

Coordination & Response

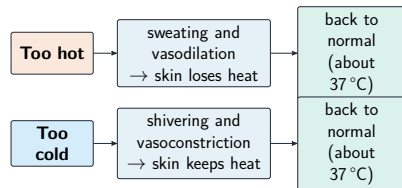
IGCSE Biology ■ Topic 14

IGCSE Biology



What we will cover

- 1 The nervous system
- 2 Reflex arc & synapses
- 3 The eye
- 4 Hormones
- 5 Homeostasis
- 6 Tropisms



homeostasis

The nervous system

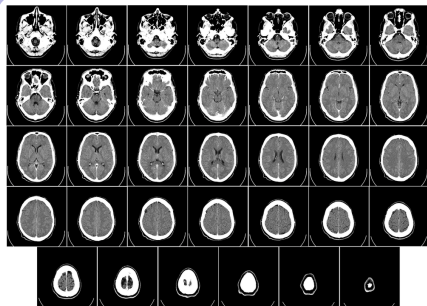
CNS 中枢神经系统

the **brain** 大脑 &
spinal cord 脊髓

Neurones 神经元 carry fast **electrical impulses** 电脉冲: **sensory** (to CNS), **relay** (within), **motor** (to effectors).

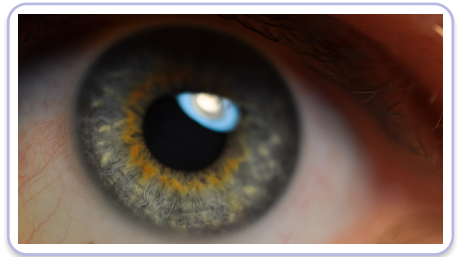
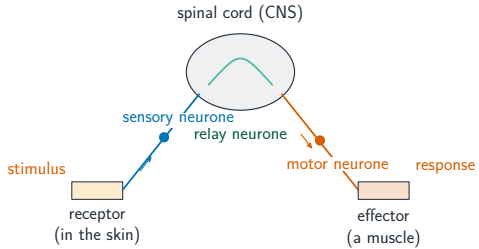
PNS 周围神经系统

all the nerves



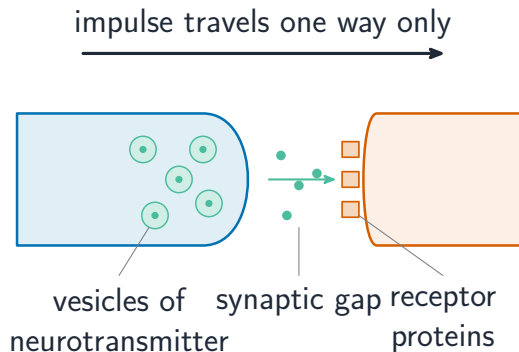
The nervous system coordinates responses

Reflex arc



Sense organs detect stimuli

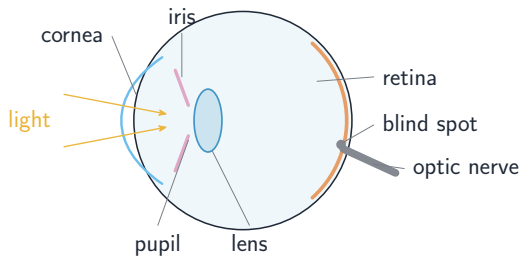
Synapses



A **synapse** 突触 is a tiny gap between neurones.

Neurotransmitter 神经递质
diffuses 扩散 across & binds
receptors – so impulses travel
one way only.

The eye



- **cornea** 角膜 & **lens** 晶状体 – **refract** 折射 light
- **iris** 虹膜 – controls the **pupil** 瞳孔
- **retina** 视网膜 – light receptors
- **optic nerve** 视神经 – to the brain

Pupil reflex and accommodation

pupil reflex

bright light → pupil **smaller**;
dim light → pupil **wider**

accommodation 视觉调节

near → lens **fatter**;
far → lens **thinner**

Hormones

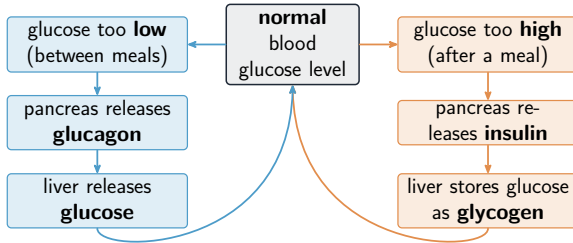
adrenaline 肾上腺素 (adrenal glands) – readies the body for ‘fight or flight’

insulin 胰岛素 / glucagon 胰高血糖素 (pancreas) – control blood glucose

testosterone / oestrogen – male / female development

Hormones 激素 are chemicals in the blood: **slower** but **longer-lasting** than nerve impulses.

Homeostasis: blood glucose



Homeostasis 稳态 keeps the inside steady by **negative feedback** 负反馈.

- too high → insulin → store **glycogen** 糖原
- too low → glucagon → release glucose

Type 1 diabetes 1 型糖尿病: no insulin made.

Controlling body temperature

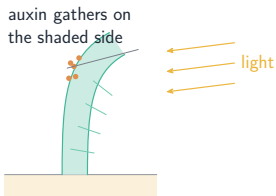
too hot

sweating 出汗; **vasodilation** 血管舒张 – more blood to the skin loses heat

too cold

shivering 颤抖; **vasoconstriction** 血管收缩 – keeps heat in

Tropisms



cells on the shaded side grow longer, so the shoot bends towards the light

A **tropism** 向性 is a directional growth response.

- **phototropism** 向光性 – shoots grow to light
- **gravitropism** 向地性 – roots down, shoots up

Auxin 生长素 gathers on the shaded side & makes cells elongate.

Worked example – a reflex arc

You touch a hot plate and pull your hand away before you feel pain. Give the pathway.

- **Receptor** in the skin detects the heat (the stimulus).
- **Sensory neurone** to the spinal cord, where a **relay neurone** passes it across.
- **Motor neurone** carries it to the **effector** (the muscle), which contracts.
- The brain is **not** in the loop $\Rightarrow$ **fast and automatic**; pain comes after.

Learn the order: stimulus
 $\rightarrow$ receptor $\rightarrow$ sensory $\rightarrow$
relay $\rightarrow$ motor $\rightarrow$ effector
 $\rightarrow$ response. Skipping the
brain is **why it is fast** –
and that protects you.

Topic 14 – key takeaways

1

Reflex arc

receptor, sensory, relay, motor,
effector

2

Synapse

neurotransmitter diffuses; one way
only

3

Hormones

slower, longer-lasting; insulin
lowers glucose

4

Homeostasis

negative feedback keeps the inside
steady

Check yourself

- 1 What are the two parts of the CNS?
- 2 Why do impulses cross a synapse one way only?
- 3 Which hormone lowers blood glucose?
- 4 Which way does a shoot grow in phototropism?



Answers 1. the brain & spinal cord 2. neurotransmitter is on one side only 3. insulin
4. towards the light