

# Internal Environment & Homeostasis

**Dr. Abdulsalam Bani Hamad**

Department of Physiology and Biochemistry  
Mutah University

**24/02/2026**

# Contents

- Levels of Organization in the Body
- Concept of Homeostasis
- Homeostatic Control Systems

# Levels of Organization in the Body

From the chemical level to the  
whole body

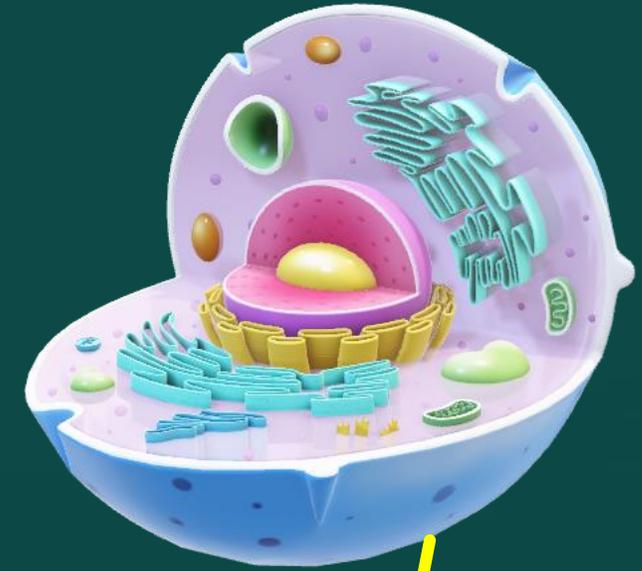
## The chemical level

- The human body is a combination of **specific atoms**, which are the **smallest building blocks** of matter.
- 96% : O<sub>2</sub>, C, H, N
- The atoms combine to form the molecules of life, such as **proteins, carbohydrates, fats, and nucleic acid**.



## The cellular level

- The nonliving chemical components must be **arranged and packaged** in precise ways to form a living entity.
- The **cell**, the **fundamental unit** of both structure and function in a living being, is the **smallest** unit capable of carrying out the processes associated with life.



**Plasma membrane**

## The cellular level

- During development of complex multicellular organisms such as humans, each cell also **differentiates**, or becomes specialized to carry out a particular function.
- Human body is made up of about **200 specialized types of cells**.

## Basic Cell Functions

1. Obtaining nutrients and O<sub>2</sub>
2. Energy production  
 $\text{Food} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$
3. Waste removal.
4. Protein synthesis
5. Transport
6. Being sensitive and responsive to changes in the surrounding environment.
7. In the case of most cells, reproducing.

## Basic Cell Functions

1. Obtaining nutrients and O<sub>2</sub>
2. Energy production  
Food + O<sub>2</sub> → CO<sub>2</sub> + H<sub>2</sub>O + energy
3. Waste removal.
4. Protein synthesis
5. Transport
6. Being sensitive and responsive to changes in the surrounding environment.
7. In the case of most cells, reproducing.

## Specialized Cell Functions

- It is usually a modification or elaboration of a basic cell function.
- The **basic cell functions** are essential for survival of individual cells, whereas the **specialized contributions and interactions** among the cells of a multicellular organism are essential for survival of the whole body.

## The cellular level

- During development of complex multicellular organisms such as humans, each cell also **differentiates**, or becomes specialized to carry out a particular function.
- Human body is made up of about **200 specialized types of cells**.

## The tissue level

- Cells of similar structure and specialized function combine to form **tissues**.
- There are four primary types of tissues: **muscle, nervous, epithelial, and connective**.

## The organ level

- Organs consist **of two or more types of primary tissue** organized to perform particular functions.

## The organ level

- Organs consist **of two or more types of primary tissue** organized to perform particular functions.

## The body system level

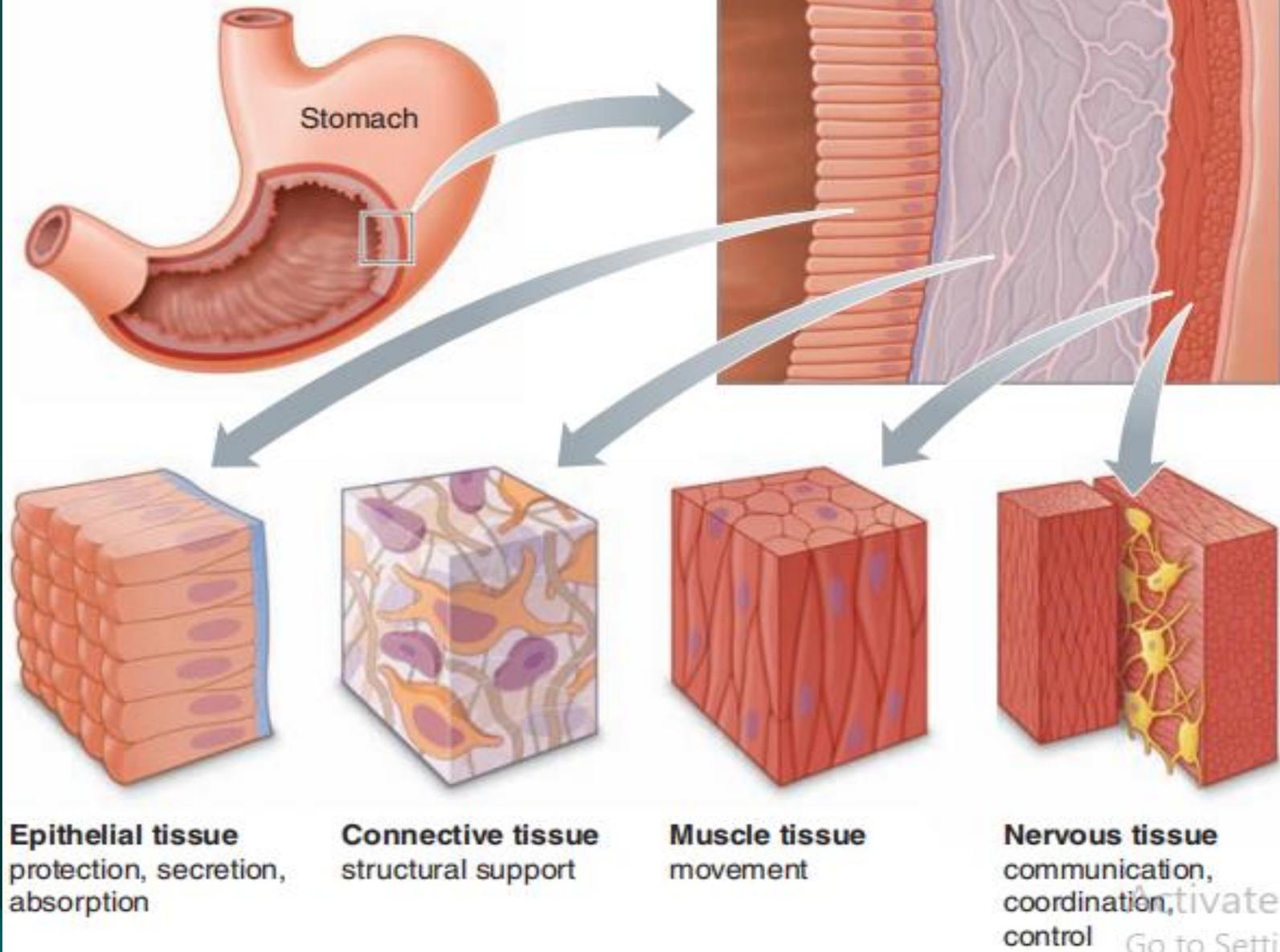
- A body system is a collection of related organs.
- The human body has 11 systems.

## The organism level

- The body systems are packaged into a functional whole body.

**Organ:**

Body structure that integrates different tissues and carries out a specific function

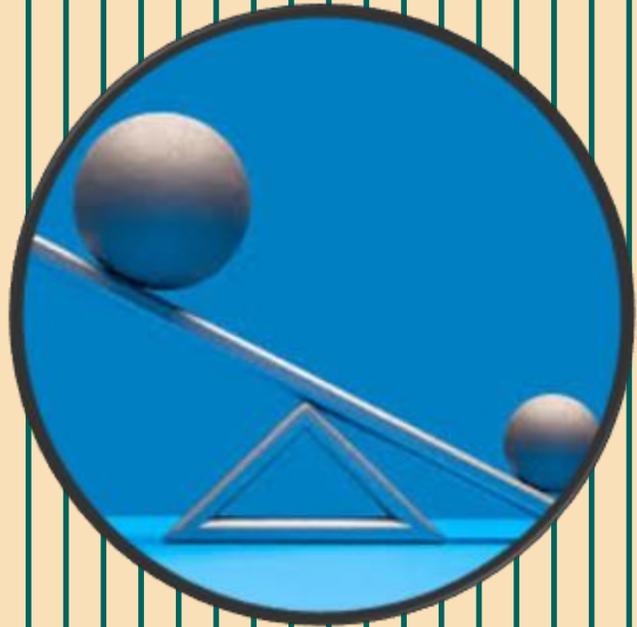


# Concept of Homeostasis

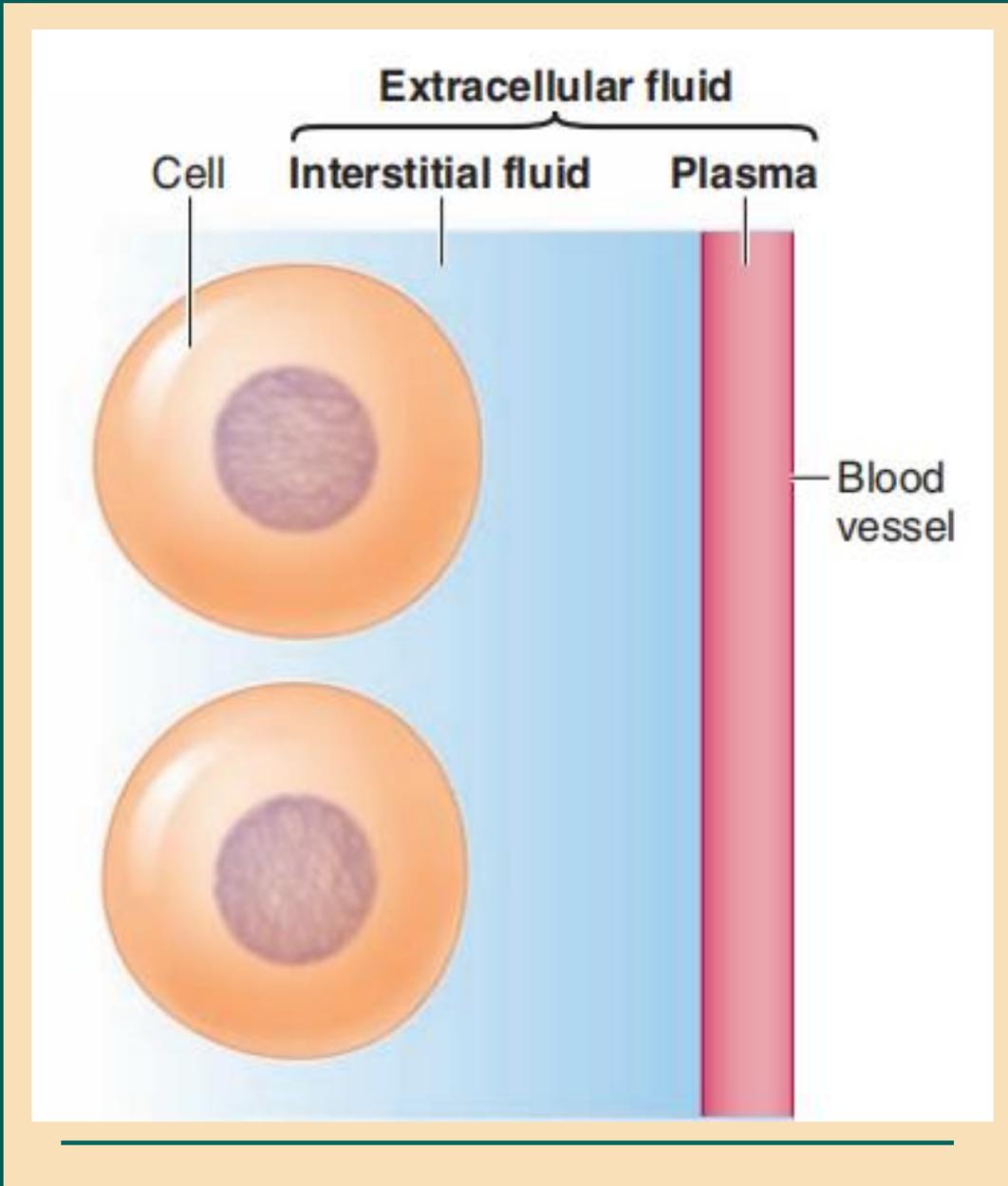
# Concept of Homeostasis

- The cells in a multicellular organism cannot live and function without contributions from the other body cells because most cells are **not in direct contact with the external environment**.
- **The external environment:** is the surrounding environment in which an organism lives.
- **The internal environment:** is the fluid that surrounds the cells and through which they make life-sustaining exchanges.

# Homeostasis

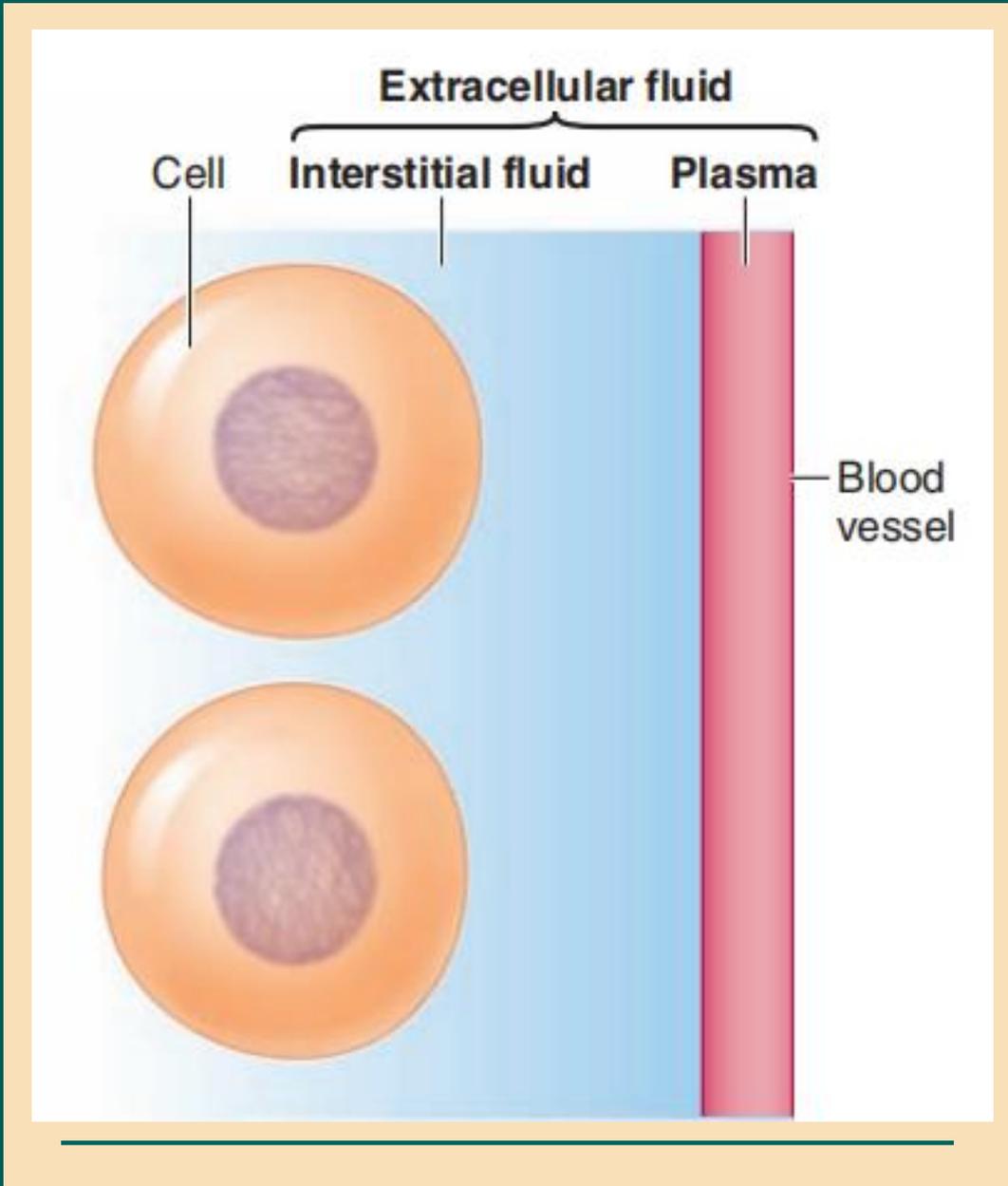


- The relatively stable conditions inside the body needed for survival.
- A dynamic steady state in the internal environment.



# Internal environment

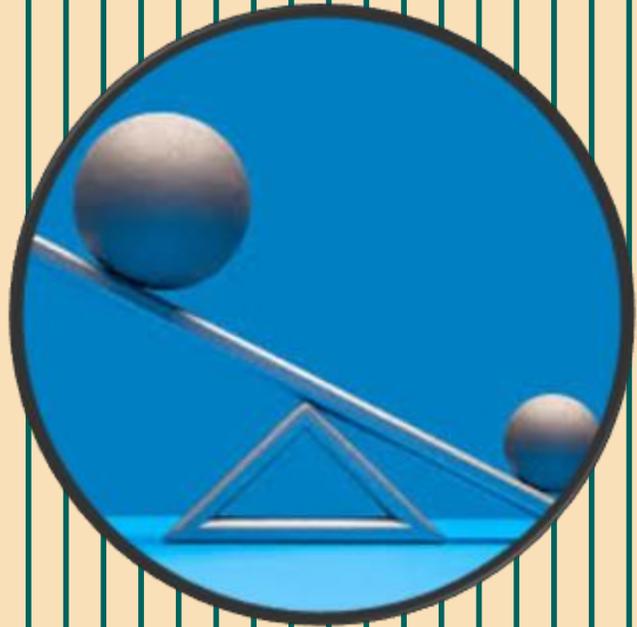
- The fluid collectively contained within all body cells is called **intracellular fluid (ICF)**.
- The fluid outside the cells is called **extracellular fluid (ECF)**.
- ❖ Note that the ECF is outside the cells but inside the body.
- ❖ Thus, the **ECF** is the internal environment of the body



# Internal environment

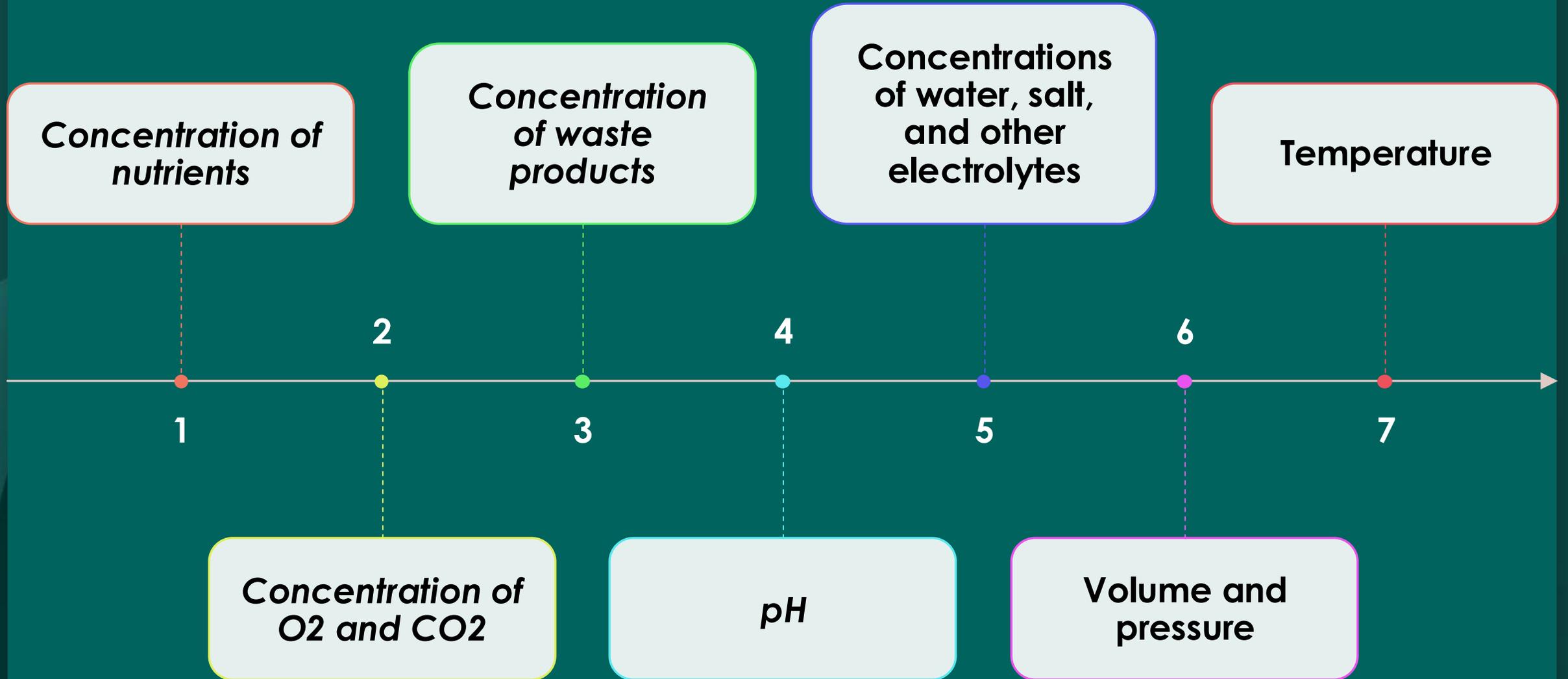
- Body cells can live and function **only when the ECF is compatible with their survival**; thus, the chemical composition and physical state of this **internal environment must be maintained within narrow limits**.
- Maintenance of a relatively stable internal environment is termed **homeostasis** (homeo means “similar”; stasis means “to stand or stay”).

# Homeostasis



- Thus, homeostasis **is not a rigid, fixed state** but **a dynamic steady state** in which changes that occur are minimized by compensatory physiological responses.

# Homeostatically Regulated Factors



# Homeostatic Control Systems

# Homeostatic control system

- It is **a functionally interconnected network of body components** that operates to maintain a given factor in the internal environment at a relatively constant optimal level.
- To maintain homeostasis, the control system must be able to:
  1. **Detect deviations from normal.** (Receptor or Sensor)
  2. **Integrate this information with any other relevant information.** (Control Center)
  3. **Make appropriate adjustments in the activity of the body parts responsible for restoring this factor to its desired value.** (Effector)

# Homeostatic control system

- Homeostatic control systems may operate **locally or bodywide**.
- Homeostatic control systems can be grouped into two classes—**intrinsic and extrinsic controls**.
- Extrinsic control of the organs and body systems is accomplished by the **nervous and endocrine systems**, the two major regulatory systems.

- In **negative feedback**, a change in a homeostatically controlled factor triggers a response that seeks to restore the factor to normal by moving the factor in the **opposite direction of its initial change**.

**Negative  
feedback**

## 1. Body Temperature Regulation

- $\uparrow$  Temperature  $\rightarrow$  sweating  $\rightarrow$   $\downarrow$  Temperature
- $\downarrow$  Temperature  $\rightarrow$  shivering  $\rightarrow$   $\uparrow$  Temperature

## 2. Blood Glucose Regulation

- $\uparrow$  Glucose  $\rightarrow$  insulin release  $\rightarrow$   $\downarrow$  Glucose
- $\downarrow$  Glucose  $\rightarrow$  glucagon release  $\rightarrow$   $\uparrow$  Glucose

## 3. Blood Pressure Regulation

- $\uparrow$  BP  $\rightarrow$  baroreceptors activate  $\rightarrow$   $\downarrow$  heart rate  $\rightarrow$   $\downarrow$  BP

# Examples of Negative Feedback

### Body Temperature Regulation



↑ Temperature → Sweating



↓ Temperature → Shivering

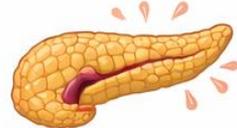
### Blood Glucose Regulation



↑ Glucose → ↓ Glucose



↓ Glucagon Release → ↑ Glucose



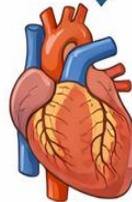
### Blood Pressure Regulation



↑ Blood Pressure

↓ Baroreceptors Activated

↓ Heart Rate



# Examples of Negative Feedback

- With **positive feedback**, by contrast, the output enhances or amplifies a change so that the controlled variable continues to **move in the direction of the initial change**.

**Positive  
feedback**

## 1. Childbirth (Labor):

- Cervical stretch → oxytocin release
- Oxytocin → stronger contractions
- Stronger contractions → more stretch
- Continues until delivery

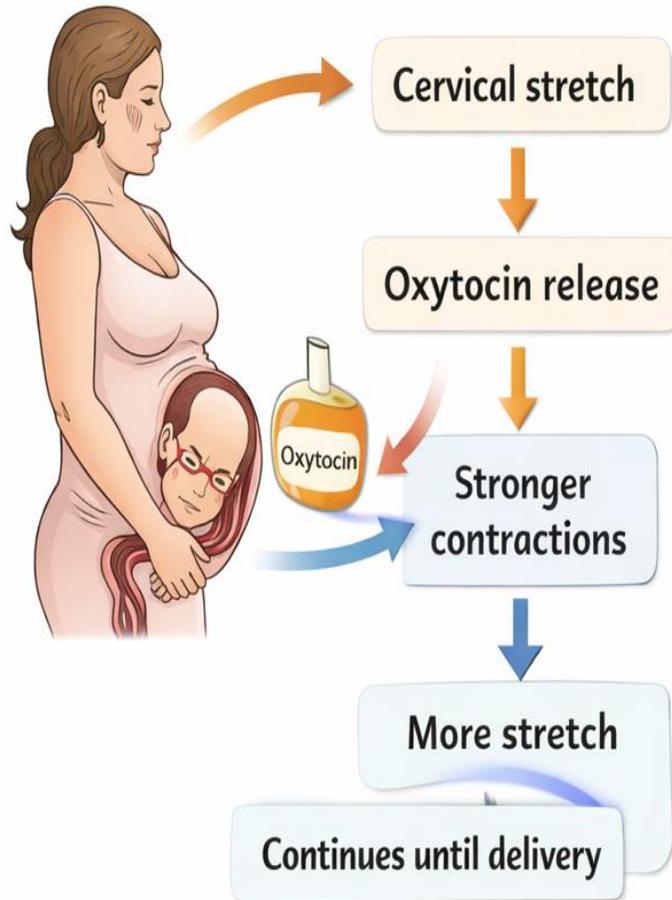
## 2. Blood Clotting

- Vessel injury → platelet activation
- Activated platelets → attract more platelets
- Amplifies until clot forms

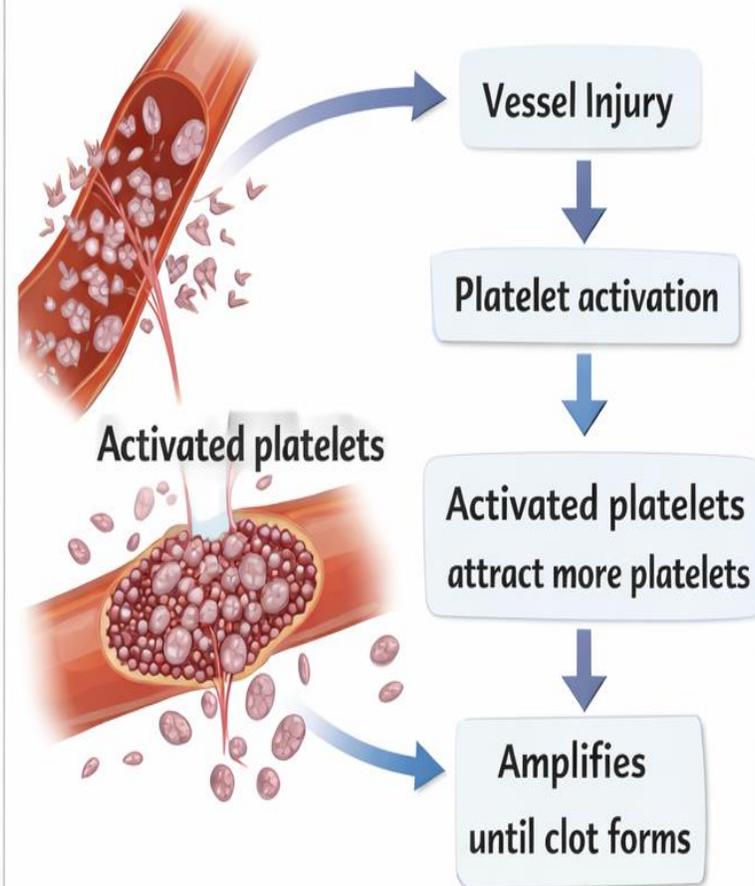
**Examples of  
Positive  
feedback**

## Examples of Positive Feedback

### Childbirth (Labor)



### Blood Clotting



Examples of  
Positive  
feedback

**Note:**

**Because the major goal in the body is to maintain stable, homeostatic conditions, positive feedback does not occur nearly as often as negative feedback.**

**Thank You**