

# B5: Homeostasis and Response

AQA · GCSE Biology · Revision Notes

Specification reference: 4.5

**Note:** Sections marked ★ HIGHER TIER ONLY are for Higher tier students only. Foundation tier students should focus on the unmarked sections.

## 4.5.1 Homeostasis

Homeostasis is the maintenance of a **stable internal environment** despite changes in external conditions. It involves automatic control systems with receptors, coordination centres and effectors.

- **Receptor** — detects a change in conditions (stimulus).
- **Coordination centre** — (brain, spinal cord, pancreas) processes information.
- **Effector** — a muscle or gland that brings about the response.

Examples of things that are controlled: body temperature (37°C), blood glucose level, water content, carbon dioxide level.

## 4.5.2 The Human Nervous System

### 4.5.2.1 Structure and Function

The nervous system allows the body to respond to changes in the environment. It consists of the central nervous system (CNS: brain and spinal cord) and peripheral nerves.

- **Sensory neurone** — carries impulses from receptors TO the CNS.
- **Relay neurone** — carries impulses within the CNS.
- **Motor neurone** — carries impulses FROM the CNS to effectors (muscles/glands).

### Key Terms

**Synapse:** A junction between two neurones — the electrical signal is carried across by chemical neurotransmitters

**Stimulus:** A change in the environment that is detected by a receptor

**Response:** The action taken by an effector

### 4.5.2.2 Reflex Actions

Reflexes are fast, automatic responses that protect the body from harm. The reflex arc: stimulus → receptor → sensory neurone → relay neurone (in spinal cord) → motor neurone → effector → response.

**Exam Tip:** In reflexes, the response bypasses the brain — the signal goes through the spinal cord. This makes reflexes faster than voluntary actions.

### ★ HIGHER TIER ONLY — The Eye

- The eye is a sense organ that detects light.
- Key structures: cornea (refracts light), lens (focuses light onto the retina), iris (controls pupil size), retina (contains receptors — rods detect dim light, cones detect colour).
- Accommodation: the lens changes shape to focus on near or distant objects. Ciliary muscles relax for distant objects (lens is thin); contract for near objects (lens is fat).
- Short sight: image forms in front of retina — corrected with a concave (diverging) lens.
- Long sight: image forms behind retina — corrected with a convex (converging) lens.

## 4.5.3 Hormonal Coordination

### 4.5.3.1 The Endocrine System

The endocrine system uses hormones — chemical messengers produced by glands, carried in the blood to target organs.

- **Pituitary gland** (brain) — "master gland"; releases many hormones including FSH and LH.
- **Pancreas** — produces insulin and glucagon to control blood glucose.
- **Thyroid gland** — controls metabolic rate.
- **Adrenal glands** — produce adrenaline (fight or flight response).
- **Ovaries** — produce oestrogen and progesterone.
- **Testes** — produce testosterone.

### 4.5.3.2 Control of Blood Glucose

Blood glucose must be kept within a narrow range. The pancreas monitors and controls it using two hormones.

- Blood glucose rises (e.g. after eating): **insulin** is released by the pancreas → glucose is converted to glycogen and stored in the liver. Glucose level falls back to normal.
- Blood glucose falls (e.g. during exercise): **glucagon** is released → glycogen is converted back to glucose and released into the blood. Level rises back to normal.
- **Type 1 diabetes** — the immune system destroys insulin-producing cells in the pancreas. Treated with insulin injections.
- **Type 2 diabetes** — body cells no longer respond to insulin (insulin resistance). Linked to obesity. Treated with diet and exercise; sometimes medication.

### Key Terms

**Insulin:** Hormone that lowers blood glucose by stimulating glycogen storage

**Glucagon:** Hormone that raises blood glucose by stimulating glycogen breakdown

**Glycogen:** The storage form of glucose in the liver and muscles

### 4.5.3.4–5 Hormones in Reproduction and Contraception

- **FSH** (follicle-stimulating hormone) — causes egg to mature in the ovary.
- **LH** (luteinising hormone) — triggers ovulation (release of egg).
- **Oestrogen** — maintains and repairs uterus lining; inhibits FSH.
- **Progesterone** — maintains uterus lining during pregnancy.

- Hormonal contraception (pill) — contains oestrogen/progesterone; prevents ovulation or implantation.
- Barrier methods — condom or diaphragm; prevent sperm reaching the egg.

★ **HIGHER TIER ONLY — Fertility Treatments**

- Fertility drugs (e.g. FSH) stimulate egg maturation in women who do not ovulate.
- IVF (in vitro fertilisation): eggs removed from ovaries, fertilised by sperm in a lab, embryo placed in uterus.
- Issues with IVF: low success rate, expensive, multiple births possible, ethical concerns.

★ **HIGHER TIER ONLY — Plant Hormones**

- Auxins are produced in shoot tips and control tropisms (directional growth responses).
- Phototropism: auxins move to the shaded side of a shoot → cells on that side grow longer → shoot bends towards light.
- Gravitropism: in roots, high auxin concentration inhibits growth. Roots grow towards gravity.
- Ethene: a gas that controls fruit ripening — used commercially to ripen bananas.
- Gibberellins: promote seed germination and stem elongation.
- Uses: auxins used as rooting powder (cuttings) and selective weedkillers.