

Chapter 12: Homeostasis in action

Knowledge organiser

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

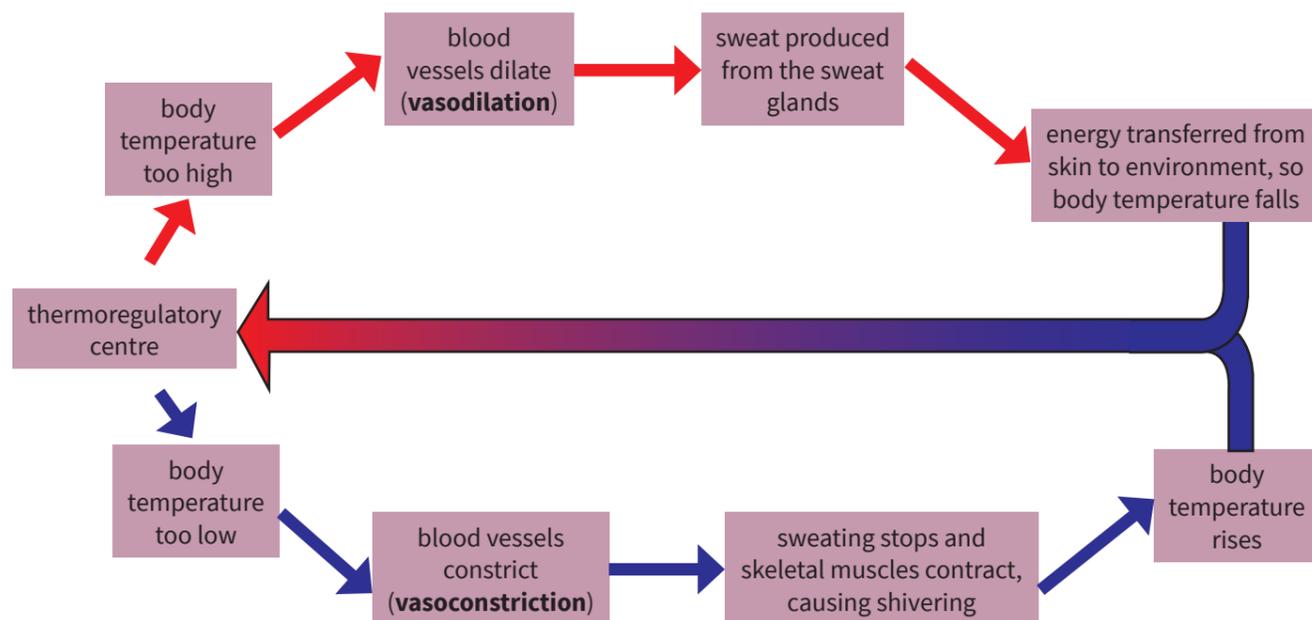
- blood glucose concentration
- body temperature
- water levels.

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.

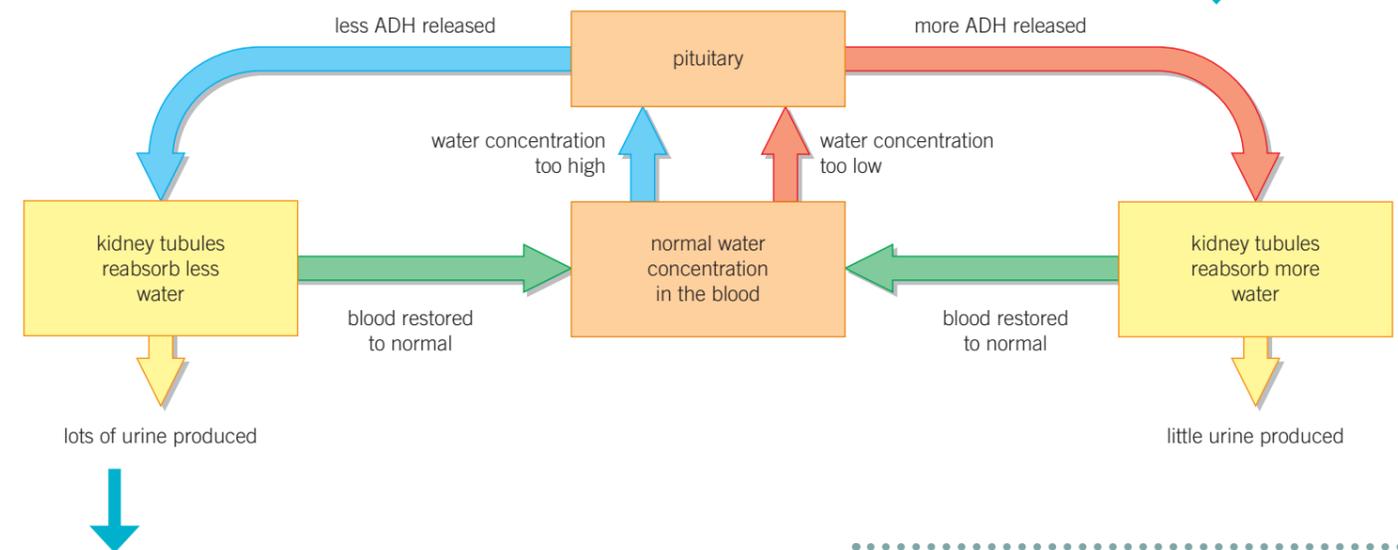
Excess water, ions, and urea are removed by the kidneys in **urine**.

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.

Key terms

Make sure you can write a definition for these key terms.

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

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Retrieval questions

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

B12 questions

Answers

1	What is homeostasis?	Put paper here	maintenance of a constant internal environment
2	Give three internal conditions controlled in homeostasis.	Put paper here	body temperature, blood glucose concentration, and water levels
3	Give three things all control systems include.	Put paper here	receptors, coordination centres, and effectors
4	Where is body temperature monitored and controlled?	Put paper here	thermoregulatory centre in the brain
5	What happens if body temperature is too high?	Put paper here	blood vessels dilate (vasodilation) and sweat is produced
6	What happens if body temperature is too low?	Put paper here	blood vessels constrict (vasoconstriction), sweating stops, and shivering takes place
7	What is the function of the kidneys?	Put paper here	filter and reabsorb useful substances from the blood, and produce urine to excrete excess water, ions, and urea
8	How are excess amino acids excreted from the body?	Put paper here	deaminated to form ammonia in the liver, ammonia is converted to urea and excreted
9	Which hormone controls the water level in the body?	Put paper here	ADH
10	How is kidney failure treated?	Put paper here	organ transplant or kidney dialysis
11	In kidney dialysis, what fluid is temporarily removed from the patients body?	Put paper here	Blood
12	In kidney dialysis, name one substance that diffuses from the patients blood into the dialysis fluid.	Put paper here	Urea or waste products
13	Define diffusion.	Put paper here	The movement of particles from an area of higher concentration to an area of lower concentration.
14	What are proteins broken down into?	Put paper here	Amino acids
15	Amino acids are de-aminated to form ammonia in what organ of the body?	Put paper here	The liver
16	Why does ammonia need to be excreted safely?	Put paper here	Ammonia is toxic
17	State two things controlled by negative feedback in the body.	Put paper here	Blood glucose, water, thyroxine
18	Where is the hormone adrenaline produced?	Put paper here	Adrenal glands
19	What is the function of adrenaline?	Put paper here	Prepares the body for fight or flight, increases heart rate
20	Where is the hormone thyroxine produced?	Put paper here	Thyroid gland
21	What is the function of thyroxine?	Put paper here	Regulates how quickly the body produces energy, makes proteins