

Highsted Knowledge Organiser, Biology, Term 1, Year 11: Homeostasis in action

What I need to know

Controlling body temperature
 Removing waste products
 The human kidney
 Dialysis- an artificial kidney
 Kidney transplants

Key Vocabulary:

ADH, adrenal gland, adrenaline, coordination centres, dialysis, effectors, endocrine system, homeostasis, hormone, kidney tubule, metabolic rate, negative feedback, stimuli, thermoregulatory centre, urea, urine, vasoconstriction, vasodilation

Challenge question: Why is important to control temperature and water levels?

Suggested reading:
www.kerboodle.com

<https://www.bbc.co.uk/bitesize/guides/zxgmfcw/revision/1>

Homeostasis

Homeostasis is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to constantly maintain optimum conditions for functioning.

This maintains optimum conditions for all cell functions and enzyme action.

In the human body, this includes control of

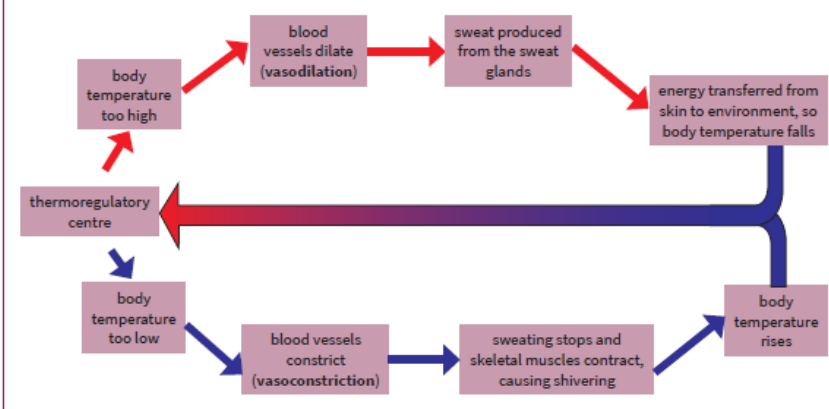
- blood glucose concentration
- body temperature
- water levels.

The automatic control systems of homeostasis may involve nervous responses or chemical responses.

All control systems involve

- receptor cells, which detect **stimuli** (changes in the environment)
- **coordination centres** (such as the brain, spinal cord, and pancreas), which receive and process information from receptors
- **effectors** (muscles or glands), which produce responses to restore optimum conditions.

Control of body temperature



Body temperature is monitored and controlled by the **thermoregulatory centre** in the brain. The centre contains receptors sensitive to the blood temperature.

The skin also contains temperature receptors and sends nervous impulses to the thermoregulatory centre.

Maintaining water and nitrogen balance

Water leaves the body through the lungs during exhalation, and water, ions, and urea are lost from the skin in sweat. The body has no control over these losses.

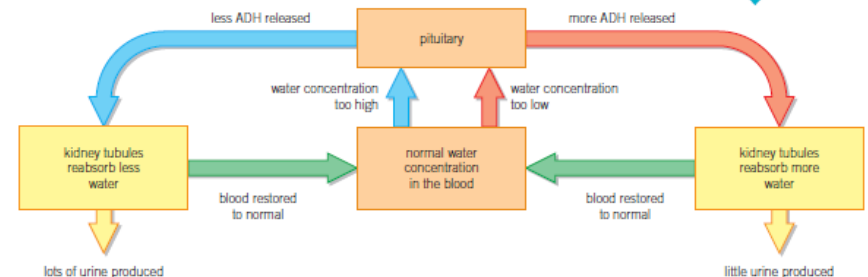
Excess water, ions, and urea are removed by the kidneys in **urine**.

Levels of water in the body must be balanced because cells do not function efficiently if they lose or gain too much water.

The kidneys produce urine by filtration of the blood and selective reabsorption of useful substances such as **water**, glucose, and some ions.

The water level in the blood is controlled through this process by the hormone **ADH**, which affects the amount of water absorbed by the **kidney tubules**.

This is a **negative feedback cycle**.



People who suffer from kidney failure may be treated by organ transplants or kidney **dialysis**.

Process of kidney dialysis

- blood temporarily removed from patient's body
- filtered through a dialysis machine
- patient's blood passes over dialysis fluid
- dialysis fluid has no urea
- urea and waste products diffuse from high concentration in patient's blood to low concentration in dialysis fluid
- patient's blood then returned to their body

Waste products

The digestion of proteins from food results in excess amino acids, which need to be excreted safely.

These amino acids are deaminated in the liver to form ammonia.

Ammonia is toxic, so it is immediately converted to urea for safe excretion.

Highsted Knowledge Organiser, Biology, Term 1, Year 11: Hormonal coordination 2

What I need to know

Human reproduction
 Hormones and the menstrual cycle
 Artificial control of fertility
 Infertility treatments
 Plant hormones and responses
 Using plant hormones

Key Vocabulary:

Auxin, contraception, follicle stimulating hormone, gravitropism, infertility, in vitro fertilisation, oestrogen, ovary, luteinising hormone, menstrual cycle, ovulation, phototropism, progesterone, testes, uterus

Challenge question: How are specific fertility treatments designed to address specific issues in the menstrual cycle?

Suggested reading:

www.kerboodle.com

<https://www.bbc.co.uk/bitesize/guides/zcnp7p3/revision/2>

<https://www.bbc.co.uk/bitesize/guides/zc6cqh/revision/5>

Hormones in human reproduction

During puberty, reproductive hormones cause the secondary sex characteristics to develop:

Oestrogen

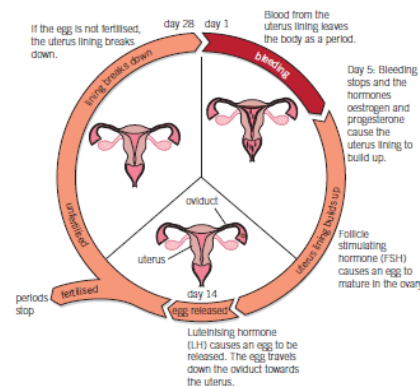
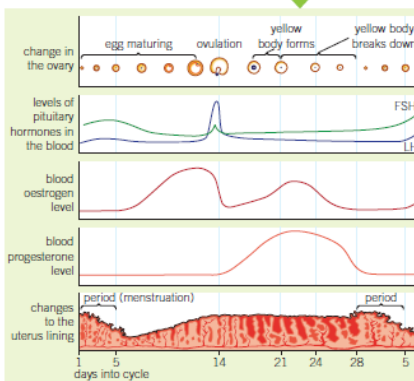
- main female reproductive hormone
- produced in the **ovary**
- at puberty, eggs begin to mature and one is released every ~28 days

Testosterone

- main male reproductive hormone
- produced by the **testes**
- stimulates sperm production

The menstrual cycle

Hormone	Released by	Function
follicle stimulating hormone (FSH)	pituitary gland	<ul style="list-style-type: none"> • causes eggs to mature in the ovaries • stimulates ovaries to produce oestrogen
luteinising hormone (LH)	pituitary gland	<ul style="list-style-type: none"> • stimulates the release of mature eggs from the ovaries (ovulation)
oestrogen	ovaries	<ul style="list-style-type: none"> • causes lining of uterus wall to thicken • inhibits release of FSH • stimulates release of LH
progesterone	ovaries	<ul style="list-style-type: none"> • maintains thick uterus lining • inhibits release of FSH and LH



Treating infertility with hormones (HT only)

Hormones are used in modern reproductive technologies to treat **infertility**. FSH and LH can be given as a drug to treat infertility, or **In vitro fertilisation (IVF)** treatment may be used.

IVF treatment

- 1 mother given FSH and LH to stimulate the maturation of several eggs
- 2 eggs collected from the mother and fertilised by sperm from the father in a laboratory
- 3 fertilised eggs develop into embryos
- 4 one or two embryos are inserted into the mother's **uterus** (womb) when the embryos are still tiny balls of cells

Fertility treatment has some disadvantages:

- it is emotionally and physically stressful
- it has a low success rate
- it can lead to multiple births, which are a risk to both the babies and the mother.

Contraception

Fertility can be controlled by a variety of hormonal and non-hormonal methods of **contraception**.

Hormonal contraception

- oral contraceptives – contain hormones to inhibit FSH production so no eggs mature
- injection, implant, skin patch, or intrauterine devices (IUD) – slowly release progesterone to inhibit maturation and release of eggs; can last months or years

Non-hormonal contraception

- barrier methods, for example, condoms and diaphragms – prevent sperm reaching the egg
- copper IUD – prevents the implantation of an embryo
- surgical methods of male and female sterilisation
- spermicidal agents – kill or disable sperm
- abstaining from intercourse when an egg may be in the oviduct

Plant hormones

A plant's response can be known as **phototropism**, when the shoots bend towards light, and **gravitropism** when the root moves towards gravity. The responses are controlled by the hormone **auxin**. In phototropism, auxin moves from the side of the shoot with light to the unlit side, meaning the cells on that side will grow more. In gravitropism, high levels of auxin means that the growth of root cells is inhibited.

(HT only) **Gibberellins** are also plant hormones which begin the process of seed germination by breaking down the

food stores in the seeds and stimulate the growth of stems. Ethene is another hormone which controls cell division.

