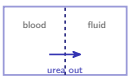
Excretion in Humans

IGCSE Biology ▪ Topic 13

IGCSE Biology

What we will cover

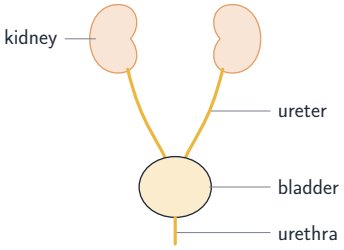
1. Excretion & the urinary system
2. The nephron
3. The liver & urea
4. Dialysis



dialysis

1 The kidneys

Excretion and the urinary system



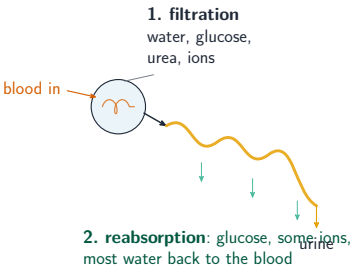
- **carbon dioxide** 二氧化碳 – made during respiration, and breathed out through the lungs.
- **urea** 尿素 – made in the **liver** 肝脏, and removed by the kidneys together with excess water and **ions** 离子.

The plumbing, and what the liver does first

Ureters	The **ureters** 输尿管 are the tubes from the kidneys to the bladder; the urethra carries urine out.
Nephrons	Each kidney holds millions of tiny tubes called **nephrons** 肾单位 – the filtering unit, repeated.
Deamination	Excess amino acids cannot be stored. The liver removes the **nitrogen** 氮-containing part – **deamination** 脱氨基 – and turns it into **urea** 尿素.
Assimilation	The liver also carries out the **assimilation** 同化 of **amino acids** 氨基酸: joining them into the proteins the body needs.

> The kidney does not *make* urea; the liver does. The kidney only removes it from the blood.

The nephron



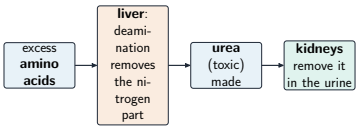
A **nephron** 肾单位 cleans the blood in two steps:

- **filtration** 过滤 at the **glomerulus** 肾小球 – water, glucose, urea, ions out
- **reabsorption** 重吸收 – all glucose, some ions, most water back

What is left is urine.

2 Urea and dialysis

The liver and urea



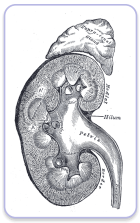
The **liver** 肝脏 breaks down excess **amino acids** 氨基酸 by **deamination** 脱氨基作用, making **urea** 尿素.

> Urea is toxic, so the kidneys must excrete it before it builds up.

Dialysis

If the kidneys fail, a **dialysis** 透析 machine does their job. Blood flows through; waste & excess water cross a thin membrane; clean blood returns.

The urinary system



> The kidneys filter the blood and make urine.

Inside the kidney

(Supplement) two regions	an outer **cortex** 皮质 and an inner **medulla** 髓质
the cortex	holds the glomeruli and the convoluted tubules, where filtering and most reabsorption happen
the medulla	holds the loops of Henle and the collecting ducts, where water is concentrated
the pelvis	where urine collects before leaving down the ureter
the nephron	the working unit – about a million per kidney, spanning both regions
the two steps	ultrafiltration in the glomerulus, then selective reabsorption along the tubule

> Filtration removes almost everything small; reabsorption takes back what the body wants. That order is why glucose appears in the filtrate but not in normal urine.

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.

3 Recap

Worked example – what the kidney does

Glucose is filtered out of the blood at the kidney, yet healthy urine has none. Explain.

- At the glomerulus, high pressure forces small molecules out: ultrafiltration.
- Water, glucose, salts and urea all cross; blood cells and proteins are too big to.
- So the filtrate does contain glucose at first.
- Further along the tubule, all the glucose is taken back into the blood: **selective reabsorption** 选择性重吸收.
- Glucose in urine therefore suggests diabetes – too much to reabsorb.

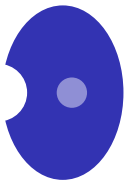
> Two steps: ultrafiltration (by size, at the glomerulus) then selective reabsorption (useful things taken back). Urea is the waste that stays.

Topic 13 – key takeaways

1. **Wastes**
   CO_2 via lungs; urea via kidneys
2. **Urine path**
   kidney, ureter, bladder, urethra
3. **Nephron**
   filter, then reabsorb glucose, ions, water
4. **Urea**
   liver makes it by deamination; it is toxic

Check yourself

1. Which organ makes urea?
2. What happens at the glomerulus?
3. What does the nephron reabsorb all of?
4. Why must urea be excreted?



> **Answers** **1.** the liver **2.** filtration of the blood **3.** glucose **4.** it is toxic if it builds up