Case-based Exercise on Cellular and Molecular Physiology

Goal: Learn to apply concepts of the course to real-life physiological and clinical situations — not just recall definitions.

What is this exercise?

- You will be presented with **short clinical/physiological scenarios**.

- Each scenario gives you **background knowledge** + a **situation** to analyze.

- Your task: **reason out** the mechanism of homeostasis involved (or why it fails).

How to do it

- Step 1: Read the background carefully.
- Step 2: Discuss the case → identify the stimulus, the system affected, and the type of feedback.
- Step 3: Answer the guiding question(s).
- Step 4: Compare your reasoning with the interpretation given.

Modes of participation

In groups (recommended) → small teams discuss and agree on an answer.

By show of hands → class votes on possible answers before revealing the interpretation.

Individually → each student writes their reasoning, then shares.

Why this matters for you

These scenarios mirror the type of reasoning required in exam questions.

It is not enough to memorize definitions: you must be able to apply mechanisms to real or clinical situations.

Practice in discussion (group or plenary) will train you to think step-by-step.

Exercise: When Homeostasis Fails

Learning Objectives

- **Understand how homeostatic mechanisms normally maintain stability.**
- **Identify the control systems (sensors, effectors, feedback loops).**
- **Recognize what happens when compensation is not sufficient.**
- **Apply reasoning to clinical and physiological case scenarios.**

Exercise: When Homeostasis Fails

Key Concepts to Recall

- **Negative feedback:** stabilizes internal environment (e.g. temperature, glucose, pH).
- **Positive feedback:** amplifies a process until completion (e.g. childbirth, clotting).
- **Feed-forward control:** anticipates a change before it happens (e.g. shivering before cold exposure).
- **Failure of homeostasis** → pathophysiology → illness → potentially death.

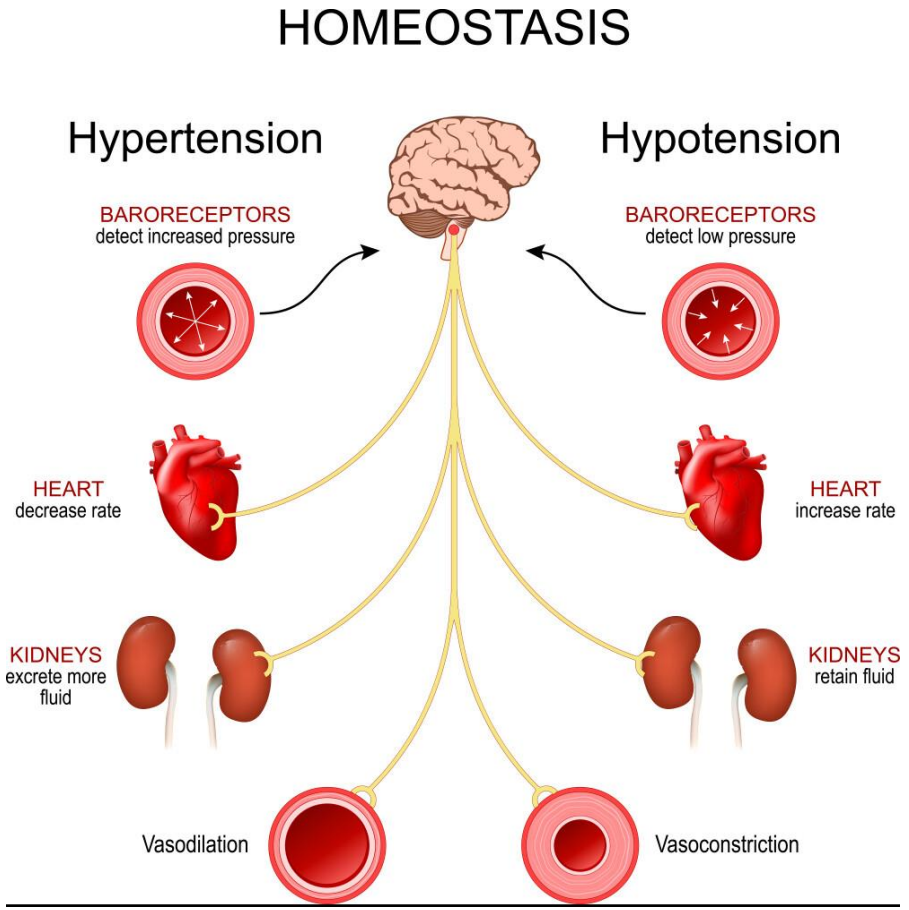
Your Task

Read each case carefully.

Ask yourself:

- **Which homeostatic variable is disturbed?**
- **Which feedback mechanism should restore balance?**
- **Why does it fail in this case?**
- **What are the clinical consequences?**

Scenario #1
When Feedback Fails
Blood Pressure Regulation



When Feedback Fails - Blood Pressure Regulation

Background Knowledge

- Arterial pressure is controlled by the **baroreceptor reflex** (negative feedback via autonomic nervous system).
- Hormonal systems (RAAS, ADH, ANP) also regulate long-term pressure.
- Positive feedback can be harmful (vicious circles like shock).

When Feedback Fails - Blood Pressure Regulation

Clinical Scenario

- **Case 1:** A healthy person suddenly stands up. For a few seconds they feel dizzy, but then blood pressure normalizes.
  Question for students: Which type of feedback is acting here, and through which sensors/effectors?

- **Case 2:** A patient with severe blood loss shows progressive hypotension that worsens despite initial baroreceptor activation.
  Question for students: Why does negative feedback fail, and which dangerous loop can take over?

- **Case 3:** Another patient with long-standing hypertension has reset baroreceptors.
  Question for students: How does this "new set point" complicate homeostasis?

Examples of exam questions:

These scenarios mirror the type of reasoning required in exam questions.

Case 1 – Healthy person stands up suddenly

Q1. A healthy individual suddenly stands up, feels dizzy for a few seconds, then blood pressure returns to normal. Which mechanism explains this recovery?

A. Positive feedback via chemoreceptors → increased vasodilation
B. Negative feedback via baroreceptors → increased sympathetic outflow
C. Feed-forward mechanism → anticipatory vasoconstriction before standing
D. Hormonal regulation via RAAS (hours to days)

Case 2 – Severe blood loss (hemorrhage)

Q2. A patient with severe blood loss shows progressive hypotension that worsens despite initial baroreceptor activation. What is the best explanation?

A. Negative feedback increases sympathetic tone and restores blood pressure completely
B. RAAS activation rapidly corrects blood volume and pressure within seconds
C. Baroreceptors reset to defend a lower set point
D. Positive feedback loops take over, leading to worsening hypotension (shock)

Case 3 – Long-standing hypertension

Q3. A patient with chronic hypertension has baroreceptors that have adapted to the higher blood pressure. How does this affect homeostasis?

A. Baroreceptors defend the higher pressure as the new "normal" set point
B. Baroreceptors remain hypersensitive and lower blood pressure excessively
C. Baroreceptors stop functioning and no longer detect blood pressure changes
D. Positive feedback maintains blood pressure fluctuations