Excretion

Excretion and its importance, the urinary system, the structure and function of the nephron, and the role of the liver in deamination and in making urea.

13.1 Excretion in humans

Excretion is the removal of toxic materials and the waste products of metabolism from organisms.

Waste products are made by the chemical reactions in cells. If they built up, they would damage the body.

Waste product	Where it is made	How it is excreted
carbon dioxide	a waste product of **respiration**	through the **lungs** (breathed out)
urea	made in the **liver** from the breakdown of **excess amino acids**	by the **kidneys**, in urine
water and salts (excess)	from the diet and from metabolism	by the kidneys in urine (and some in sweat)

NOTE

Egestion is not excretion. Egestion is the removal of **undigested food** (faeces) from the gut: it has never been part of the cells' chemical reactions.

Urea is toxic, which is why it must be excreted: if it built up, it would be poisonous to cells.

13.1 The urinary system

Organ	Function
kidneys	remove **urea, excess salts and excess water** from the blood, to form **urine**
ureters	tubes that carry urine from the kidneys to the bladder
bladder	stores urine
urethra	carries urine out of the body

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The nephron

Each kidney contains about a million tiny filtering units called **nephrons**.

Part	Function
glomerulus	a knot of capillaries; blood is under high pressure, so small molecules are filtered out
Bowman's capsule	a cup around the glomerulus that collects the filtrate
tubule (and loop of Henle)	where useful substances are **reabsorbed** into the blood
collecting duct	collects urine from the tubules and carries it to the ureter

What the nephron does

1. **Filtration.** In the **glomerulus**, **water, glucose, urea and ions** are filtered out of the blood into the Bowman's capsule. Blood cells and large proteins are too big and stay in the blood.
2. **Reabsorption.** As the filtrate passes along the tubule, **all of the glucose**, **some of the ions** and **most of the water** are taken back into the blood.
3. **Urine formation.** What is left is **urine**: **urea, excess water and excess ions**. It flows down the collecting duct to the ureter.

(The details of how these processes happen are not needed.) The amount of water and ions in the urine varies, so the kidneys help keep the blood's composition constant.

> TRY IT
>
> Glucose is found in the filtrate but not in the urine of a healthy person. Explain why.

All the glucose is **reabsorbed** into the blood from the tubule. (If glucose appears in the urine, the person may have diabetes.)

The liver and the breakdown of amino acids

The liver is involved in the **assimilation of amino acids**: it **converts amino acids into proteins**, such as plasma proteins.

Amino acids cannot be stored, so any that are in excess are broken down in the liver by **deamination**.

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Deamination is the removal of the nitrogen-containing part (the amino group) from amino acids in the liver. The nitrogen-containing part is converted into urea. The rest of the amino acid is used in respiration to release energy (or converted into carbohydrate or fat).

The urea is carried in the blood plasma to the kidneys, where it is excreted in urine.

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