

Exercise walk-through

14.1

Coordination and response

IGCSE Biology

Endocrine glands, and how hormones differ from nerves

Endocrine glands

Hormones are made by **endocrine glands**, which release them straight into the blood – so they reach every organ, and only target cells respond.

Ovaries and testes

The **ovaries** make **oestrogen** for female development; the **testes** make **testosterone** for male development.

Adrenaline

It raises the breathing rate, the **heart rate**, the blood glucose **concentration** and the pupil diameter – and the **liver** releases glucose to fuel it.

Duration

That is the real difference: a nervous response is fast and short-lived, a hormonal one slower and **longer-lasting**.

Speed, path and **duration**: three columns that separate nervous from hormonal control in any comparison question.

Skin, blood and the set point

Too hot

You sweat, and the **arterioles** widen (**vasodilation**) so more blood flows to the skin **capillaries** and loses heat.

Too cold

Vasoconstriction narrows them, shivering releases heat from muscle, and hairs stand up to trap air.

Set point

Homeostasis keeps a constant internal **environment** by **negative feedback**: when a value moves off its **set point**, the body acts to bring it back.

Gravitropism

Plants have their own version: **gravitropism** is growth in response to **gravity** – roots down, shoots up.

The capillaries themselves do not move. It is the *arterioles* feeding them that widen or narrow.

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
→ receptor → sensory →
relay → motor → effector
→ response. Skipping the
brain is **why it is fast** –
and that protects you.

Exercises 2.1-2.3

2.1 Name the two parts of the central nervous system. [2]

2.2 State the job of a motor neurone. [1]

2.3 Name the three types of neurone in a reflex arc, in the order the impulse travels. [3]

Exercises 2.1-2.3

2.1 Name the two parts of the central nervous system. [2]

2.1

- the CNS is the **brain** and the **spinal cord**
-

2.2 State the job of a motor neurone. [1]

2.2

- a motor neurone carries impulses from the CNS to an **effector**
-

2.3 Name the three types of neurone in a reflex arc, in the order the impulse travels. [3]

2.3

- in order: **sensory, relay, motor**

Exercises 2.4·2.5

2.4 Explain why an impulse can travel across a synapse in one direction only. [2]

2.5 State what is meant by an effector, and give one example. [2]

Exercises 2.4·2.5

2.4 Explain why an impulse can travel across a synapse in one direction only. [2]

2.4

- neurotransmitter is released from **one side** only
- receptors are on the **other** side, so the impulse cannot reverse

2.5 State what is meant by an effector, and give one example. [2]

2.5

- an effector is a **muscle or a gland** that carries out the response
- e.g. the **biceps**, or a hormone-secreting gland

Exercise 3.1

3.1 The correct order of a reflex arc is:

[1]

☐

A receptor → motor → relay → sensory → effector

B receptor → sensory → relay → motor → effector

C effector → motor → relay → sensory → receptor

D receptor → relay → sensory → motor → effector

Exercise 3.1

3.1 The correct order of a reflex arc is:

[1]

☐

A receptor → motor → relay → sensory → effector

B receptor → sensory → relay → motor → effector

C effector → motor → relay → sensory → receptor

D receptor → relay → sensory → motor → effector

3.1 B

- order: **receptor → sensory → relay → motor → effector**
- A, C and D scramble the chain

Exercise 3.2 (a)

3.2 A synapse joins two neurones.

(a) Describe how an impulse crosses a synapse.

[3]

Exercise 3.2 (a)

3.2 A synapse joins two neurones.

(a) Describe how an impulse crosses a synapse.

[3]

(a)

- vesicles release **neurotransmitter** into the gap
- it **diffuses across**
- it binds receptors on the next neurone, starting a **new impulse**

Exercise 3.2 (b)

3.2 A synapse joins two neurones.

(b) Explain why a synapse makes impulses travel in one direction only.

[1]

Exercise 3.2 (b)

3.2 A synapse joins two neurones.

(b) Explain why a synapse makes impulses travel in one direction only. [1]

(b)

- only the first neurone **releases** neurotransmitter; only the second has **receptors**

Exercise 3.3 (a)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(a) Complete the sequence of the reflex arc. [3]

stimulus → **receptor** → _____ → _____ → _____ → effector →
response

Exercise 3.3 (a)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(a) Complete the sequence of the reflex arc. [3]

stimulus → **receptor** → _____ → _____ → _____ → effector →
response

(a)

- **sensory** → **relay** → **motor**

Exercise 3.3 (b)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(b) Name the effector in this reflex and state the response it produces. [2]

Exercise 3.3 (b)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(b) Name the effector in this reflex and state the response it produces. [2]

(b)

- the effector is a **leg muscle**
- it **contracts** and lifts the foot away

Exercise 3.3 (c)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(c) Explain why the foot is pulled away before the pain is felt.

[2]

Exercise 3.3 (c)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(c) Explain why the foot is pulled away before the pain is felt.

[2]

(c)

- the reflex is completed in the **spinal cord**, not the conscious brain
- that path is shorter, so the response happens **before pain is felt**

Exercise 3.3 (d)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(d) Describe how the impulse crosses a synapse.

[4]

Exercise 3.3 (d)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(d) Describe how the impulse crosses a synapse.

[4]

(d)

- the impulse arrives at the end of the first neurone
- **neurotransmitter** is released into the gap
- it **diffuses** across the synapse
- it binds receptors and starts a **new impulse**

Exercise 3.3 (e)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(e) Explain the advantage of reflex actions to the body.

[2]

Exercise 3.3 (e)

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(e) Explain the advantage of reflex actions to the body. [2]

(e)

- reflexes are **fast and automatic**
- the body is protected **before conscious thought** could act