

Homeostasis

Effects of Exercise

→ changes pH, O₂, CO₂, temperature levels

- During submaximal exercise: control systems can maintain steady state (in a cool environment)
- During intense or prolonged exercise: may exceed ability to maintain steady state, may result in fatigue + cessation of exercise (in hot conditions)

Example Homeostasis Questions & Answers

Define the term *homeostasis*. How does it differ from the term *steady state*?

Homeostasis is the maintenance of a relatively stable internal environment about a set point, despite fluctuations in the external environment. Whereas steady state is a steady and unchanging level, i.e. a plateau.

Cite an example of a biological homeostasis control system.

An example of a biological control system is the regulation of blood glucose concentration. A change in blood glucose concentrations is detected by alpha and beta cells in the islets of Langerhans, which are found in the pancreas. If blood glucose is too high, then beta cells respond by manufacturing and releasing insulin, which causes the conversion of glucose to glycogen (glycogenesis) and hence, blood glucose concentrations return to normal state. When blood glucose concentration is too low, then alpha cells release glucagon which causes gluconeogenesis & glycogenolysis so that more glucose is produced and blood glucose concentration returns to normal. This biological control system is an example of a negative feedback loop.

Briefly explain the role of the sensor, the integrating centre, and the effector organ in a biological control system.

A biological control system is a series of interconnected components that maintain a chemical or physical parameter of the body near a constant value. The sensor (receptors) detect stimuli. The integrating centre is the control centre, and integrates a response. The effector organ produces the desired effect.

Explain the term *negative feedback*. Give a biological example of negative feedback.

Negative feedback is a response that reverses the original disturbances in homeostasis – it's the opposite to the stimulus and restores the normal values of a variable.

An example of this is when core body temperature gets too high, thermoreceptors detect the rise in body temperature and the hypothalamus is the control centre that coordinates the response. This then sends messages to the effectors to initiate the response. Responses include sweating, skin blood vessels dilating, and skin hairs lying flat to promote heat loss. This is a negative feedback loop.

Discuss the concept of gain associated with a biological control system.

A gain of a control system is the degree to which it maintains homeostasis. The larger the gain, the greater the control of homeostasis. An example of a system with a large gain is the pulmonary system which is essential for life.