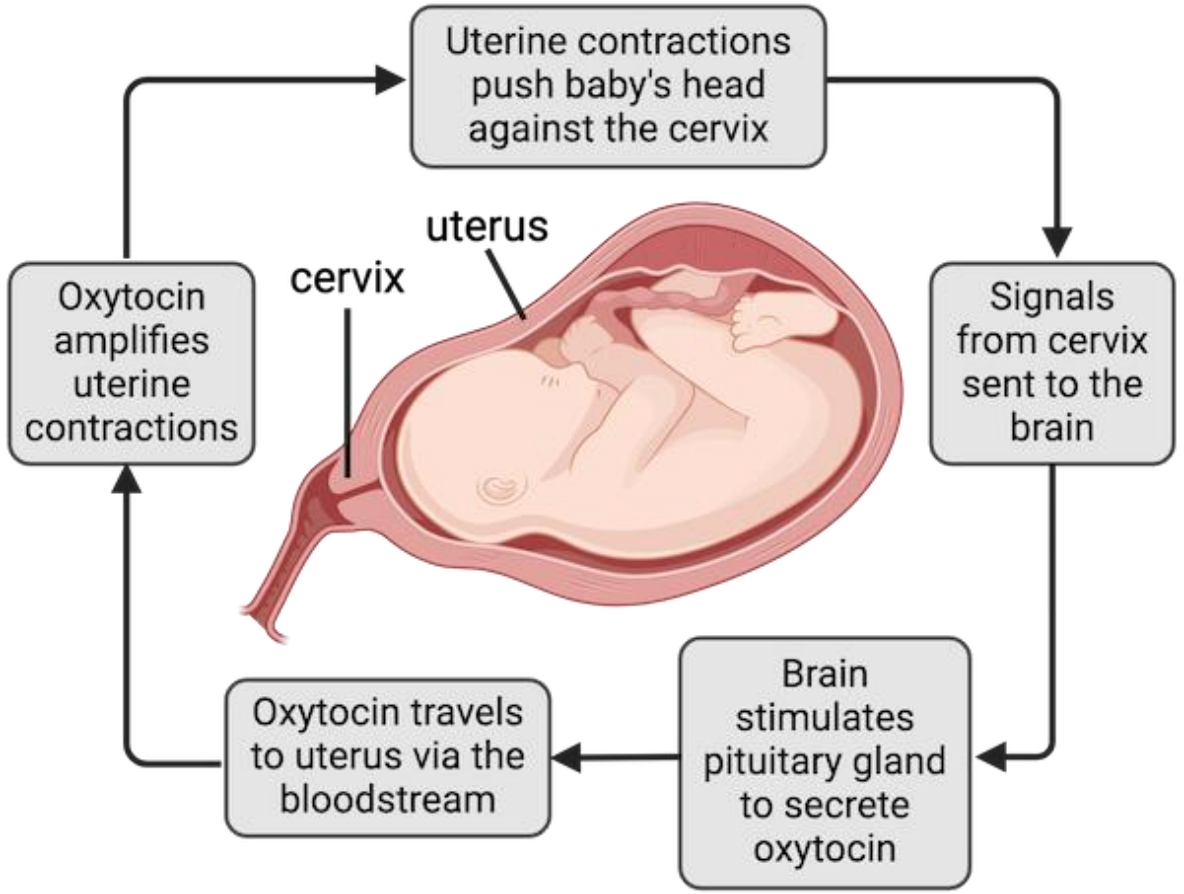
Positive Feedback Loops

Definition: Amplifies changes to complete a process (less common).

Example: Childbirth

Stimulus: Oxytocin release → intensified contractions.

Response: Baby delivered → loop stops.



Real-Life Applications

Diabetes: Breakdown in glucose regulation (insulin/glucagon). Insulin decreases blood sugar level, while glucagon increases it.

Thermoregulation: Fever response causes increase in body temperature, while exercise causes decrease in body temperature.

Kidneys: Water balance via ADH.