

**AQA B5 Homeostasis and Response: Nervous Control
COMBINED HIGHER (page 1 of 2)**

Required Practical - Reaction Time

The Sense Organs

Sense Organ	Receptors sensitive to...
ears	Sound and changes in position for balance
eyes	Light
skin	Touch, pressure, pain, temperature
nose and tongue	Chemicals for smell and taste

Homeostasis is the **regulation** of the **internal conditions** of a cell or organism to **maintain optimum conditions** for function, in response to internal and external changes. Homeostasis maintains optimal conditions for enzyme action and all cell functions. Human control systems include:

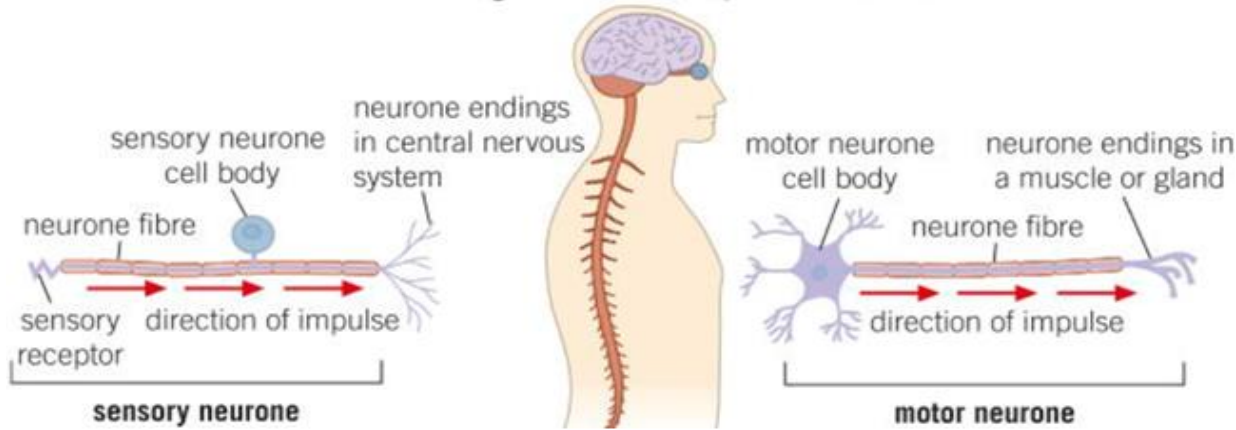
Receptor cells	Coordination centres	Effectors
These detect stimuli (changes in the environment)	E.g. brain, spinal cord and pancreas that receive information from receptors	Muscles or glands, which bring about a response to restore optimum levels

Reflex actions are **automatic** and **rapid**; they do not involve the conscious part of the brain and can **protect** humans from harm. They involve a **relay neurone** instead of the CNS.

The Nervous System

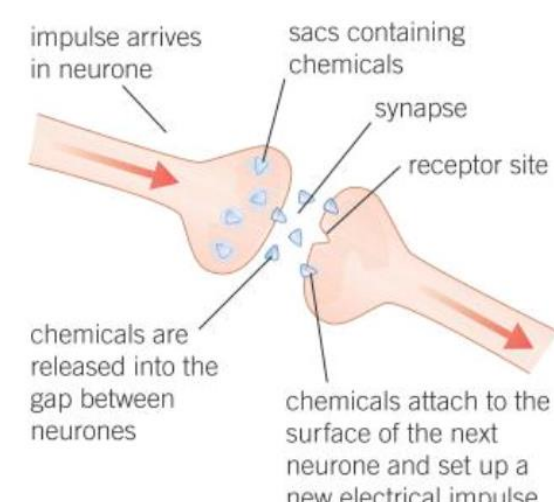
This system enables humans to react to their surroundings and coordinate their behaviour.

Sensory nerves carry impulses to the CNS. the information is processed and impulses are sent out along motor nerves to produce an action.



Synapse

This is a gap where neurones meet. A chemical message is used involving a neurotransmitter.



Reflex Arc Pathway

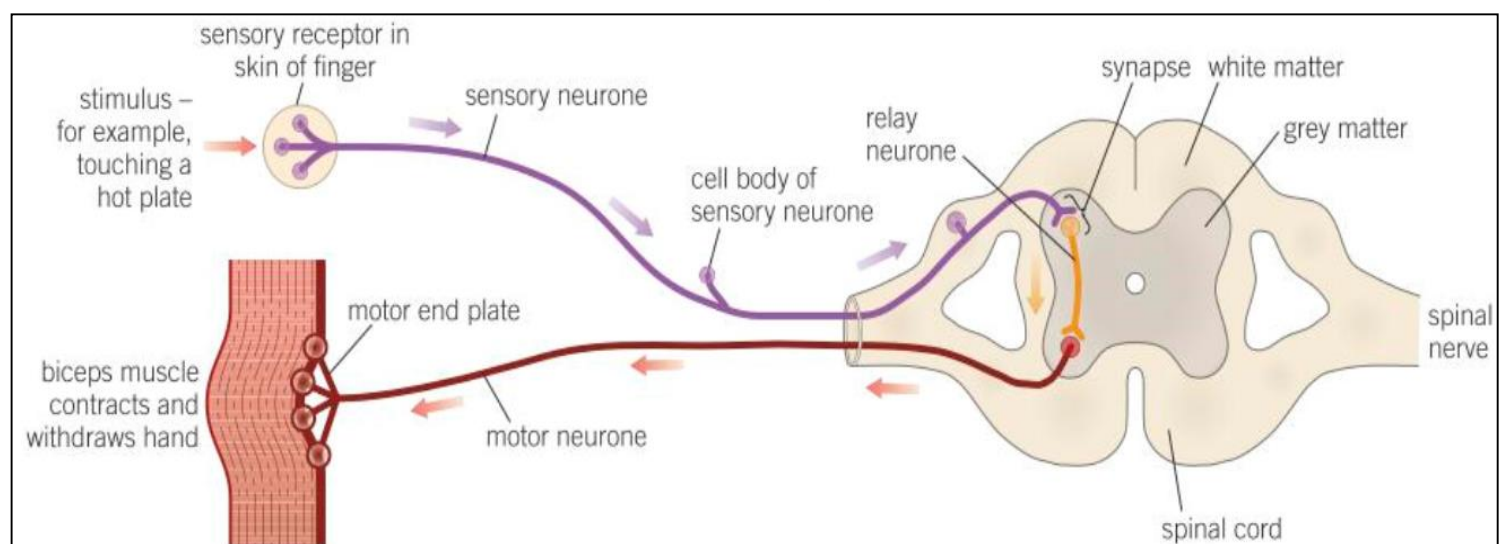
Pathway	Example
stimulus	Touch hot plate
receptor	Cells in finger
sensory neurone	Long - carries impulse from receptor to relay neurone in spinal cord
relay neurone	Allows impulses to travel between the sensory neurone and the motor neurone in the spinal cord
motor neurone	Long carries impulse to effector
effector	Biceps muscle contracts
response	Withdraw hand

The Nervous System Voluntary Response Pathway

Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS). The CNS coordinates the response of the effectors which may be muscles contracting or glands secreting hormones.

Pathway	Example
stimulus	Lights switch on
receptor	Cells in retina (eye)
sensory neurone	Carries impulse to coordinator
coordinator	Central nervous system (CNS) – brain or spinal cord
motor neurone (very long)	Carries impulse to effector
effector (muscle or gland)	Muscles connected to iris
response	Pupils get smaller

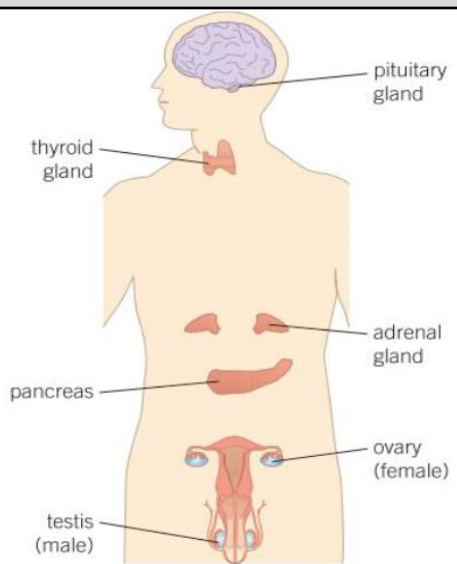
The Reflex Arc



AQA B5 Homeostasis and Response: Hormonal Control COMBINED HIGHER (page 2 of 2)

The human **endocrine system** is made of glands, which release chemicals called **hormones** directly into the **bloodstream**. The blood carries the hormone to a **target organ** where it produces an effect. Examples of these controls include blood glucose concentration, body temperature and water levels. Compared to the nervous system the effects are slower but act for longer.

Endocrine Gland	Role of its Hormones
pituitary	The 'Master Gland'; secretes several hormones into the blood to stimulate other glands to release hormones
thyroid	Controls metabolic rate
pancreas	Controls glucose levels
adrenal	Prepares body for stress
ovaries	Involved in menstrual cycle
testes	Involved in sperm production



Negative Feedback	
Adrenaline	Thyroxine
Produced in adrenal glands. Increases breathing/heart rate and blood flow to muscles. Prepares the body for 'fight or flight'.	Produced in thyroid gland, stimulates basal metabolic rate. Important in growth and development. Increasing thyroxine levels prevent the release of TSH, which stops the release of thyroxine.

Blood glucose concentration is monitored and controlled by the pancreas .	
Blood glucose too High	Pancreas produces the hormone insulin , glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.
Blood glucose too Low	Pancreas produces the hormone glucagon , causes glycogen to be converted into glucose and released into blood. Negative feedback: Rising glucose levels inhibit the release of glucagon. Insulin is released to reduce glucose levels, which causes the pancreas to release glucagon
Type 1 diabetes	Pancreas fails to produce enough insulin leading to uncontrolled blood glucose levels. Treatment: by insulin injection.
Type 2 diabetes	Obesity is a risk factor. Body cells no longer respond to insulin. Treatment: changing diet and increasing exercise.

Hormones in Human Reproduction

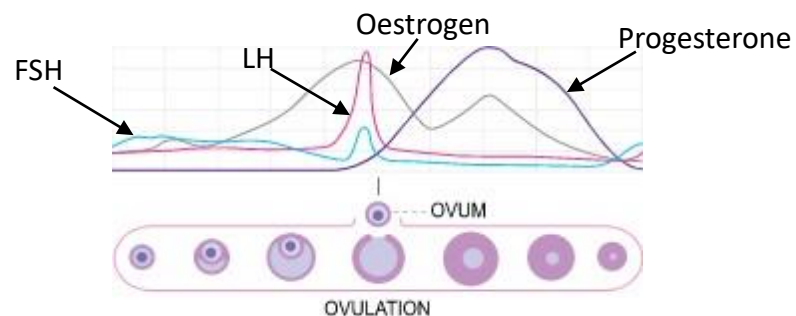
During puberty reproductive hormones cause secondary sexual characteristics to develop

Hormone	Role of the Hormone
testosterone	Main male reproductive hormone. Stimulates sperm production in testes.
oestrogen	Main female reproductive hormone produced in the ovary. At puberty eggs begin to mature and one is released every 28 days approx. This is called ovulation.

Several hormones are involved in the menstrual cycle of women:

follicle stimulating hormone (FSH)	Matures an egg in the ovary. Stimulates ovary to produce oestrogen.
luteinising hormone (LH)	Stimulates release of an egg (ovulation)
oestrogen	Stimulates uterus lining to develop. Inhibits FSH and stimulates the release of LH.
progesterone	Maintains uterus lining. Inhibits release of FSH and LH.

The menstrual cycle:



Contraception – fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception

Name	How it works
oral contraceptive (pill)	Contains hormones to inhibit FSH so no eggs mature
injection, implant, patch	Releases progesterone slowly to inhibit the maturation and release of eggs
barrier methods - condoms/diaphragms	prevent sperm from reaching egg
intrauterine devices	Prevent implantation of an embryo
spermicidal agents	Kill or disable sperm
abstinence	Avoiding sex when an egg may be in the oviduct
surgery	Male or female sterilisation (surgery to stop you having offspring e.g. vasectomy in males)

Hormones are used in modern reproductive technologies to treat infertility

FSH and LH are used as fertility drugs to help someone become pregnant in the normal way.

In Vitro Fertilisation (IVF) treatment:

- Eggs are collected from mother (after being given FSH and LH to stimulate maturation of several eggs) → Fertilised by father's sperm in a lab → The fertilised eggs develop into embryos → One or two embryos are inserted into the mother's uterus (womb)

Disadvantages of IVF

- Emotional and physical stress
- Low success rates
- Multiple births risk to mother and babies