

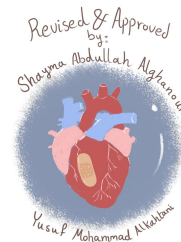


# Homeostasis(1+2)

Team Leaders:

Haya Alenazi

Abdulrahman Alswat



**Red: Important**

**Black: In Male & Female slides**

**Blue: In male slides**

**Pink: In female slides**

**Green: Notes & extra information**

# Objectives

- Understand the concept and importance of homeostasis.
- Understand how the steady state is monitored.
- Discuss the physiological control mechanisms that enable maintenance of the normal steady state of the body.
- Identify and describe the compensatory responses to any change in the steady state.
- Define a feedback mechanism and describe its components.
- Differentiate between positive and negative feedback mechanisms and give examples for each in the body.
- Apply the knowledge gained in feedback mechanisms to disturbances in the disturbances in ECF volume and osmolarity.
- Define the concept of the "internal environment" and state its physiological importance and differentiate between the external and internal environment.

# The concept of the "internal environment"

All the cells in the body are continuously bathing in fluid which called "Extracellular fluid" = ECF

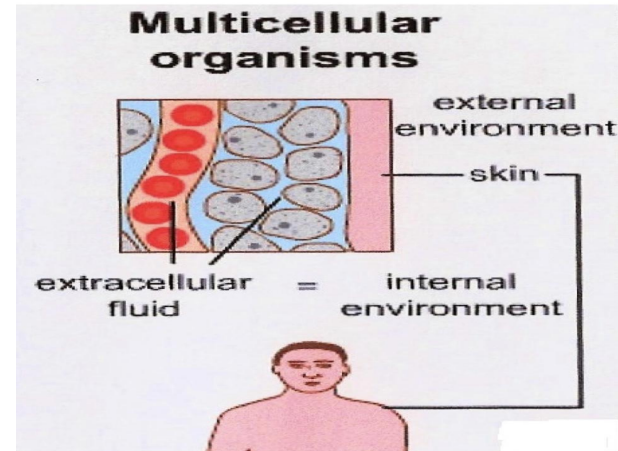
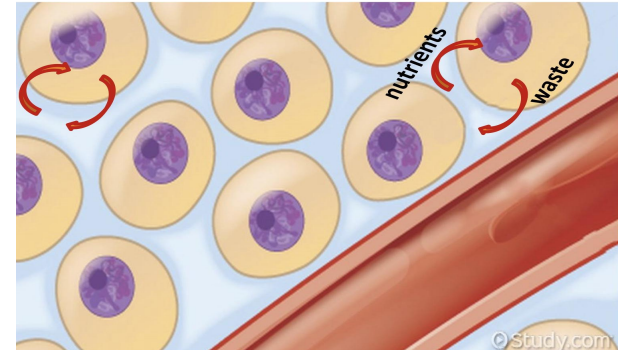
It was named "the internal environment" = ECF  
By french physiologist claude bernard

We have external and internal environment,  
The skin separate them.

All body cells live in the same environment and that means; composition of ECF is almost similar between the different species.

The skin separates this environment from the outside world which known as the external environment.

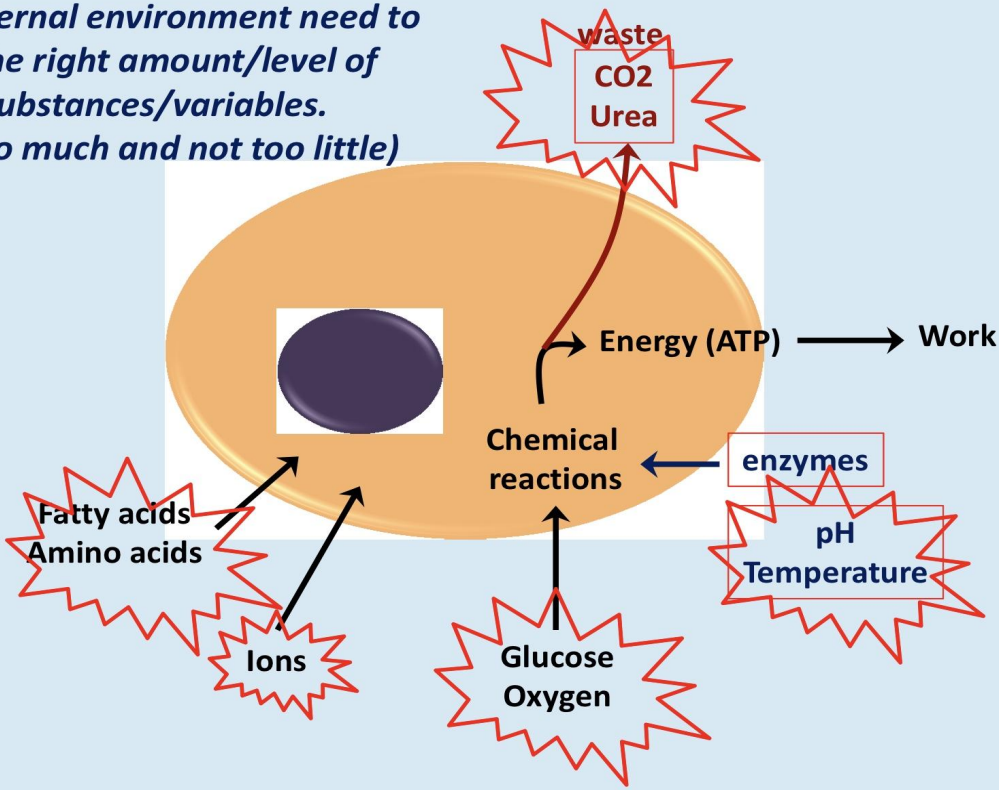
It's from the ECF that cells get the ions nutrients needed to maintain life.



# External vs internal environment

*In order for the cell to function properly,*

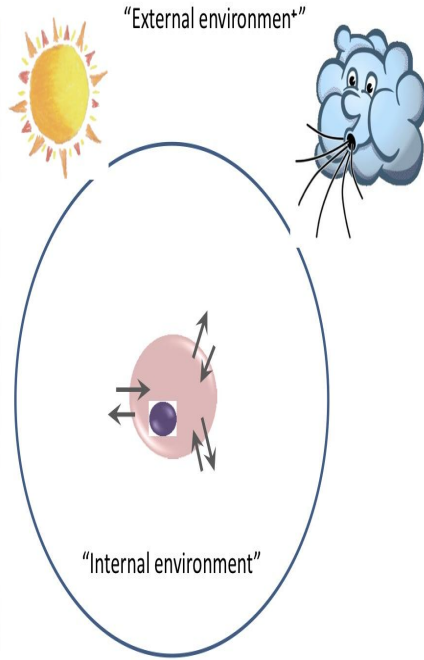
*The internal environment need to have the right amount/level of these substances/variables. (not too much and not too little)*



# External vs Internal environment

In Multicellular organisms

In Unicellular organisms



Internal environment = External environment



# HOMEOSTASIS:

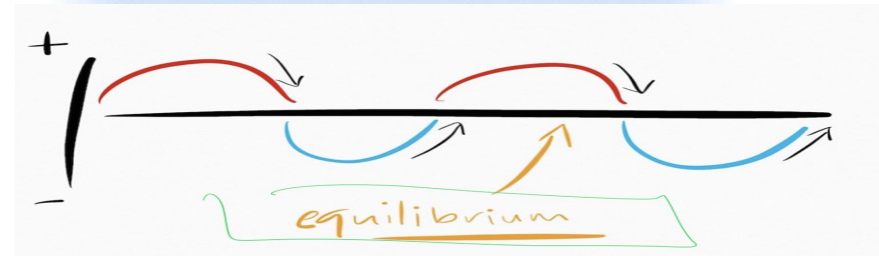
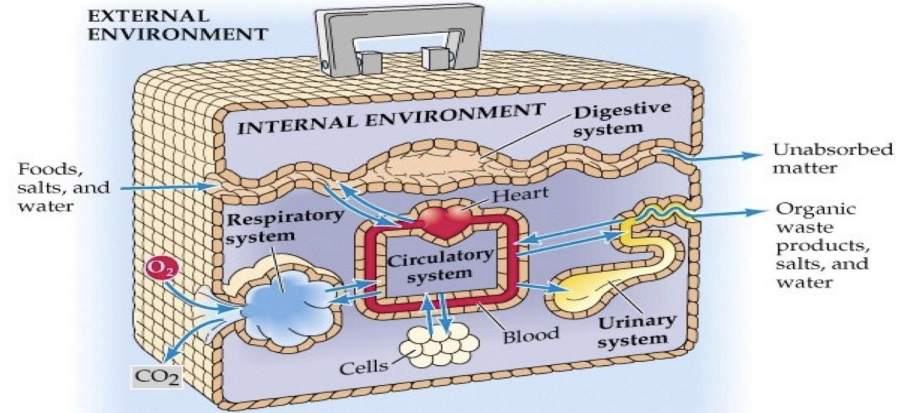
## • What is Homeostasis?

Homeo= sameness, similarity  
stasis=standing

- It is the ability to maintain a relatively stable internal environment in an ever-changing outside world.
- The internal environment of the body (ECF) is in (a dynamic state of equilibrium).
- The process by which the body keeps the internal environment constant despite changes in the external environments
- All different body systems operate in harmony to provide homeostasis.
- The internal environment must be kept constant in the face of an ever changing external environment

-Essentially all the functions of the body organs and tissue aim at keeping the internal environment at a nearly constant state

## External vs Internal environment

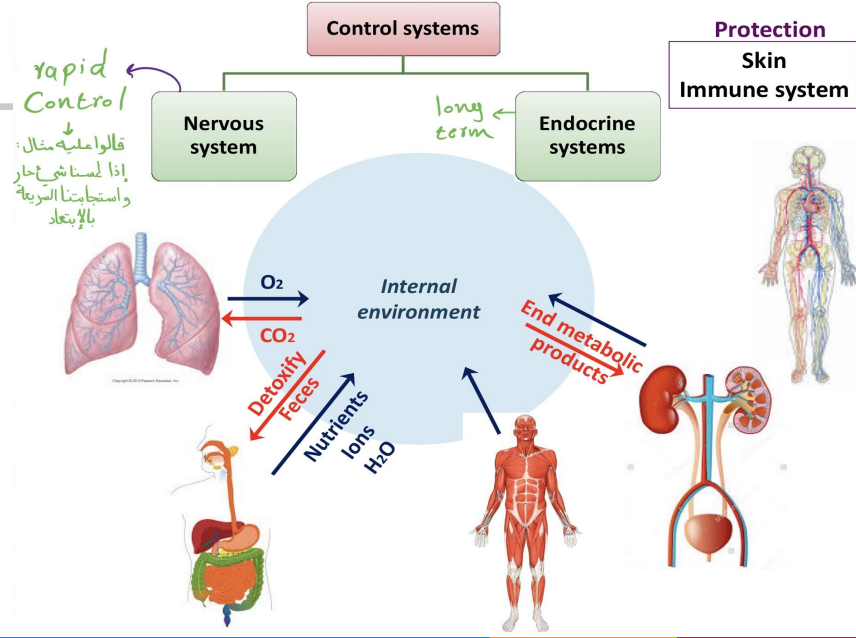
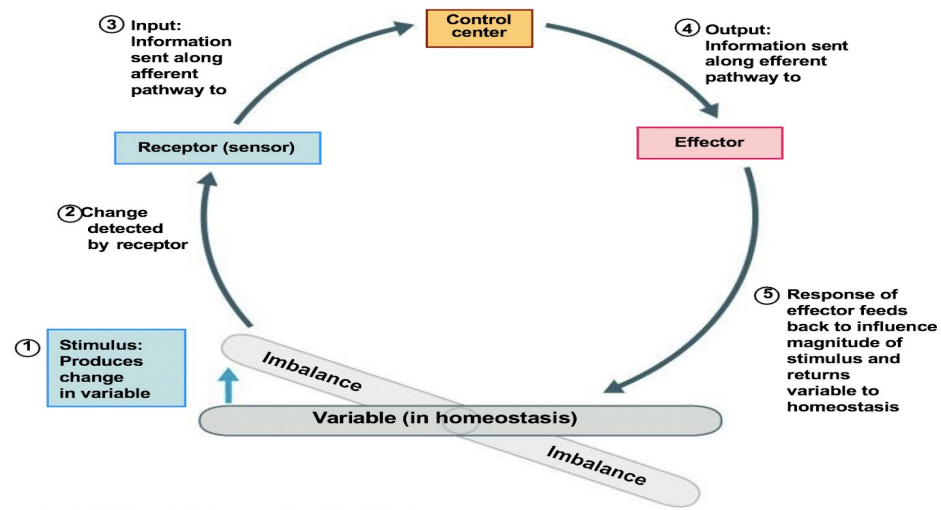


# HOMEOSTATIC CONTROL MECHANISM:

- Variable -> Change in the body (Stimuli).
- There are three interdependent components of control mechanisms:
  - **Receptor**: monitors the environments and responds to changes (stimuli).
  - **Control center**: determines the set point at which the variable is maintained.
  - **Effector**: provides the means to respond to the stimulus.

- The body has thousands of control system
- They function to restore balance when it is lost.
- **Control system operate:**
  - within the organ itself
  - Throughout the body → to control **interrelations between organs**

## Homeostatic Control Mechanisms



**Body constituents are normally regulated within a range rather than a fixed value;**

### Concentrations of Extracellular and Intracellular Electrolytes in Adults

Electrolyte	Extracellular Concentration*	Intracellular Concentration*
Sodium	135–148 mEq/L	10–14 mEq/L
Potassium	3.5–5.0 mEq/L	140–150 mEq/L
Chloride	98–106 mEq/L	3–4 mEq/L
Bicarbonate	24–31 mEq/L	7–10 mEq/L
Calcium	8.5–10.5 mg/dl	< 1 mEq/L
Phosphate/ phosphorus	2.5–4.5 mg/dl	4 mEq/kg <sup>†</sup>
Magnesium	1.8–2.7 mg/dl	40 mEq/kg <sup>†</sup>

\*Values may vary among laboratories, depending on the method of analysis used.

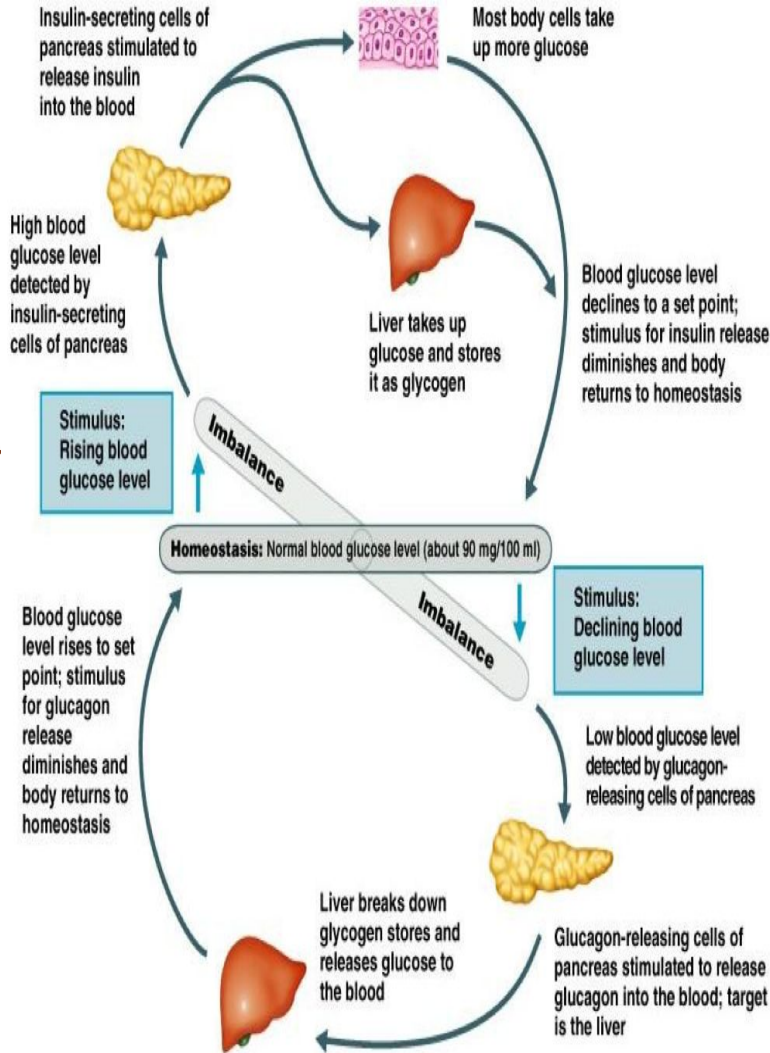
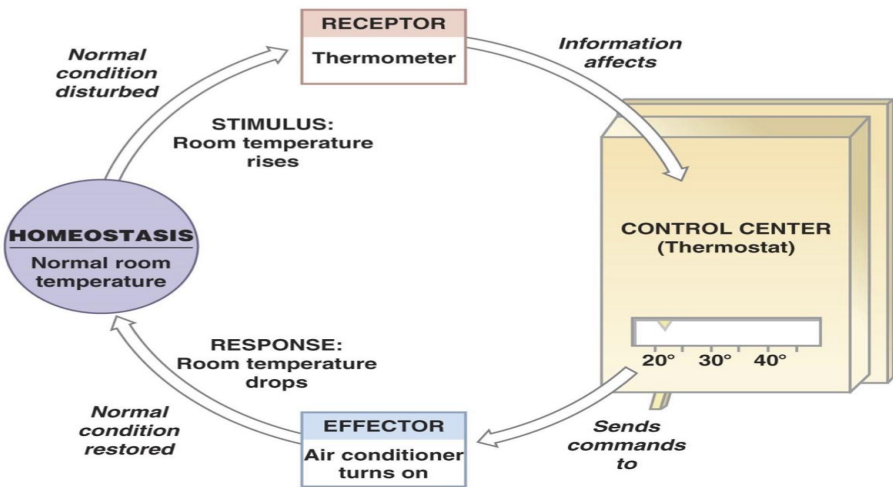
<sup>†</sup>Values vary among various tissues and with nutritional status.

# Feedback Mechanism:

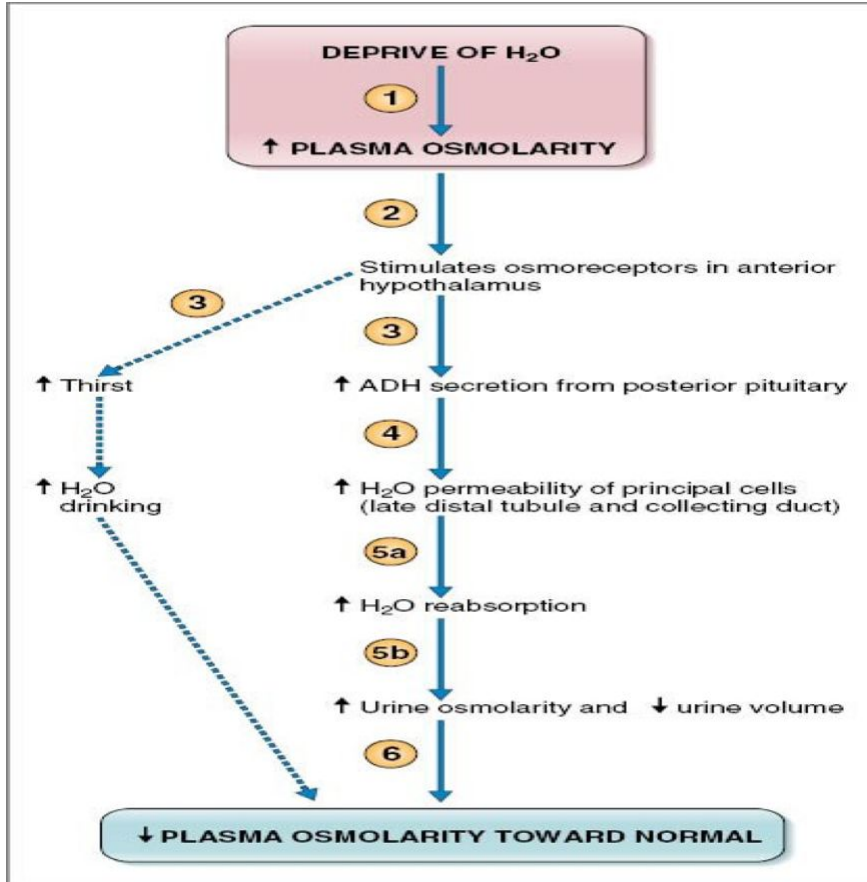
## What is meant by feedback?

A loop system in which the system responds to perturbation either in the same direction (positive feedback) or in the opposite direction (negative feedback).

## The Thermostat Analogy







# Types of Feedback Mechanisms

## Negative feedback

The effector response of the system is in the **opposite direction** to the stimulus that initiated the response.

E.g;

- A **high level of in CO<sub>2</sub>** in the ECF will increase pulmonary ventilation, increasing the amount of CO<sub>2</sub> expired which will **bring the level of CO<sub>2</sub> in ECF down**.
- Most of the control systems of the body act by negative feedback.

## Positive feedback

The effector response is in the same direction of the stimulus that initiated the response.

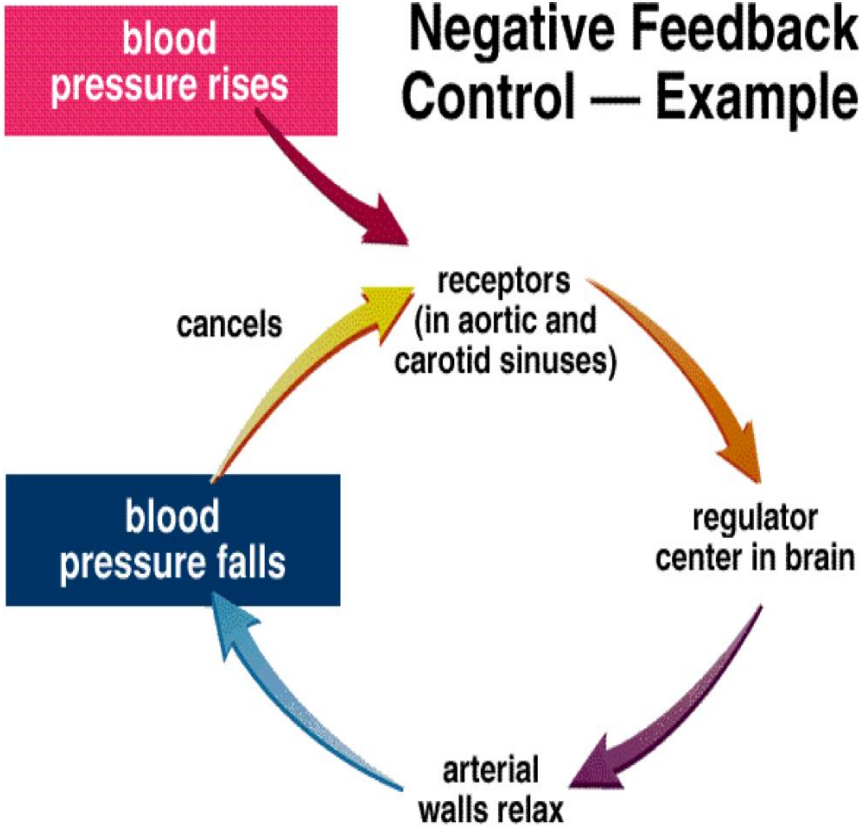
نفس المزد كل واحد يرفع على الثاني

E.g;

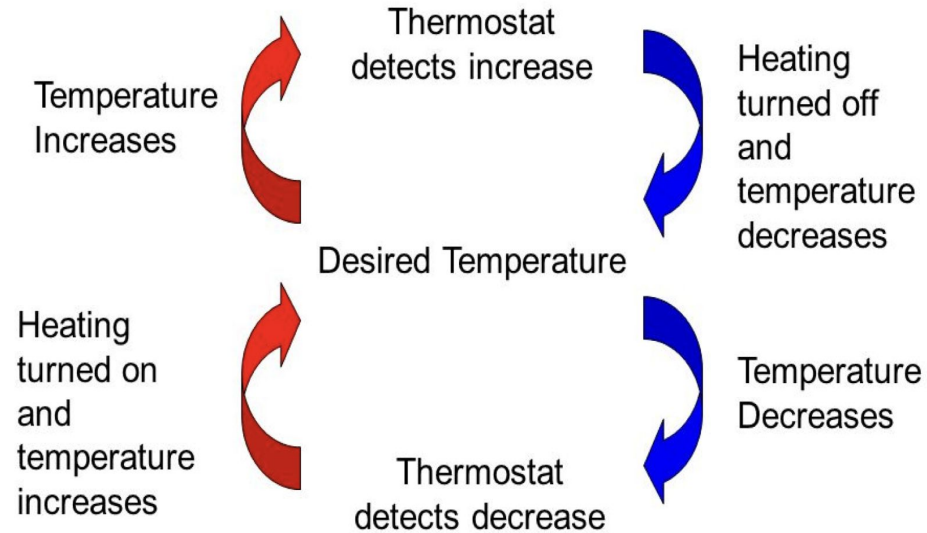
- In nerve signaling, **entry of a small amount of Na<sup>+</sup>** into the cell will open more Na<sup>+</sup> channels **causing more Na<sup>+</sup> to enter the cell**.
- Only few systems display positive feedback mechanisms.. **WHY?**

# Examples of negative feedback (1)

## Negative Feedback Control — Example



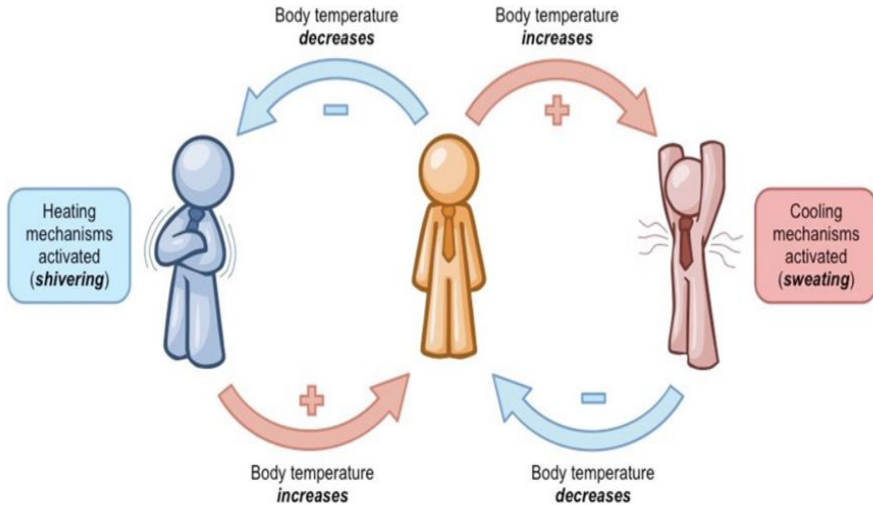
## Negative Feedback (thermostat analogy)



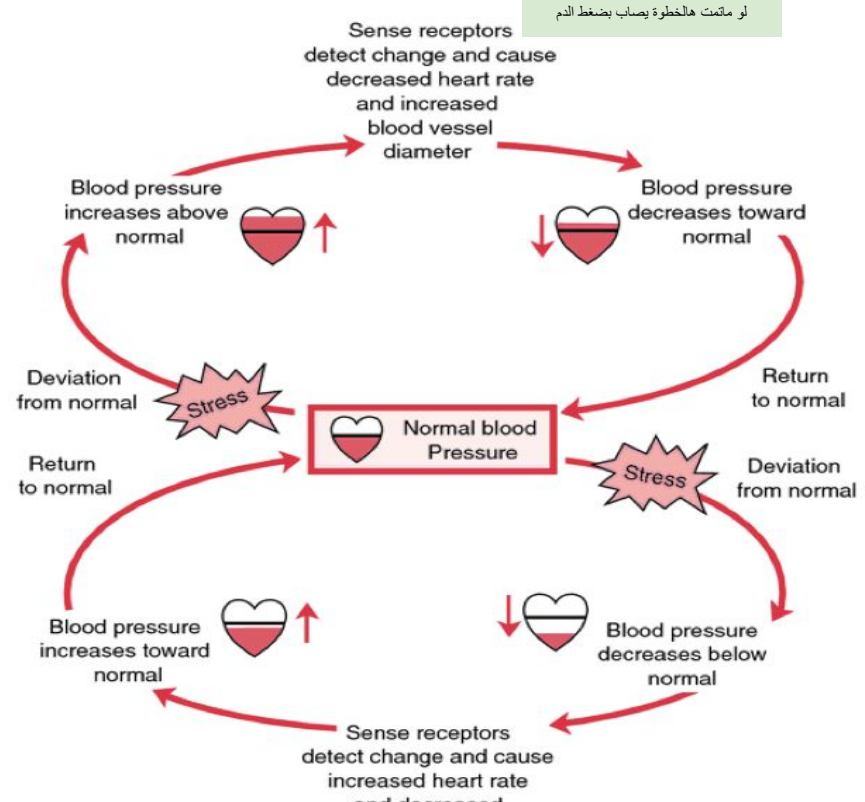
# Examples of negative feedback (2)

## Examples of Negative Feedback Mechanisms

### Body temperature control



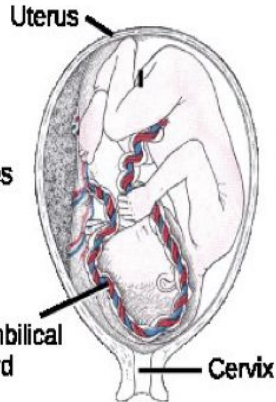
### Blood pressure control



# Examples of positive feedback (3)

## Childbirth

The baby pushes against the cervix, causing it to stretch.



Stretching of the cervix causes nerve impulses to be sent to the brain.

Oxytocin causes the uterus to contract.

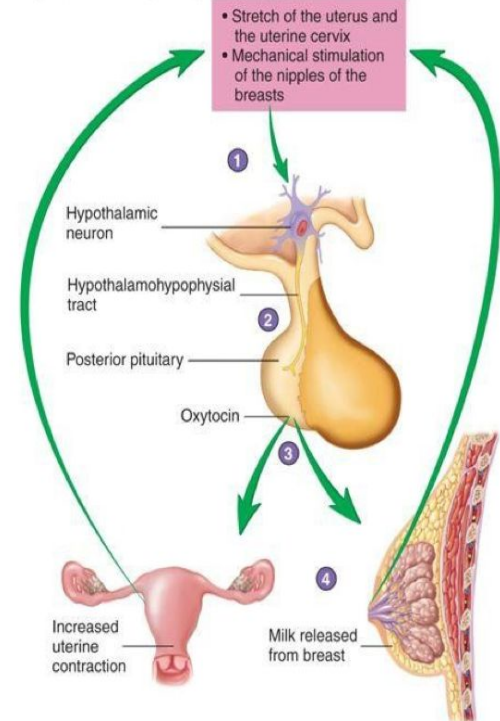
The brain stimulates the pituitary to release oxytocin.

*Can you find other examples for a positive feedback mechanism in the body?*

## Control of Oxytocin Secretion

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

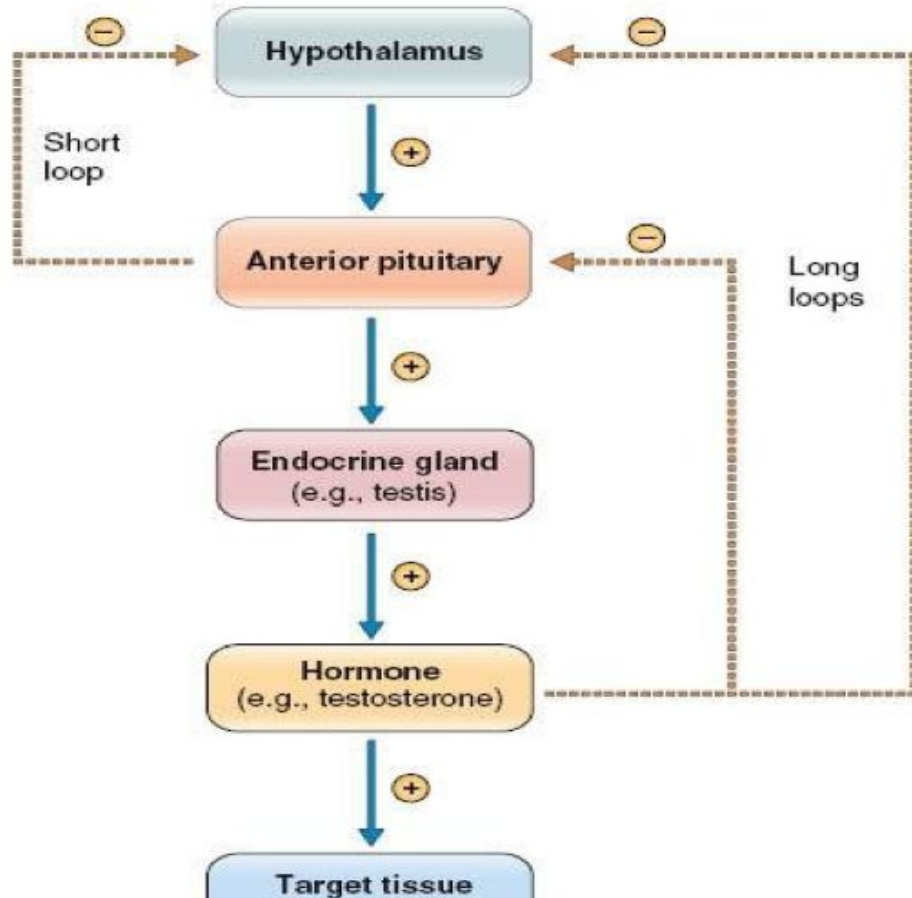
- 1 Stretch of the uterus and the uterine cervix or stimulation of the breasts' nipples increases action potentials in axons of oxytocin-secreting neurons.
- 2 Action potentials are conducted by sensory neurons from the uterus and breast to the spinal cord and up ascending tracts to the hypothalamus.
- 3 Action potentials are conducted by axons of oxytocin-secreting neurons in the hypothalamohypophysial tract to the posterior pituitary, where they increase oxytocin secretion.
- 4 Oxytocin enters the circulation, increasing contractions of the uterus and milk ejection from the lactating breast.



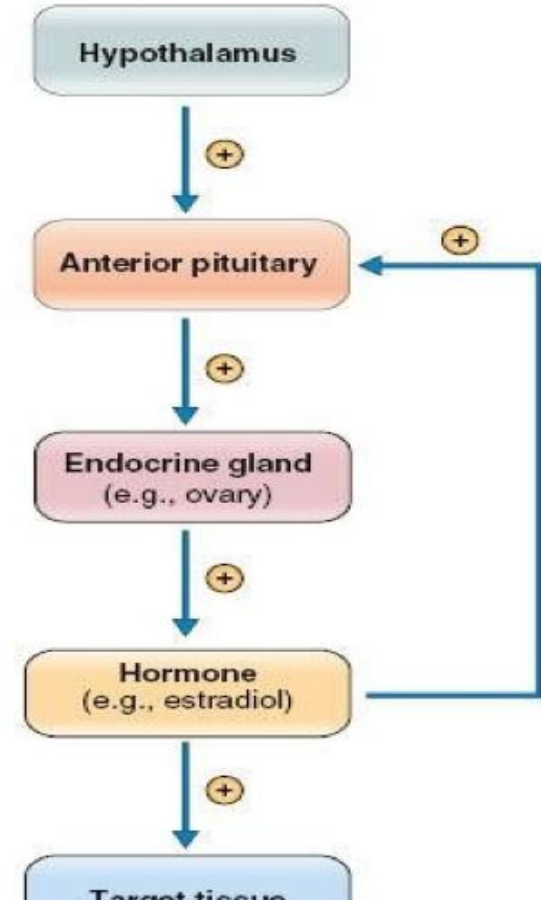
cont..

This slide was found only in male slide

### NEGATIVE FEEDBACK



### POSITIVE FEEDBACK



## REGULATION OF BODY FUNCTIONS:

### 1) Nervous system:

- **Sensory input:** detect the state of the body, or the state of the surroundings, it comes through the sensory organs (the eyes, ears..)
- **Central nervous system (CNS):** determines the required reaction to response to the sensations, and produce a signal.
- **MOTOR OUTPUT:** Perform the desired action.
- Faster in regulation of body function

### 2) Hormonal system of regulation:

- Hormones are being secreted from the major 8 endocrine glands(pancreas, thyroid...) in the body to the extracellular fluid and then to all parts of the body to help regulate cellular functions.
- E.g: insulin is secreted from the pancreas to help control glucose level.
  - Slower in regulation of body function

# HOMEOSTATIC IMBALANCE:

- It is the disturbance of homeostasis or the body's normal equilibrium.
- It basically produces a change in the normal condition of the internal environment.

The homeostasis then will produce a reaction that will either be:

## ★ Successful compensation:

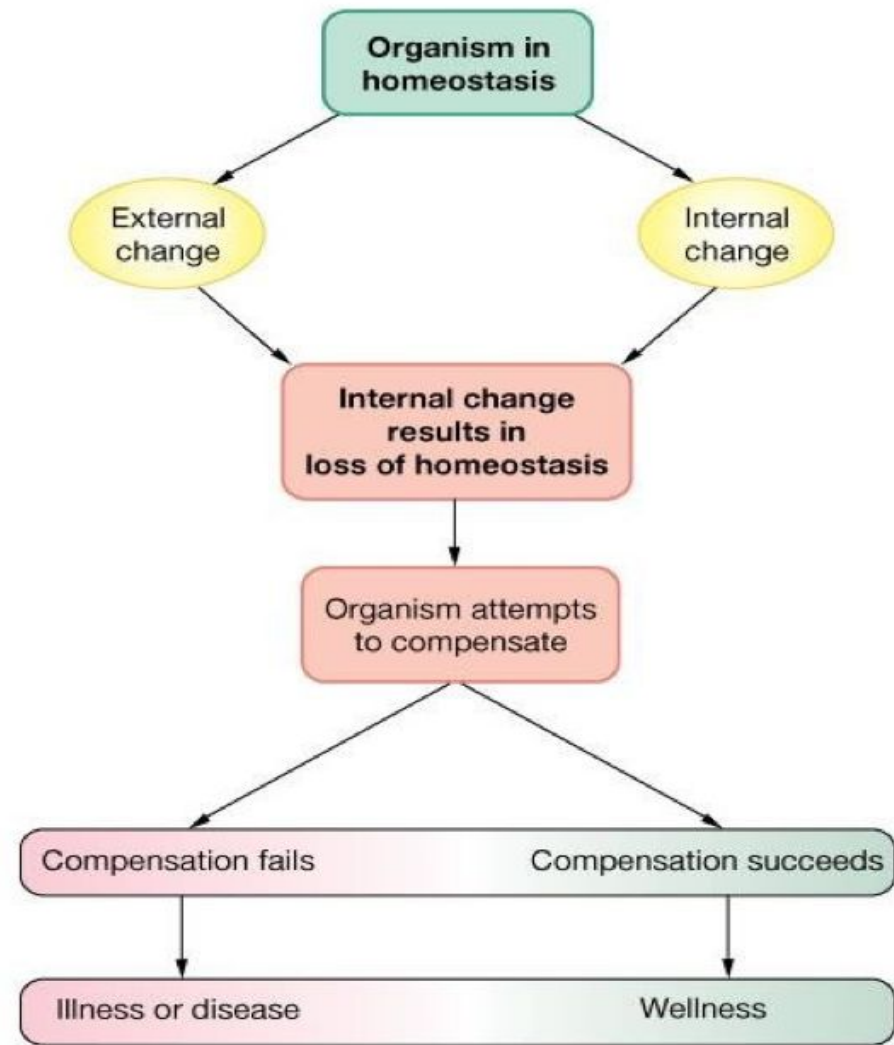
- Homeostasis reestablished.

## ★ Failure to compensate:

- Pathophysiology.

- Illness.

- Death.



# QUIZ!

## MCQs

Q1: control of Oxytocin secretion is a type of :

A) Osmosis

B) Negative feedback

C) positive feedback

D) Disease

Q2: "A loop system in which the system responds to perturbation either in the same direction of the opposite direction"

A) Positive feedback

B) negative feedback

C) A & B

D) non of these

Q3: heart/ kidney failure cause low capillary pressure

A) True

B) False

C)

D)

Q4 : the synonym of Extracellular fluid is

A) External environment

B) internal environment

C) intracellular environment

D) A & C

## SAQ

Q1:

What are the three interdependent components of control mechanisms?

Q2:

Give one example of negative feedback

MCQs key answer :  
1) C  
2) C  
3) B  
4) B

SAQ answer key :  
1) Receptor - control center  
effector  
2) body temperature control ...



# Thank You

## Team members:

- ▶ ماجد العسكر
- ▶ مشعل الثنيان
- ▶ عبد العزيز الربيعة
- ▶ باسل فقيها
- ▶ **محمد بياري**
- ▶ محمد السلطان
- ▶ عبد الرحمن الدويش
- ▶ مرشد الحربي
- ▶ منيب الخطيب
- ▶ نايف الشهري
- ▶ فيصل العمري
- ▶ عبد العزيز الغليقة
- ▶ عبد العزيز السحيم

- ▶ **حصة الطيبان**
- ▶ شذى الظهير
- ▶ سمو الزير
- ▶ نورة الشثري
- ▶ سارة القحطاني
- ▶ ريناد الحميدي
- ▶ ياسمين القرني
- ▶ يارا الزهراني
- ▶ لمى الأحمدى
- ▶ آلاء السلمي
- ▶ سارة العيدروس
- ▶ بدور المبارك
- ▶ فرح البكر
- ▶ سارة العبيد



• Made by



Contact info: physiology439@gmail.com



Editing file



Physiology 439 file