
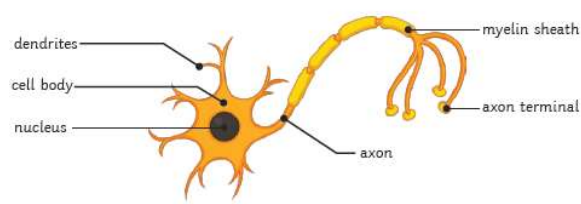









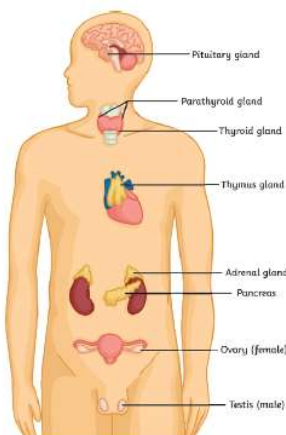


AQA GCSE Biology (Combined Science) Unit 5: Homeostasis and Response Knowledge Organiser

Homeostasis	Synapses	The Human Nervous System						
<p>Homeostasis is the regulation of a constant internal environment. The conditions are maintained to ensure optimum conditions for metabolism and changes in response to both internal and external fluctuations.</p> <p>In humans, homeostasis regulates the blood glucose (sugar) levels, the body temperature, CO₂ levels and water levels.</p> <p>The levels are monitored and regulated by automatic control systems which can be either nervous responses (coordinated by the nervous system) or chemical responses (coordinated by the endocrine system). Information about the environment is called a stimulus and is detected by a receptor. The information is processed by a central coordination system and a response is initiated by an effector.</p>	<p>A synapse is the gap where the ends of two neurons meet.</p>  <p>The information needs to be passed from one neuron to the next, but cannot be passed as an electrical impulse over the synapse (gap). Instead, the message is transmitted by chemical neurotransmitters.</p> <p>When the electrical impulse arrives at the terminal of the first neuron, it causes a release of neurotransmitter chemicals into the synapse. They travel across the gap and bind to receptor sites on the terminal of the next neuron.</p> <p>The receptor sites are specific for each type of neurotransmitter. A nerve impulse will only be created in the second neuron when a complementary chemical binds.</p>	<p>The nervous system allows a fast, short-lived response to a stimulus in the surroundings. The information is received by a receptor, passed along the neurons (nerve cells) as an electrical impulse and results in a response.</p> <p>You might have to label the parts of a typical neuron:</p>  <ul style="list-style-type: none"> The axon is the main part of the nerve cell. It is a long, stretched-out fibre of cytoplasm which the electrical impulse will travel along. Some axons are surrounded in a layer of fatty cells called the myelin sheath and it helps to insulate the electrical impulse. The branched endings, dendrites, connect the neurons together to create a network. <table border="1"> <thead> <tr> <th>sensory neuron</th><th>relay neuron</th><th>motor neuron</th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td></tr> </tbody> </table>	sensory neuron	relay neuron	motor neuron			
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<p>The Nervous Pathway</p> <p>A stimulus is a change in the environment (internally or externally). In a typical response to stimuli, this information is received by the receptor and sent as an electrical impulse along a sensory neuron towards the central nervous system (CNS). The CNS is comprised of the brain and spinal cord. Here, the impulse is passed through relay neurons and a response to the stimulus is coordinated. This could be consciously or subconsciously. The CNS sends information about the response along a motor neuron as an electrical impulse. The effector receives the impulse and carries out the response.</p> <p>[stimulus] → receptor → sensory neuron → CNS → motor neuron → effector → [response]</p> <p>Examples of receptors include rod and cone cells within the eye which respond to light and allow us to see. Or it could be the cells in the skin which respond to pressure or temperature changes allowing us to feel.</p> <p>An effector could be a muscle or a gland. In response, a muscle might contract to make a movement or a gland releases a chemical into the body.</p>								

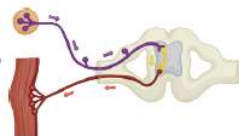
The Endocrine System

You should be able to identify the major glands of the endocrine system, as shown below.



Reflexes

A reflex is a fast and automatic response to a particular stimulus which may be harmful to the organism. They are quick because there is no conscious thought or process to deliver the response (they are an involuntary action). The pathway which carries the information about a reflex action is called a reflex arc.



A reflex arc begins with the stimulus e.g. a bee sting or a hot object on the skin. The stimulus is detected by the receptor cells and an electrical impulse is transmitted along the sensory neuron. The impulse is passed through relay neurons in the spinal cord or the unconscious areas of the brain. The response is coordinated automatically and sent along the motor neuron to the effector cells.

Hormones

Hormones are chemical messengers transported in the bloodstream to an effector where they can activate a response. They are produced and released from glands around the body which all make up the endocrine system. Hormones do a similar job to the neurons of the nervous system but there are some differences.

	neurons	hormones
speed	fast	slow
duration	short	long
target area	specific	general

The hormones released travel in the blood plasma to their target cells and affect only those certain cells. Hormones act on organs or cells where constant adjustments are made to maintain a stable state.

Some examples you should know:

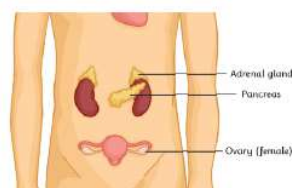
The pituitary gland produces a range of hormones including FSH and LH which help to regulate the menstrual cycle. The pituitary gland acts as a master gland because many of the hormones it releases control and coordinate the release of other hormones from other glands in the body.

Diabetes

There are two types of diabetes: type 1 and type 2.

Type 1 diabetes is a disorder affecting the pancreas. In type 1 diabetes, the pancreas does not produce enough insulin to control the blood sugar level and so the levels become higher than normal. Type 1 diabetes is usually treated by injections of insulin.

Type 2 diabetes is a disorder of effector cells which no longer respond to the hormones released from the pancreas. Type 2 diabetes can usually be managed through lifestyle choices such as maintaining a carbohydrate-controlled diet and regular exercise.



The risk of developing type 2 diabetes is higher in people who are obese (have a BMI > 30).

Hormones in Human Reproduction

Oestrogen is the main reproductive hormone in females. It is produced in the ovaries. During puberty, this hormone increases and it stimulates an egg to be released from an ovary each month. This process is called ovulation and happens, on average, every 28 days.

Testosterone is the main reproductive hormone in males. It is produced in the testes. This hormone stimulates the production of sperm.

Homeostasis

The nervous system

The endocrine system

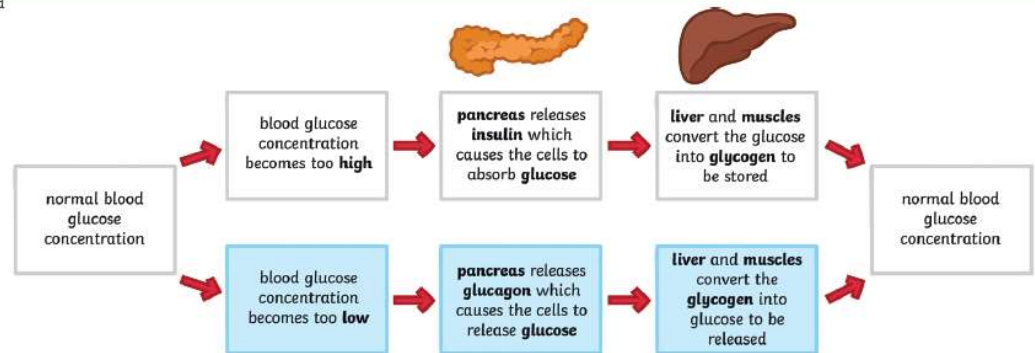
The menstrual cycle

Control of Blood Glucose

The pancreas is the organ and gland which monitors and regulates the blood glucose concentration.

(HT only)

If the blood glucose concentration becomes too low, a negative feedback loop is triggered and the pancreas releases another hormone, glucagon, which acts on the liver and muscles to cause the stored glycogen to be converted back into glucose and released into the bloodstream.

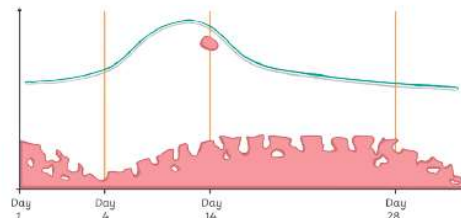


The Menstrual Cycle

The menstrual cycle occurs in females, approximately every 28 days. It is a cyclical process of the building of the lining of the uterus and ovulation. If the egg become fertilised by a sperm, then pregnancy follows. If the egg is not fertilised, then the lining of the uterus is shed away and leaves the body as the menstruation (or period).

The whole cycle is controlled by four main reproductive hormones:

- follicle stimulating hormone (FSH)
- oestrogen
- luteinising hormone (LH)
- progesterone



Hormone	Where It Is Produced	Response Caused	Interaction with Other Hormones (HT only)
FSH	pituitary gland	An egg to develop in one of the ovaries.	Stimulates the production of oestrogen.
oestrogen	ovaries	The lining of the uterus builds up and thickens.	Stimulates the production of LH. Inhibits the production of FSH.
LH	pituitary gland	Ovulation (at around day 14 of the cycle).	Indirectly stimulates the production of progesterone.
progesterone	ovaries	The uterus lining to maintain.	Inhibits the production of LH.

Contraception

There are many different types of contraceptive (or birth control) methods. They are categorised as hormonal methods and non-hormonal methods.



Method	Hormonal or Non-Hormonal	How It Works	Pros and Cons
oral contraceptives ('the pill')	hormonal	Pill taken which contains hormones to inhibit FSH so that an egg does not mature.	<ul style="list-style-type: none"> ☺ Easily self-administered. Short-term effects. Can easily be reversed. Very reliable. ☹ May have mild side-effects associated. Could lead to pregnancy if missed. Does not protect from STIs.
injection, implant or skin patch	hormonal	Contains progesterone which is slowly released to inhibit the release of eggs for months or even years.	<ul style="list-style-type: none"> ☺ Administered through routine appointment at GP surgery. Requires little to no aftercare or maintenance. Very reliable. ☹ May take some time for effects to be reversed once removed. Does not protect from STIs.
condoms or diaphragm (female condom)	non-hormonal	Creates a physical barrier to prevent the sperm from reaching the egg.	<ul style="list-style-type: none"> ☺ Easy to use. Short-term effects. Very reliable. Provides protection from most STIs. ☹ Can fail.
intrauterine devices (coil)	hormonal	The device is attached to the lining of the uterus and releases hormones or prevents the implantation of an embryo.	<ul style="list-style-type: none"> ☺ Requires little to no aftercare or maintenance. Very reliable. ☹ May take some time for effects to be reversed once removed. Does not protect from STIs.
spermicidal agents	non-hormonal	Contains chemicals to kill or immobilise sperm cells.	<ul style="list-style-type: none"> ☺ Easy to use. Short-term effects. ☹ Does not protect from STIs. Less effective when used as the only method.
abstaining from intercourse (around the time of ovulation)	non-hormonal	Avoiding sexual intercourse when there is a likelihood of an egg being present in the oviduct.	<ul style="list-style-type: none"> ☺ inexpensive ☹ Not always reliable.
surgery	non-hormonal	A surgical procedure carried out in men or women. In males, the vas deferens tubes are sealed or blocked to prevent the passage of sperm from the testes. In females, the fallopian tubes (oviducts) are sealed or blocked to prevent the passage of the egg from the ovaries.	<ul style="list-style-type: none"> ☹ Risks associated with surgery (such as infection). ☹ Difficult to reverse (if at all possible). Can take several months to be reliable.