

Homeostasis

A-Level Biology ■ Topic 14

A-Level Biology



Homeostasis

What we will cover

- 1 Negative feedback
- 2 The kidney
- 3 The nephron
- 4 Osmoregulation & ADH
- 5 Blood glucose
- 6 Stomata



glucose kept in narrow limits

1 Principles

Homeostasis

Principles

Negative feedback

A change is detected, and the response **reverses** it – keeping the factor near a set point. That is **homeostasis** 稳态.

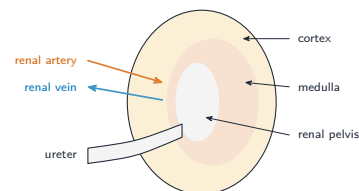
Positive feedback increases the change (oxytocin in labour). It is rare, and it does not give a stable internal environment.

2 The kidney

Homeostasis

The kidney

The kidney



The **kidney** 肾脏 cleans the blood and controls its water.

■ **cortex** 皮质 & **medulla** 髓质 clean the blood

■ urine collects in the **renal pelvis** 肾盂

The liver makes **urea** 尿素 from excess amino acids (**deamination** 脱氨基作用).

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The kidney

The nephron and making urine

- ultrafiltration 超滤 (Bowman's capsule 鲍曼囊)**
 - pressure pushes out small molecules; cells & proteins stay
- selective reabsorption 选择性重吸收 (proximal tubule 近曲小管)**
 - glucose & water taken back

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The kidney

Osmoregulation and ADH

The **hypothalamus 下丘脑** detects the blood's **water potential 水势**.

If too concentrated, the pituitary releases **ADH 抗利尿激素** – the **collecting ducts 集合管** reabsorb more water, so less, concentrated urine is made.

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Blood glucose

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Blood glucose

Controlling blood glucose

Two hormones work against each other:

- high glucose → **insulin 胰岛素** stores it as **glycogen 糖原**
- low glucose → **glucagon 胰高血糖素** breaks glycogen back to glucose

Homeostasis

Blood glucose

Cell signalling: the glucagon cascade

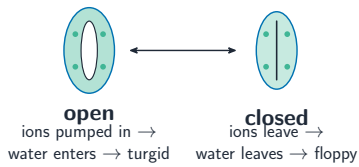
Glucagon binds a receptor → **G-protein G 蛋白** → **cAMP 环腺苷酸** (a **second messenger 第二信使**) → an **enzyme cascade 酶级联反应**.

Each step switches on **many** of the next, so the signal is greatly **amplified 放大**.

4

Plants

Stomata and guard cells



Guard cells 保卫细胞 open a **stoma** 气孔 by taking in water (turgid) and close it by losing water. Under water stress, **abscisic acid** 脱落酸 closes the stomata to save water.

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Recap

Worked example – controlling blood glucose

Explain how blood glucose returns to normal after a meal.

- Glucose rises above the set point. *β* cells in the islets of Langerhans detect it.
- They secrete *insulin*, which binds receptors on liver and muscle cells.
- More *GLUT4* transporters move into the membrane, and glucose → *glycogen* (glycogenesis).
- Blood glucose falls ⇒ less insulin secreted: *negative feedback*.

Name the *detector* (*β* cell), the *signal* (insulin) and the *effector* (liver). Insulin *lowers*, glucagon *raises* – both from the pancreas.

Topic 14 – key takeaways

1 Negative feedback

receptor detects, effector corrects

2 Nephron

ultrafiltration then selective reabsorption

3 Osmoregulation

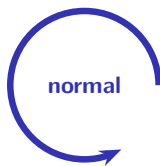
ADH makes ducts reabsorb more water

4 Blood glucose

insulin vs glucagon; cascade amplifies

Check yourself

- Where in the nephron does ultrafiltration happen?
- Which hormone makes collecting ducts reabsorb water?
- Which hormone lowers blood glucose?
- What is cAMP called in cell signalling?



Answers 1. the Bowman's capsule 2. ADH 3. insulin 4. a second messenger