

Knowledge Organiser Y9 Homeostasis

What is homeostasis?

Homeostasis is the regulation of internal conditions of an **organism** to maintain optimum conditions for **cell function**.

In the human body, these include control of:

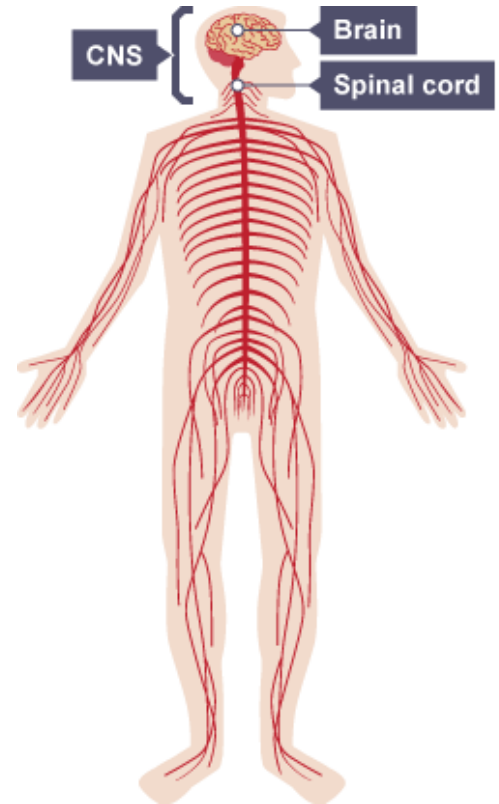
- blood glucose concentration
- body temperature
- water levels.

The Nervous System

The nervous system enables humans to react to their surroundings and to coordinate their behaviour.

The human nervous system consists of:

- the **central nervous system** (CNS)– the brain and spinal cord
- the **peripheral nervous system** (PNS)– nerve cells that carry information to or from the CNS.



Neurones

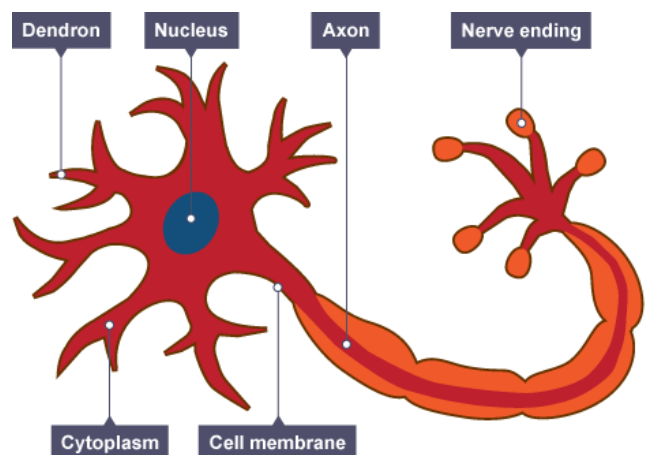
Nerve cells are called **neurones**. They are adapted to **carry electrical impulses** from one place to another.

A bundle of neurones is called a **nerve**.

There are three main types of neurone: **sensory, motor and relay**.

They have some features in common:

- A **long fibre (axon)** which is insulated by a **fatty (myelin) sheath**. They are **long** so they can carry messages up and down the body.
- Tiny **branches (dendrons)** which branch further as **dendrites** at each end. These receive incoming impulses from other neurones.



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Receptors

Receptors are groups of **specialised cells**. They detect a change in the environment (stimulus) and stimulate electrical impulses in response. **Sense organs** contain groups of receptors that respond to specific stimuli.

Sense organ	Stimulus
Skin	Touch, temperature and pain
Tongue	Chemicals (in food and drink, for example)
Nose	Chemicals (in the air, for example)
Eye	Light
Ear	Sound and position of head

The Coordination Centre

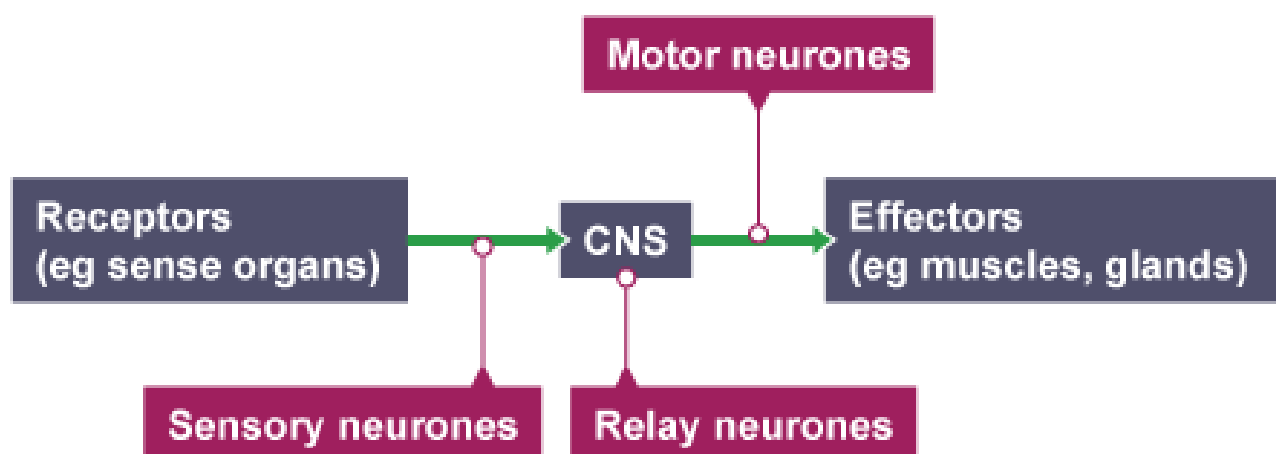
The coordination centre, such as the **brain, spinal cord or pancreas**, receives and processes information from receptors around the body.

Effectors

Effectors bring about responses, which restore optimum levels, such as core body temperature and blood glucose levels. Effectors include **muscles and glands**, and so responses can include **muscle contractions** or **hormone release**.

Receptors to effectors

The diagram summarises how information flows from receptors to effectors in the nervous system:



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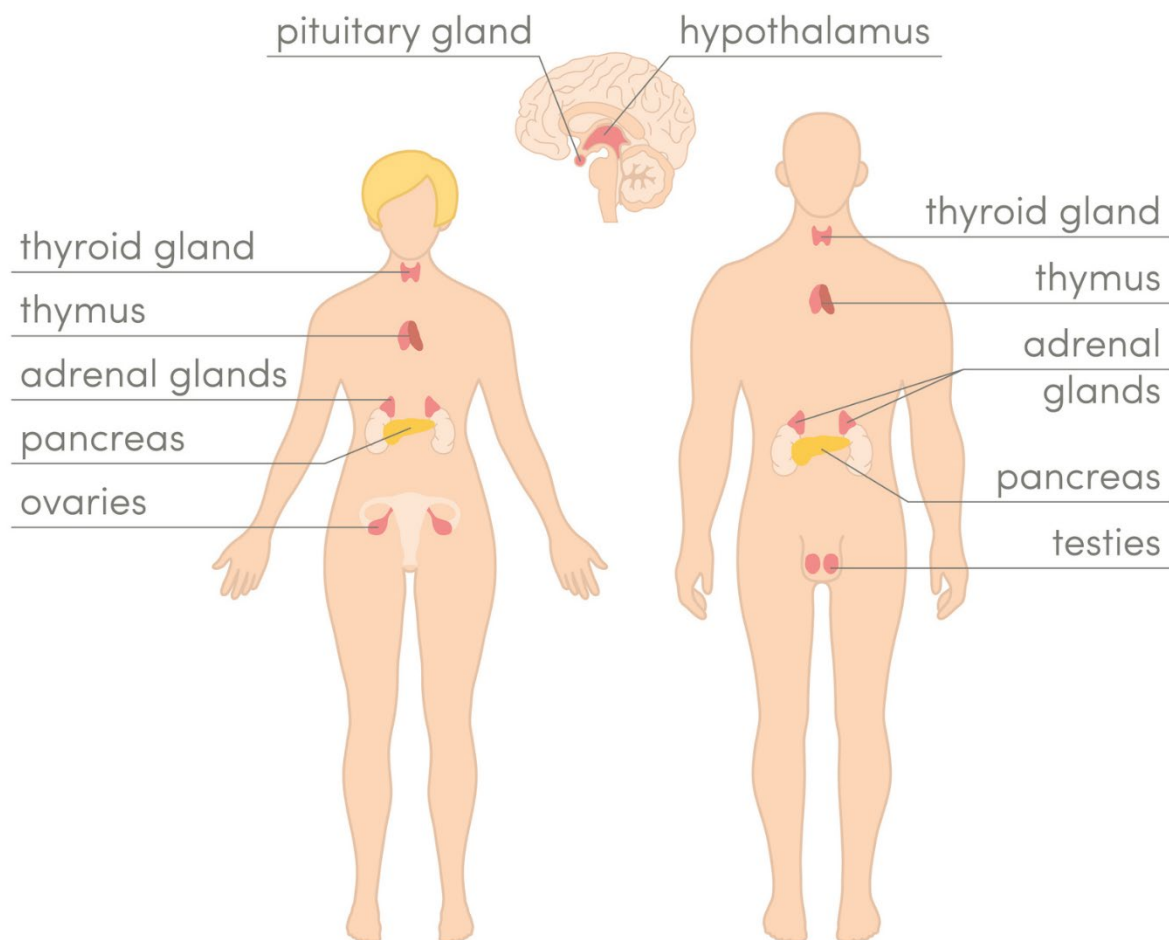
The Human Endocrine System

A **hormone** is a chemical substance, produced by a **gland** and carried in the bloodstream, which alters the activity of specific target organs.

Like the nervous system, hormones **can control the body**. The effects are much **slower** than the nervous system, but they **last for longer**.

Different hormones

The body produces a range of different chemical **hormones** that travel in the bloodstream and affect a number of different organs or cells in the body.

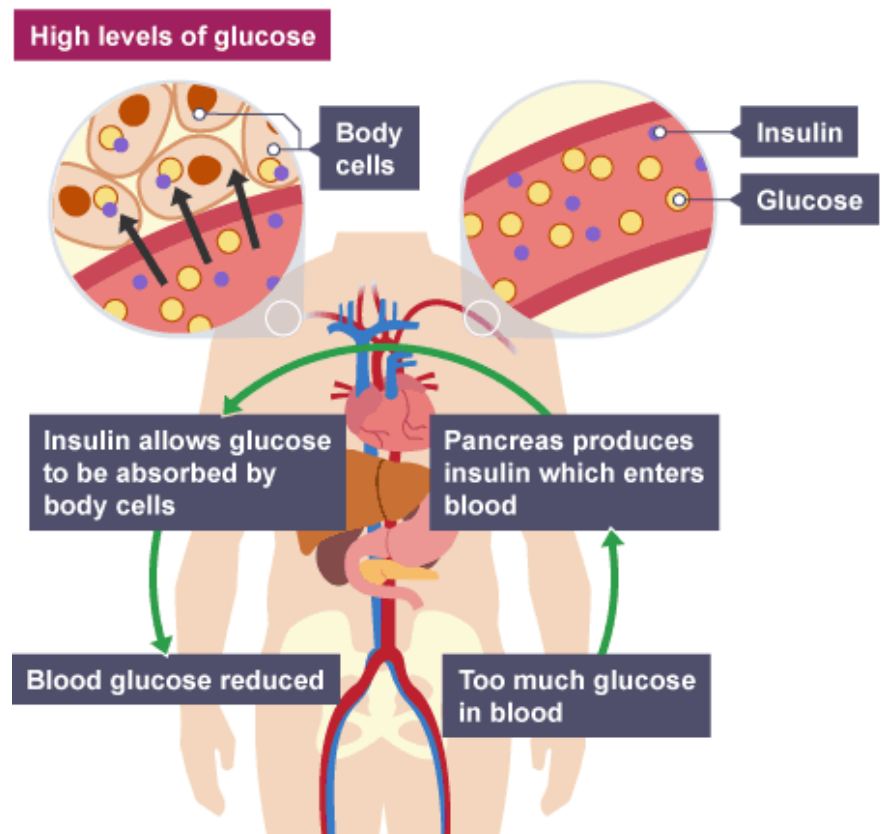


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Regulating blood glucose

Glucose is needed by cells for **respiration**. It is important that the concentration of glucose in the blood is maintained at a constant level and controlled carefully. **Insulin** is a hormone - produced by the **pancreas** - that regulates glucose concentrations in the blood.

If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells. In liver and muscle cells **excess glucose is converted to glycogen** for storage, and will be used at a later date.



Diabetes

Diabetes is a condition where the blood glucose levels remain too high. There are two types of diabetes - **type 1** and **type 2**.

Type 1 diabetes

Type 1 diabetes is a disorder in which the **pancreas fails to produce enough insulin**. It can be controlled by **injecting insulin**.

Type 2 diabetes

In type 2 diabetes the **person's body cells no longer respond to insulin** produced by the pancreas. It can be controlled by a **carbohydrate controlled diet** and an **exercise regime**. There is a correlation between **rising levels of obesity** in the general population and **increasing levels of type 2 diabetes**.

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Puberty

Puberty is the stage in life when a child's body develops into an adult's body. The changes take place gradually, usually between the ages of **10 and 16**.

Changes occur at puberty because of hormones:

- **testosterone** - produced by the testes - controls the development of male secondary sexual characteristics
- **oestrogen** - produced by the ovaries - controls the development of female secondary sexual characteristics

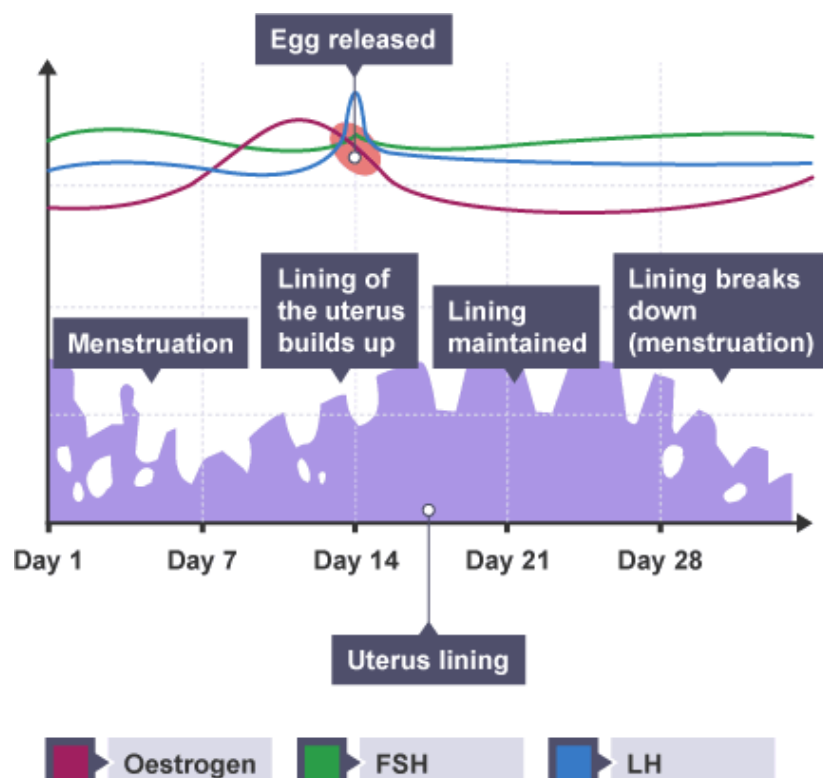
Secondary sexual characteristics appear during puberty and were not present at birth.

Changes during puberty

Boys only	Boys & girls	Girls only
Voice breaks	Pubic hair grows	Voice deepens gradually
Hair grows on face and body	Underarm hair grows	Hips get wider
Body becomes more muscular	Sexual organs grow and develop	Breasts develop
Testes start to produce sperm cells		Ovaries start to release egg cells - menstruation starts

The Menstrual Cycle

The menstrual cycle is a recurring process which takes around **28 days**. During the process, the lining of the uterus is prepared for pregnancy. If **implantation** of the fertilised egg into the uterus lining does not happen, the lining is then shed. This is known as **menstruation**. The menstrual cycle is controlled by **hormones**.



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Hormonal Contraception

Human fertility is controlled by hormones, so **fertility** can be controlled using hormonal forms of contraception. The **oral contraceptive**, which is known as **the pill**, contains hormones which stop the eggs from maturing.



Benefits and risks

Oral contraceptives are more than 99% effective if taken correctly and can reduce the risk of certain cancers.

However, there are possible **side effects**, such as changes in weight, mood and blood pressure due to high levels of oestrogen.

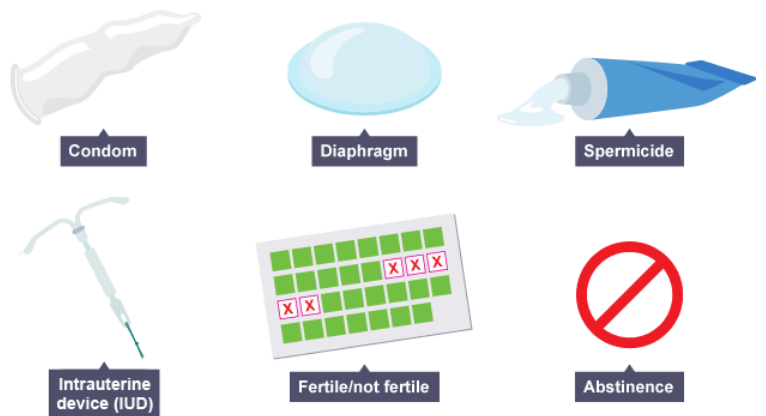
Contraceptive injections, implants or skin patches work in a similar way to inhibit the **maturation and release of eggs**.

Non-hormonal methods of contraception

Fertility can be controlled without hormones.

These methods include:

- Physical barrier methods such as **condoms and diaphragms**, which prevent the sperm reaching an egg
- Intrauterine devices (IUD)** also known as a coil, prevent the implantation of an embryo or release of a hormone
- Spermicidal agents** which kill or disable sperm
- Abstaining** from intercourse when an egg may be in the oviduct
- Surgical methods** of male and female sterilisation. An example is a vasectomy, where the sperm ducts are cut and tied.



Benefits and risks

- Condoms are **easy and quick to use**, but sometimes they can **tear or rip**.
- IUDs need to be **fitted by a health professional**. IUD can remain in position for up to 10 years. However, there is a small risk of causing an **ectopic pregnancy**.
- Abstaining can be used successfully, but if the **timings are not accurate** the chance of pregnancy is high.
- Surgical methods **cannot be reversed**, and is considered permanent.