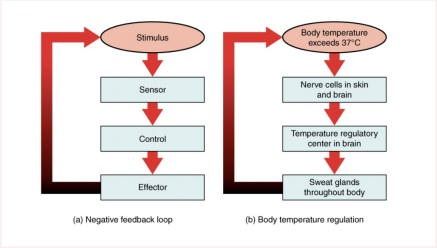
Key Concepts

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.

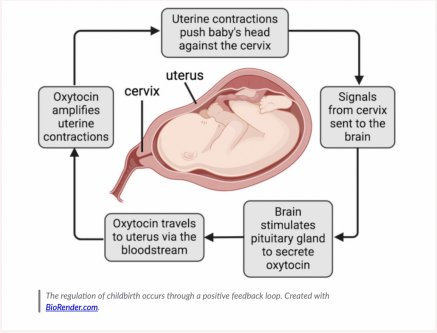
Intrinsic Control Systems

Intrinsic (local) control systems are “built in” to an organ or tissue.	e.g., Increased CO 2 production by exercising skeletal muscle leads to relaxation of smooth muscle and dilation of blood vessels, increased blood flow brings more O 2

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 insterstitial 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 Osmalarity	~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.