

Integration of body systems

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

This handout covers selected HL topics for the course first assessed in 2025; it is not the whole syllabus.

Prerequisites: read the stated quantities and units, and use arithmetic and the model conditions below.

The examples are original and fictional: they are not real measurements or real student investigations.

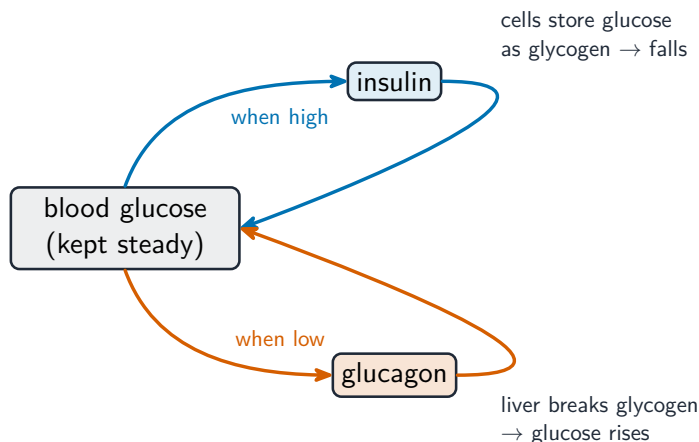
Feedback and internal conditions

■ What would explain this observation?

- Blood glucose rises after a meal, but usually does not keep rising indefinitely. A control system responds to the change in internal conditions.

■ Build the model

- **Homeostasis** maintains internal conditions within suitable limits.
- Receptors detect changes, coordination centres process information, and effectors respond.
- **Negative feedback** opposes the original change.
- homeostasis: Maintenance of suitable internal conditions.
- negative feedback: A response opposing the original change.



Insulin lowers a high blood glucose; glucagon raises a low one: negative feedback

■ Choose evidence that can test it

- When blood glucose is high, insulin helps increase glucose uptake and storage as glycogen.
- When it is low, glucagon supports release of glucose from stores.
- These responses are coordinated, not identical effects of two hormones.

In the lab: Interpret a time graph by identifying the initial disturbance, the response and the return toward the normal range. Mark the delay before a response. Do not assume a graph shows an instantaneous correction.

■ Work from known quantities

- Known: glucose changes from 5.0 to 7.0 arbitrary concentration units.
- Increase = final - initial.
- Increase = $7.0 - 5.0 = 2.0$ units.
- Percentage increase = $2.0/5.0 \times 100 = 40\%$.
- The numerical change is evidence of a disturbance, not a diagnosis on its own.

Your turn: A value rises from 4.0 to 5.0. Calculate the percentage increase.

■ Check the conclusion and its limits

- Negative feedback does not mean the response is harmful or the measured value becomes negative.
- Diabetes has different mechanisms; do not treat every case as a failure to make insulin.

Not true: Negative feedback always makes the measured value negative. Negative feedback means the response opposes the change - it pushes the value back towards the set point. “Negative” describes the direction of correction, not a harmful effect or a negative measurement.

Key:

- Homeostasis maintains internal conditions within suitable limits.
- When blood glucose is high, insulin helps increase glucose uptake and storage as glycogen.
- Watch for: negative feedback does not mean the response is harmful or the measured value becomes negative.

■ **Write from a rise of 60 percent**

- A glucose value rises from 5.0 to 8.0 units.
- Find the percentage increase. The number is not a diagnosis.

■ **Write from a fall of 37.5 percent**

- A second glucose value falls from 8.0 back to 5.0 units.
- Find the percentage decrease, and say why it is not also 60 percent: the denominator is the new original.
- Both use $\text{change over original} \times 100$ – only the original has changed.

■ **Write from a doubling**

- A third value doubles from 2.0 to 4.0 units.
- Find the percentage increase: 2.0 over an original of 2.0 – 100 percent, and every doubling always is.