Coordination & Response

IGCSE Biology ▪ Topic 14

IGCSE Biology

What we will cover

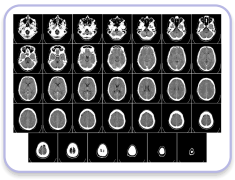
1 The nervous system

The nervous system

CNS 中枢神经系统
the **brain** 大脑 &
spinal cord 脊髓

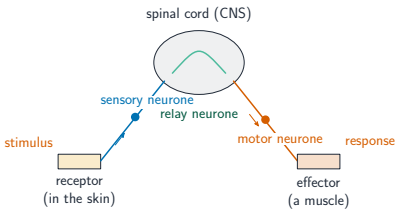
PNS 周围神经系统
all the nerves outside the CNS

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



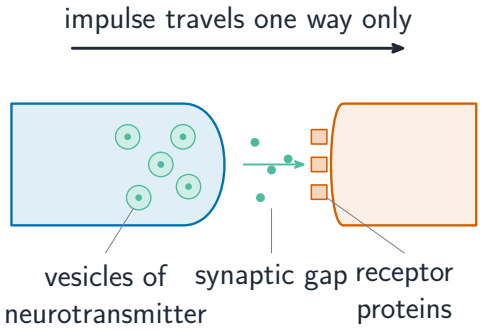
The nervous system coordinates responses

Reflex arc



- **sensory neurones** 感觉神经元 – carry impulses from receptors to the CNS.
- **relay neurones** 中间神经元 – pass impulses on inside the CNS.
- **motor neurones** 运动神经元 – carry impulses from the CNS to effectors.

Synapses

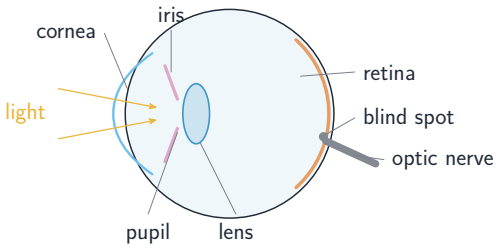


A **synapse** 突触 is a tiny gap between neurones.

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

2 The eye

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

3 Hormones & homeostasis

Hormones

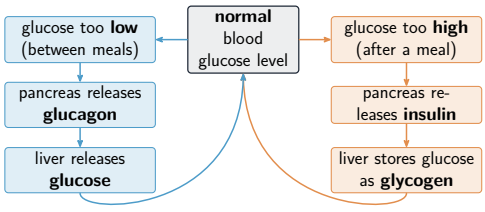
adrenaline 肾上腺素 (adrenal glands) – readies the body for 'fight or flight'

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

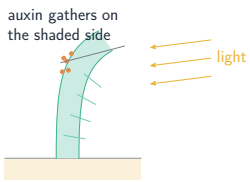
sweating 出汗; **vasodilation** 血管舒张 – more blood to the skin loses heat

too cold

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

4 Plants

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.

5 Recap

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 ⇒ fast and automatic; pain comes after.

Learn the order: stimulus → receptor → sensory → relay → motor → effector → 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