



# PHYSIOLOGY

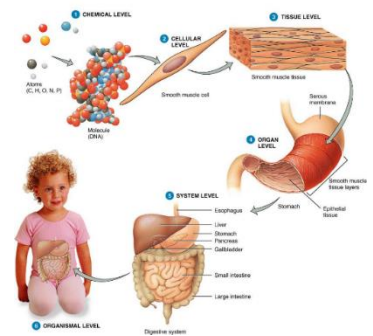
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# 2025

Study smarter, not harder!

## Introduction to Physiology

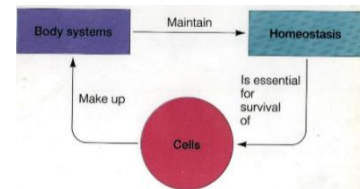
- **Physiology:** It is the science that studies body functions and regulation of these functions
- Body structures are highly organized into many levels:



- **Chemical level:** include *atoms* and *molecules*
  - ✓ Atoms most commonly include C, H, O
  - ✓ Molecules are composed of many atoms (such as water, DNA)
- **Cellular level:** Include cells which are the *smallest functional unit* of the body, that can reproduce and function independently
- **Tissue level:** Composed of many cells with specific properties that serve their function
  - ✓ Examples: Muscle tissue, Nerve tissue, Epithelial tissue, Connective tissue
- **Organ level:** Composed of many tissues having the same target
- **System level:** Consist of many related organs with a common function
  - ✓ Examples: Gastrointestinal, urinary, respiratory, endocrine, reproductive, nervous system
  - ✓ Each system works for a certain function, but **all of them** aim to keep the internal environment almost constant (Homeostatic function)
  - ✓ The **nervous and endocrine** systems are the **controlling systems** (**regulate** body function)

## Homeostasis

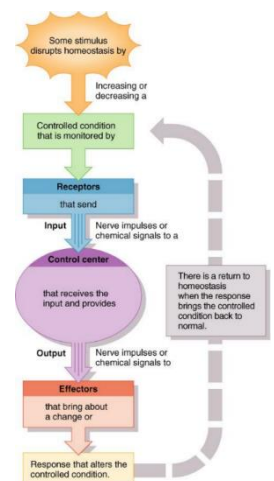
- It is a condition of *equilibrium (balance)* in the internal environment of the body, where a variable is maintained *almost constant* in a *narrow range*
- Variable: A condition in the internal environment of the body
- Homeostasis is *dynamic* not static, where the body has a normal range of values for each variable with narrow variation



- If the homeostatic state is **disturbed** (changed, fluctuated), balance is **restored** by the **feedback system**
- Feedback system has three basic components:

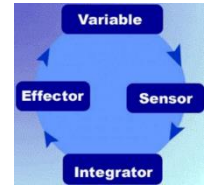
### 1. Receptors (sensors)

- Structures that *monitor* (sense, detect) changes in a condition (variable)
- **Send input** signals to the control center
- Examples:
  - Nerve ending of the skin in response to temperature change
  - **Baroreceptors:** receptors of blood pressure
  - **Osmoreceptors:** monitors the concentration (osmolarity) of solutes



## 2. Control center (integrator)

- Receive inputs, *evaluate* (analyze, integrate) them to make a *decision* and then generate *outputs*
- It includes *brain, spinal cord* (central nervous system) and some *gland*



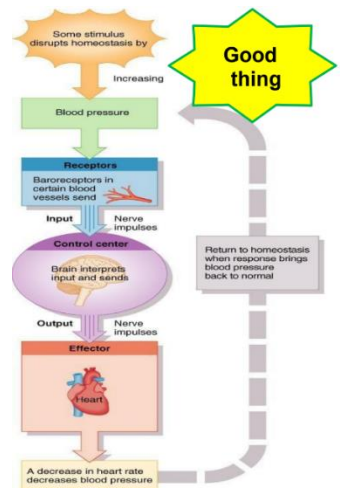
## 3. Effectors

- Receives output from the control center, and then *produces a response* (effect)
- Found in nearly every organ or tissue
- Signals (inputs and outputs) can be either *electrical impulses* or *hormones*

- Feedback system is divided into:

### A. Negative feedback

- The response *opposes (negates)* the stimulus
- *Most conditions* are controlled by the negative feedback system
- Examples:



- *Blood pressure*: any change in the blood pressure is detected by *baroreceptors*, which send inputs to the brain, then the *heart and blood vessels* (effectors) respond to the stimulus
- *Ions (such as Ca<sup>+2</sup>) concentration in the blood*: when the concentration of calcium decreases, *PTH* hormone is released which increases bone resorption, Ca<sup>+2</sup> intestinal absorption and renal reabsorption
- *Glucose blood level*: when glucose:
  - ✓ **Increases**, *β cells* of the pancreas release *insulin* which stimulate glucose entry to the cells reducing its blood level
  - ✓ **Decreases**, *α cells* of the pancreas release *glucagon* which stimulates the release of glucose from there store by the degradation of glycogen, elevating (increasing) its blood level

### B. Positive feedback


- The response *reinforces (boost)* the stimulus
- Examples:
  - *Normal childbirth (delivery)*: as the delivery get closer, more *oxytocin* is released
  - *Blood clotting*
  - *Extreme blood loss (hemorrhage)*

## Past Papers


- Which one of the following best describes homeostasis?*
  - More glucose in the blood → more insulin → less glucose in the blood
  - Less glucose in the blood → more glucagon release → more glucose in the blood
  - Low blood pressure → more sympathetic activity → higher pressure
  - A&C
  - All of the above
- Rapid growth during puberty causes your body to release more and more growth hormones. As you grow, more and more growth hormones are released until puberty is reached, and then the hormones stop. This represents a:*
  - Positive Feedback Response
  - Negative Feedback Loop
  - None of the above
  - More than one of the above
- Which of the following is TRUE about homeostasis?*
  - Maintaining variables of the body at a fixed level
  - Essential for the survival of cells
  - Is the responsibility of the nervous & endocrine systems only
  - More than one of the above
- When the body temperature increases, thermoreceptors sends signals to the hypothalamus, then sweating increases. Which of the following is FALSE*
  - Thermoreceptors are the sensors
  - Hypothalamus is the regulatory center
  - Sweat glands are the effectors
  - This is positive feedback as the increase of temperature caused an increase in sweating
  - None of the above
- As you get dehydrated, your blood becomes thicker and harder to pump. Your kidneys will respond by stopping urine production, sending the water from urine into your bloodstream to thin your blood back to normal level is a*
  - Positive Feedback Response
  - Negative feedback loop
  - Not a regulatory mechanism
  - Both A & B
- An increase in the concentration of carbon dioxide above it's normal range is detected by a(n):*
  - sensor
  - messenger
  - afferent
  - integrator
  - effector

### Answers

- E
- A
- B
- D
- B
- A

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