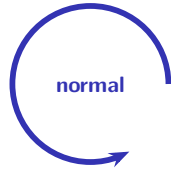


Homeostasis

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

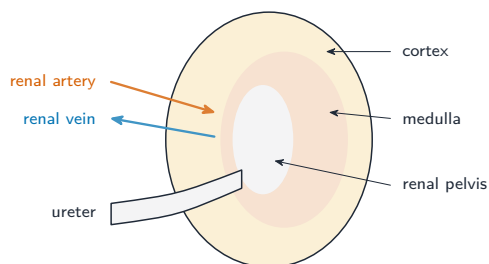
Negative feedback

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

The kidney

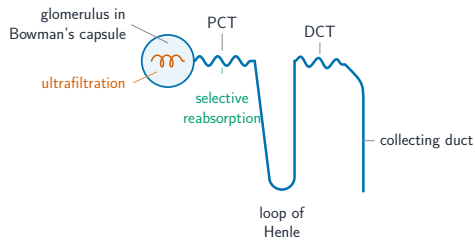


The **kidney** 肾脏 cleans the blood and controls its water.

- **cortex** 皮质 & **medulla** 髓质 clean the blood
- urine collects in the **renal pelvis** 肾盂

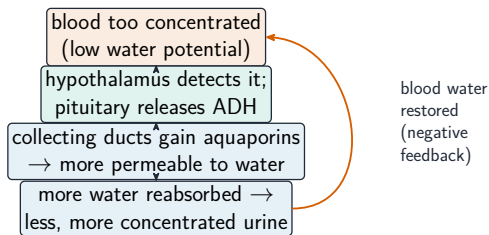
The liver makes **urea** 尿素 from excess amino acids (**deamination** 脱氨基作用).

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

Osmoregulation and ADH

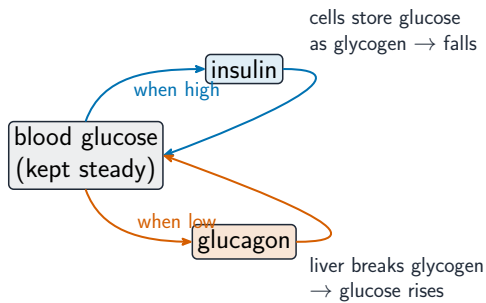


The **hypothalamus** 下丘脑 detects the blood's **water potential** 水势.

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.

3 Blood glucose

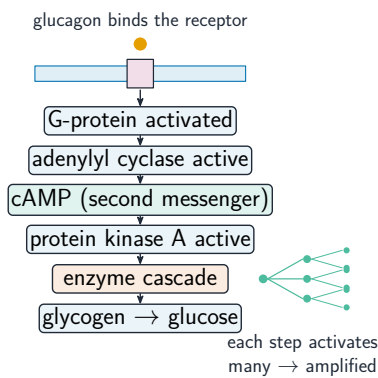
Controlling blood glucose



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

Cell signalling: the glucagon cascade



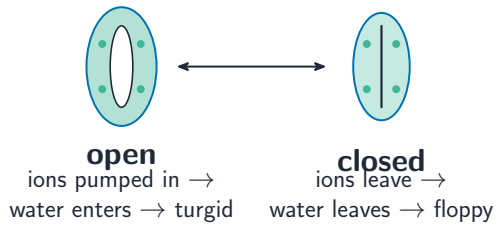
Glucagon binds a receptor → **G-protein** G 蛋白 → **cAMP** 环腺苷酸 (a **second messenger** 第二信使) → an **enzyme cascade** 酶级联反应.

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.

5

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 $\Rightarrow$ 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

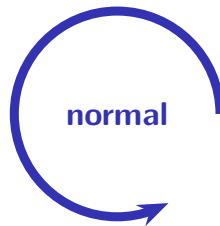
ADH makes ducts reabsorb more water

4 Blood glucose

insulin vs glucagon; cascade amplifies

Check yourself

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



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