

Excretion in humans

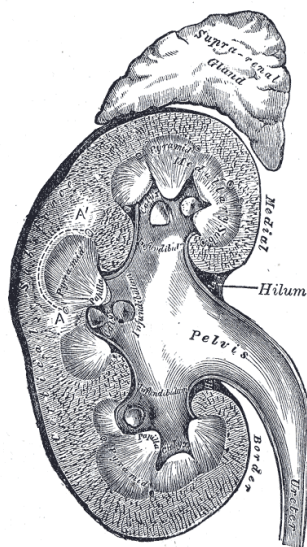
IGCSE Biology

Excretion

Excretion 排泄 is the removal of the waste products of metabolism, and of substances the body has in excess. Two main wastes are removed:

- **carbon dioxide** 二氧化碳 — made during respiration, and breathed out through the lungs.
- **urea** 尿素 — made in the **liver** 肝脏, and removed by the kidneys together with excess water and **ions** 离子.

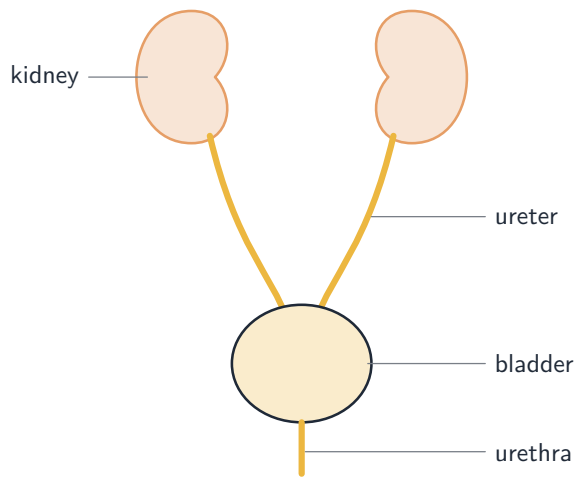
The urinary system



The kidneys filter the blood and make urine.

The **kidneys** 肾脏 clean the blood and make **urine** 尿液. The urine then passes through:

- the **ureters** 输尿管 — tubes from the kidneys to the bladder.
- the **bladder** 膀胱 — stores the urine.
- the **urethra** 尿道 — carries the urine out of the body.



The kidneys make urine, which flows down the ureters to the bladder and out of the urethra

If the kidneys stop working, a **dialysis** 透析 machine can do their job. The patient's blood flows through the machine, where waste and excess water pass out across a thin membrane, and the clean blood returns to the body.



A dialysis machine cleans the blood when the kidneys stop working

Inside the kidney (Supplement)

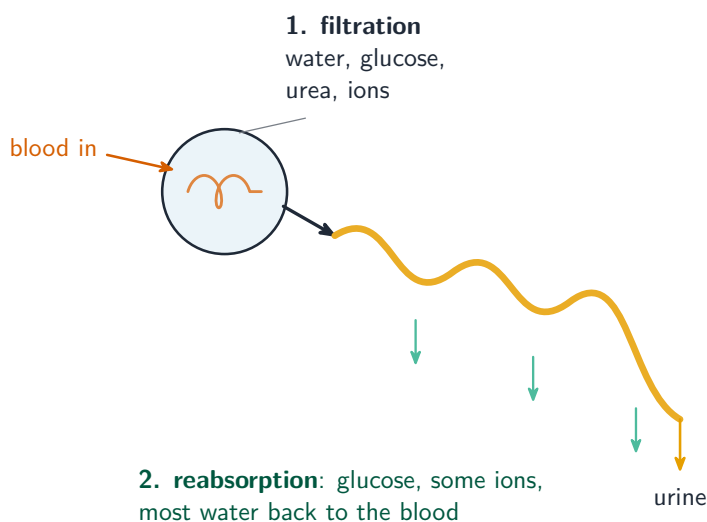
A kidney has two regions: an outer **cortex** 皮质 and an inner **medulla** 髓质.

The nephron

Each kidney holds millions of tiny tubes called **nephrons** 肾单位. A nephron cleans the blood in two steps:

1. **Filtration** 过滤: at the **glomerulus** 肾小球 (a knot of capillaries), high pressure forces water, **glucose** 葡萄糖, urea and ions out of the blood and into the nephron.
2. **Reabsorption** 重吸收: as the liquid flows along the nephron, the blood takes back **all** of the glucose, **some** of the ions, and **most** of the water.

What is left behind — urea, excess water and excess ions — becomes the urine.



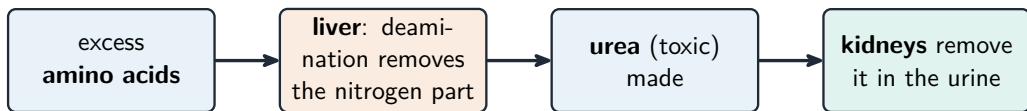
A nephron filters the blood, then reabsorbs the useful substances; what is left is urine

Worked example. A healthy person's urine contains urea and ions but **no** glucose, even though glucose is forced out of the blood at the glomerulus. Explain. Filtration does not choose: high pressure pushes water, glucose, urea and ions into the nephron together. The choosing happens at the next step - during **reabsorption** the blood takes back **all** of the glucose, so none is left to reach the urine. Glucose does appear in the urine of someone with untreated diabetes, because there is more of it than the nephron can reabsorb. Filtration removes; reabsorption selects.

The liver, amino acids and urea (Supplement)

The liver carries out the **assimilation** 同化 of **amino acids** 氨基酸: it joins them together into the **proteins** 蛋白质 that the body needs.

The body cannot store extra amino acids. The liver breaks the excess down by **deamination** 脱氨基作用 — it removes the **nitrogen** 氮-containing part of each amino acid. This part is then turned into urea.



The liver makes urea from excess amino acids; the kidneys excrete it

Urea must be excreted because it is **toxic** 有毒 (poisonous) if it is allowed to build up in the blood.

Exam tips

- Excretion removes metabolic wastes. Carbon dioxide leaves through the lungs; urea, excess water and excess ions leave through the kidneys.
- Urine path: kidney → ureter → bladder → urethra.
- Nephron: the glomerulus **filters** the blood; the nephron **reabsorbs** all the glucose, some ions and most of the water. What is left is urine.
- Urea is made in the **liver** from excess amino acids by **deamination**.
- We must excrete urea because it is **toxic** to the body.